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A Cultural History of Heredity II: 18th and 19th Centuries

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Introduction

The contributions to this volume were prepared for the second of a series of workshops dedicated to the cultural history of heredity. Concentrating in turn on a succession of time periods in chronological order, this series attempts to uncover and relate to each other the agricultural, technical, juridical, medical, and scientific practices in which knowledge of inheritance was materially anchored and in which it gradually revealed its effects. While the first workshop concentrated on the late seventeenth and eighteenth centuries, the second dealt with a time period demarcated by two classical publications: Immanuel Kant's *Von den verschiedenen Rassen der Menschen* (1775) and Charles Darwin's *The Variation of Plants and Animals under Domestication* (1868).[1]

One of the major results of the first workshop was corroborated by the contributions to the second, namely that no general concept of heredity was underlying the discourse on life (including medicine, anthropology and the moral sciences) in the eighteenth century and that such a concept was only slowly emerging in the first half of the nineteenth century.[2] Carlos López Beltrán illustrates this in his contribution to this volume by directing our attention to a decisive linguistic shift: while the use of the adjective hereditary can be dated back to antiquity in the context of nosography (*maladies héréditaires*), a transition to a nominal use (*hérédité*) took place only from the 1830s onwards, first among French physiologists, then in other European scientific communities. This shift indicates a reification of the concept, or, in López Beltrán's words, the establishment of a "structured set of meanings that outlined and unified an emerging biological conceptual space […] produc[ing] the first appearance of our modern concept of biological heredity." For the fields of natural history and breeding one can recognise a similar shift from the use of adjectives like 'constant' and 'true' to refer to characters that remain unchanged in the course of generations, to the recognition of 'heredity' or 'inheritance' as one of the central life forces.[3] Alongside this development, one can observe the erosion of a set of very ancient distinctions in regard to observed similarities between parents and offspring: the distinction of specific vs. individual, paternal vs. maternal, normal vs. pathological similarities all gave way gradually to a generalised notion of heredity capturing relations among traits independent of the particular life forms they were part of.[4]

This can be viewed as the main outcome of the first two workshops on the cultural history of heredity, to which all contributions, in one way or the other, attest. At the same time, however, this result provides the central, historiographical problem for our project. How is it that a phenomenon that, from a contemporary perspective, appears to be of central importance, and in

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1 For more details on the project and the workshops see http://www.mpiwg-berlin.mpg.de/Heredity/. The original program of the second workshop is reproduced at the end of this volume.

2 Results of the first workshop have been published in: *A Cultural History of Heredity I: 17th and 18th Centuries,* Max-Planck-Institute for the History of Science Preprint 222, Berlin 2002.

3 See Mclaughlin, Müller-Wille, and Wood, this volume.

4 See López Beltrán, McLaughlin, Müller-Wille, and Pomata in this volume; cf. Coffin, this volume, on the work of Bénédict Augustin Morel who, in the mid nineteenth-century, still upheld the distinction of normal vs. pathological heredity.

its effects appears to be so tangible in everyday life, was subjected to conceptualisation so late? This seems to be the most curious feature of the cultural history of heredity: while 'heredity' today belongs to the most fundamental concepts of the life sciences, it entered the scenes of inquiry into the phenomena of life only very late in history. The late emergence of heredity coincides, moreover, with the important transformation that the life sciences underwent in general around 1800 and that Michel Foucault and François Jacob have described so succinctly.[5] Though both of these authors focussed on the concept of organisation in studying this transformation, it seems highly probable that the emergence of heredity represents an aspect of utmost significance for fully understanding this transformation.[6]

Most of what the essays assembled in this volume have to say on this point, leads to a solution of the historiographical problem just outlined that may come as a surprise. It is not that the concept of heredity emerged from a growing attention to regularities, a sort of fixation of the scientific mind on the laws of nature at the expense of the contingenices and complexities of real life. It seems, rather, that the emergence of heredity occurred within an epistemic space that unfolded while people, objects, and their relationships were set into motion.[7] This means that it was a condition for distinguishing between inherited and environmentally induced traits in organisms, for example, that organisms were actually removed from their natural and (agri-) cultural habitats. Only then could an environmental difference express itself in a difference in traits, and only then could heritable traits manifest their steadiness against environmental changes. Breeding new varieties for specific marketable traits, the exchange of specimens among botanical and zoological gardens, experiments in fertilisation and hybridisation, the dislocation of Europeans and Africans that accompanied colonialism, and the appearance of new social strata in the context of industrialisation and urbanisation, all these processes interlocked in mobilising cultural and natural ties and thus provided, as will be explained in more detail in the following, the material substrate for the emerging concept of heredity.

It is true, of course, that the principle of 'like engenders like' had been around since the earliest times of Greek poetry and philosophy, as an expression for what ought to happen as a rule.[8] This 'law' remained unanalysed, however, so that it lacked the kind of inner structure that could have provoked the application of a metaphor that in its proper context, that of legal regulations of property transmission, possessed such complex semantics as 'heredity' did. And this, as Wolfgang Lefèvre demonstrates for the cases of Lamarck and Geoffroy St. Hilaire in this volume, remained valid for the preformationist and epigenetic theories of evolution up to the early nineteenth century. In a sense, even, both preformation and epigenesis – and both conceptions have a well-known, ancient legacy – excluded inheritance: according to preformation nothing is transmitted in generation because everything has been there from the beginning; according to epigenesis nothing is transmitted in generation because in each instant everything is built up from scratch.

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5 Michel Foucault, *Les mots et les choses*, (Paris, 1966); François Jacob, *La logique du vivant*, (Paris, 1970).

6 Cf. Michel Foucault, *Histoire de la sexualité, vol. 1: La volonté de savoir*, (Paris, 1976).

7 This is emphasised in the comments by Raphael Falk and Gianna Pomata included in this volume. For a different perspective see Waller and van Wyhe in this volume.

8 See Erna Lesky, *Die Zeugungs- und Vererbungslehren der Antike und ihr Nachwirken,* (Wiesbaden, 1950); Hans Stubbe, *Kurze Geschichte der Genetik bis zur Wiederentdeckung der Vererbungsregeln Gregor Mendels,* (Cambridge, Mass., 1965; engl. transl. 1972).

As Peter McLaughlin points out in his contribution, it is in Immanuel Kant that we encounter a theory of propagation which is neither preformationist nor epigenetic – and in which, at the same time, conceptions of heredity began to unfold a manifold of specific meanings. "Anerben", "ererben", "vererben", "forterben" are all terms that Kant used in this context to distinguish, as McLaughlin puts it, "various aspects, permutations and combinations of hereditary phenomena." The phenomenon that gave rise to this proliferation of terms was not simply the similarity that offspring exhibited with regard to their parents. It was rather a narrowly circumscribed, highly specific phenomenon, the existence of distinct races in the human species distinguished by traits that were invariably transmitted to offspring even if environmental conditions should change. Empirically this peculiar behaviour was exhibited to Kant by Portuguese colonists in Africa (whose children remained white, despite dislocation) and black Africans in Europe (who likewise continued to produce black children there). Such a phenomenon undercut the ancient distinction of specific forms and individual peculiarities: characterising classes at a subspecific level, racial characters belonged to the individual peculiarities that interfered with the universality of species form; yet being infallibly reproduced generation by generation they seemed to be subject to the same regularities that governed species form. To account for this, Kant brought together natural law and contingent (family) history in his concept of *Vererbung*: the potential or *Anlagen* for hereditary traits were included in the original organisation of ancestors, but once they had been expressed in reaction to a change in environment, they were permanently and irrevocably transmitted.

The way in which Kant set up the problem and the way in which he advanced a solution by exploring the complex semantics of *Vererbung* can be regarded as prototypical for the emergence of heredity. The problem was not the constancy of species form but the patterns of variety that structure life at a sub-specific level. As long as such patterns coincided with the distribution of organisms over locally circumscribed environments, however, such patterns were readily explainable by the permanence of ties between organisms and their "natural places". In these cases, it is, in a sense, the place that "inherits" its inhabitants and impresses its character upon them. It is only when this tie is dissolved to open up a variety of correlations between forms, places, and modes of transmission, that a need arises for a complex metaphor like heredity to be inserted in order to account for the proliferating phenomena. From this perspective, also, Kant's preoccupation with human races seems less eccentric: it is, after all, first and foremost through human activities that people and, along with them, things are actually seen to be mobilised. Kant's famous *dictum*, that better progress in knowledge may be achieved by letting the spectator revolve around objects quite consequentially put anthropology in the centre of thought.

This motivation to apply and explore the concept of heredity in face of a mobilisation of social and natural ties was observed in all the cultural sub-fields that were explored at the workshop. Inheritance regulations that imposed restrictions to succession for future generations as well as the extent to which cousin marriages should be outlawed came under intense discussion in the aftermath of the French revolution. They were perceived as guaranteeing the stability of possessions and privileges on the one hand, and, on the other, as an obstacle to social strategies aimed at coping with the progressive dominance of mobile vis-à-vis landed property.[9] The interest of physicians in hereditary diseases turned from "noble" maladies like gout, seen to be "softly"

inherited by over-consumption, to diseases like phthisis (tuberculosis) and madness that were ascribed to the rapidly growing class of the landless and poor urban populations and perceived as "degenerative" diseases based in a permanent defect of hereditary dispositions.[10] Breeders were progressively engaging in attempts to transplant strains from one country to the other, and to "mould" their creatures for specific traits in the context of industrialisation, and refining, alongside with this, the image of the "self-made man" which was reflecting concerns among the middle classes about inborn or acquired character in the wider, moral sense.[11] Natural historians and evolutionists came to recognise patterns of heredity in the series of transplantations and hybridisations that they set off in their experiments, experiments which were carried out not rarely despite the abhorrence experimenters sensed in face of their monstrous productions.[12] Anthropologists, finally, began to concentrate on racial differences as exhibited in the dislocation of European and African people or on the traits of "savage children" who had been uprooted and raised without education.[13]

These cultural subfields did not cohere immediately, after the model of mutual influences, but they were connected by a kind of domino effect that mobilisation in one field had on others. The import of plants for collection purposes of natural history inspired attempts at their acclimatisation for economic purposes (and vice versa). The successes of breeders in establishing marketable strains provided the model for the "self-made man". The growth of a class that depended on mobile property evoked a culture of leisure collecting and breeding. Thus, the results of the first two workshops do not so much point to a unitary "culture of heredity" that suddenly emerged around 1800, but rather to a piecemeal relaxation of social and natural ties in several, highly specific cultural sub-fields that opened up the epistemic space which would eventually come to be occupied by the concept of heredity.

We would like to thank the government of Liechtenstein for financial support.

Hans-Jörg Rheinberger Staffan Müller-Wille

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9 See Ulrike Vedder's contribution on the majorate. The topic of cousin marriage regulations was explored by David Sabean in the comment he gave at the workshop (unfortunately, he was prevented from preparing them for publication in this volume); see his *Kinship in Neckarhausen, 1700-1870*, (Cambridge 1998).

10 These aspects are covered in great detail in the contributions to this volume by Laure Cartron, Phillip Wilson, John C. Waller, Jean-Christophe Coffin, John van Wyhe, and Paul White. Gianna Pomata discusses the first three of these contributions.

11 See Roger Wood and Paul White in this volume.

12 See Staffan Müller-Wille on the experimental tradition of "hybridism" in this volume.

13 The former aspect is discussed by Peter McLaughlin, the latter by Nicolas Pethes in their contributions to this volume.

Heredity old and new; French physicians and l'hérédité naturelle *in early 19th century.*

Carlos López-Beltrán

The coinage of hérédité

At some point in the early decades of the 19th century, French medical men and physiologists adopted the noun "hérédité" as the carrier of a structured set of meanings that outlined and unified an emerging biological conceptual space. The elements of this domain had previously been loosely connected by the metaphorical mirroring between physical resemblance between parents and offspring and the passing on of property and titles through the generations and projected over the medical, zoological, agricultural, and ethnological fields. The development of such a conceptual space, and in those domains, during the first half of the 19th century in several European countries, produced the first appearance of our modern concept of biological heredity.[1]

Le Trésor de la Langue Francaise gives a 1821 quote as the first registered occurrence of the noun "hérédité" with a biological meaning.[2] The work cited is Joseph de Maistre's *Les Soirées de Saint-Pétersbourg*, where he talks of "cette triste hérédité" referring to the physical ailments bequeathed to the infants due to the sins of their elders from several generations. I have located several previous instances linked also to the transmission of disease, where the notion of a noxious bequeathal (*facheuse hérédité*) dropping down the generations is dominant.[3] The link between the Christian (Augustinian) notion that hereditary physical ailments stem from a divine punishment linked to the original sin and the substantialization of hereditary diseases into a reified entity *hérédité* seems to me undeniable.[4]

The early 19th century French medical community played a major role in the articulation of our modern concept of heredity, only comparable with the role played by animal and plant breeders. The aim of this presentation is to outline that process. I begin with an empirical fact: after c.1830 "hérédité" became an increasingly popular noun amongst French medical men. In the preceding years the traditional medical formula *maladies héréditaires* (a derivation from the usage of *morbi hereditarii* at least since Avicenna) was being transformed into phrases like "hérédité des maladies", "hérédité morbeuse", "héredité pathologique", transferring the stress of the fact of transmission to a noun, that opens the space for a more general notion, and somehow eroding the

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1 For heredity during the 18th century see Rey (1989); *A Cultural History of Heredity I* (2002). For recent views on the history of the concept of heredity see Olby (1992); López-Beltrán (1994); Gayon (1999); Wood and Orel (2001); Waller (2001b).

2 The metaphorical, adjectival use in several European languages derive from *morbis haereditarii*, and was well in place amongst physicians by the 16th century; we thus have "maladies héréditaires", "Erbkrankheit", "hereditary disease" and several variants scattered in medical treatises, with an increasing rate during the 18th century. See Appendix 1 in López-Beltrán (1992).

3 See for instance Fodéré (1813), 5: p. 365. *Le Grand Robert* gives the same occurrence as the first one. De Maistre's book is really from 1822.

4 Two contests set by the Royal Society of Medicine in the 18th century where instrumental for the development of this analysis (López-Beltrán 1994). For the English world John Hunter did the most surprising and clarifying discussion; see Hunter ([1786] 1835-1837), 1: pp. 353-359.

metaphorical cushion. The presence of the noun suggests the existence of a "thing" (a force, a law, a mechanism), the nature and reach of which was then progressively shaped by French physicians.

After its adoption in French medical literature *hérédité* frequently was qualified by different adjectives that established important oppositions. Common among these was the contrast between "hérédité physiologique" and "hérédité pathologique". But after a few decades the most influential opposition was that between "hérédité physique" and "hérédité moral". The first pair was used to emphasize the growing perception that there was a natural aspect of hereditary phenomena, which was free from the common noxious connotations.[5] Such opposition served, I believe, to define the axis through which the structure of the medical concept of hereditary transmission was transported into a more general, biological frame, and was "de-pathologized" for the consumption by a wider spectrum of savants. I speak of the "structure of the concept" because I want to emphasize the existence in that period of a cluster of classificatory and explanatory elements that the medical analysis and disputes around the notion of hereditary transmission produced. In previous works I have shown how medics were the first theorists to propose and develop important features of biological heredity, like the distinction between innate and congenital characters, or the latent and pre-dispositional nature of hereditary causes; these and other criteria were used as pointers towards the necessary separation between accidental and hereditary variation.[6]

Once heredity was in place different physiological schools struggled to take over the increasingly powerful new domain. Several generations of French physicians, alienists, physiologists and naturalists contributed with alternative accounts of how heredity was acting in the shaping of individual, familiar, and even national constitutions.[7]

Hérédité *and Constitution*

The traditional medical concepts of temperament, complexion and constitution, which had been adapted in the different periods according to dominant physiological creeds had been for centuries the depositaries of underlying, general potencies and dispositions that could account for both typical and idiosyncratic physical responses of individual organisms under different surroundings. In contrast, the moral peculiarities of human beings were alternatively linked to, or separated from the physical (constitution, temperament) in accordance to theological and metaphysical positions.[8]

Late 18th century medics, when the pendulum was moving in some places towards materialistic approaches, found once more in the medical concepts of temperament and constitution a good framing device for their attempt at grounding the moral on the physiological, and on using that as a launching base for hygienist programs of physical and moral improvement

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5 John Hunter in 1786 maintained that the hereditary principle "[…] may be divided into two kinds: the transmission of natural properties, and the transmission of diseased, or what I shall call acquired or accidental properties" (Hunter 1835-1837, 1: pp. 353-354).

6 See López-Beltrán (1992). See also Olby (1992); Gayon (1999); Waller (2001a).

7 *Aliéniste* was the name given in France to the early psychiatrists as they dealt with mental alienation, or insanity. The word for insane was *aliéné*.

8 Roger (1963) remains the outstanding investigation of this for the French context from the 16th to the 18th centuries.

of humanity. The influential work of P. J. G. Cabanis set the tone for a repositioning among French medical men with regards to the plasticity or permanence of the inborn temperamental features with respect to the influence of the environment. Temperament could be modified, improved, up to a certain point. A crucial consideration in the hygienists project was that

> […] les habitudes de la constitution se transmettent des pères et mères aux enfants; qu'elles se conservent comme une marque ineffaceable, au milieu des circonstances les plus diverses de l'éducation, du climat, des travaux, du régime.[9]

The notion that some aspects of the bodily features could become entrenched in some lineages through this hereditary transmission was one that was progressively made explicit by physicians in the period. The transmission of the set of empirical facts that I have elsewhere called *the hereditary* (resemblance of offspring to parents, atavism, recurrence of disease or of striking peculiarities within families or groups...)[10] provided a link between parents' temperaments (or constitutions) and those of their children; that connection, extended over time to whole genealogies, justified the talk of family, or even national characters. Cabanis emphasized this, and insisted that it could be the basis for a program (similar to those followed by breeders) that eliminated the undesirable and consolidated the desirable traits. This of course was one of the influences that shaped Lamarck's notions of the inheritance of bodily adaptations.[11]

But it was disease that had driven the medics to pay such close attention to hereditary transmission in the first place. Physicians had found useful the notion of actual physical transmission (by both parents) of some kind of casual influence, through physiological means at the moment of conception, as a useful theoretical resource for the explanation of some diseases. Especially those with familial patterns, and mainly chronic ailments, which were also generically known as "constitutional." Among them insanity, epilepsy and other mental abnormalities were sometimes included, but not particularly stressed.[12]

It is important not to mistake the presence of the notion of hereditary transmission with the presence of the concept of heredity itself. My story turns around this distinction. Lamarck is a good example of what I mean. Although posterior developments situated the name and the work of Lamarck in the center of the debates about heredity of acquired characters, neither him nor Cabanis (nor anyone from their generation) could pay attention to heredity itself, as it wasn't there yet. As André Pichot has recently phrased it:

> […] même si l'hérédité est bien le centre de la théorie de Lamarck, ce centre n'est pas theorisé. Par la suite, quand on parlera de la théorie de l'hérédité lamarckienne, on va projeter sur la théorie de Lamarck la notion d'hérédité elaborée après sa théorie.[13]

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9 Cabanis, ([1802] 1824), 3: p. 431. See Staum (1980); and Williams (1994), for Cabanis' influence on the French medical world in early 19th century.

10 López-Beltrán, (2002).

11 See Cabanis (1824), 3: p. 434. See also Carol (1995), p. 24. For the influence of Cabanis and other ideologues on Lamarck see Corsi (1998).

12 The hereditary character of mental diseases had been a characteristic observed and discussed since ancient times. In the Hippocratic corpus it is in discussing epilepsy, the sacred disease (*morbus sacer*) that some of the clearer passages concerning the hereditary and its relation to generation, is to be found. See for this Lonie (1981) and Boylan (1984).

This elaboration required, I believe, that medical men integrated the notion of hereditary transmission within the semantic field of the powerful and prestigious concepts of temperament and constitution. There have been several successful studies of the expansion of hereditarianism into different areas of the medical practice and of natural history after the 1840s.[14] However, the previous, necessary, and rather dramatic shift in emphasis, during the first few decades of the century, from the hereditary as an important but secondary (predisposing) component of many physical and mental conditions, to heredity as a main (if not *the* main) cause responsible for all the natural bodily (and thus, for some, moral) endowments of individuals has not been adequately described. William Coleman has persuasively shown how, with the turn of the century, French physicians abandoned the Galenic old language of the "six non-naturals" when alluding to the external influences on health (like nutrition, climate, etc.) and began to speak of hygiene. I believe that a parallel move occurred with the complementary concept of the "naturals" (i.e. the temperament), which was eventually substituted by heredity, in order to reproduce the previous dialectic between body and external milieu.[15]

The social and political developments during the French Revolution, and afterwards during the Napoleonic reforms, opened the space in which medical practitioners found the opportunity to promote these two new powerful conceptual weapons that could help promote their gremial aspirations for a major role in the reorganization of civil life. Hereditary transmission had never before been looked at as a subject of special analytical and theoretical interest. Then, in a few years, it was all over the place.[16] There was a notorious change of emphasis, and what had been kept aside on footnotes or short discussions, became the subject of chapters in books, and an increasing number of dissertations. Particularly curious is the adoption after 1810 of hereditary explanations by some medical authors who had written several works before and had not resorted to them. I can mention Emmanuel Fodéré, Antoine Portal, and Philippe Pinel; all of which played leading parts in the post-revolutionary medical reforms. They had of course acknowledged the hereditary influences in their early works, but only at this period they gave them a central role.[17]

After the Revolution the hereditarian wave gathered momentum, and with the exception of isolated cases of skepticism,[18] the French medical community seems to have been finally overtaken by it by the beginning of the 1830s.

The process by which the conversion of heredity from a marginal metaphoric use into an important explanatory tool within the biological disciplines occurred and the momentum it

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13 Pichot (2002).

14 Dowbiggin, (1991); Gayon (1999); Orel (1996); Waller (2001a).

15 Coleman (1974); (1984); Williams (1994); and López-Beltrán (2002).

16 For the appeal to the dialectics of hygiene and heredity see Williams (1994). Cabanis managed to defend simultaneously that the breeds of human beings ought to be improved to attain a basic equality, and that diversity is a basic human value that ought not to be jeopardized (Cabanis 1824, pp. 435-436).

17 For instance Fodéré (1792); Portal (1781), (1800); and Pinel (1785). Wide perspectives can be had in Poilroux (1821); Caillot (1818). See also Ackerknecht (1967); Williams (1994).

18 An important skeptical argument was made by Sersiron (1836). He maintained that true hereditary transmission of disease ought to be as "fatal" and deterministic as the hereditary transmission of specific characters, like the shape of the bones or the form of the eyes. Any accidental character can disappear from the genealogical line after a few generations, so it cannot properly be claimed to be affected by the same hereditary cause that maintains the unity of the species. Their transmission is therefore also accidental and not lawfully governed.

gathered in these decades remains to be better understood. Among the several factors influencing the process a few more can be mentioned, besides the post-revolutionary reforming zeal: The rise and fall of the phrenological movement, and the disputes around vitalist physiology and medicine.[19] The outbreak of hard hereditarian, degenerationist and racist thinking in the French scene after the 1850s is well documented. Its brewing phase among the alienists in the decade of the 40s has been also described. What has not been seen clearly is that this in its turn was only possible due to the great amount of groundwork that the previous generation of French medical men had been accomplishing by shaping and structuring a working notion of *hérédité.*

Hérédité *in the physiological battleground*

The French milieu transformed its marginal 18th century medical disputes around *les maladies héréditaires* into a widespread theoretical and ideological 19th century preoccupation with the general workings of *l'hérédité.* The last decade of the 18th century, and especially the early years of the 19th, had witnessed the publication in France of a number of treatises, essays, articles, and dictionary entries on "hereditary diseases". François Pagès, Alexis Pujol, and Joseph Claude Rougemont published essays on hereditary disease written for a Royal Society of Medicine competition (1788-90).[20] These were soon joined by a succession of very authoritative works on the subject. Antoine Portal, Antoine Petit, Emmanuel Fodéré wrote extensively on the subject.[21] Hereditary causation was with increasing frequency emphasized in general pathologies and in treatises concerning the main chronic diseases.[22] With some reluctance, but unequivocally, the famous alienist Philippe Pinel had acknowledged the importance of hereditary predisposition in the onset of mental illness, and very soon his followers enthusiastically took to exploring the theme. Among them Esquirol and Fodéré, who promoted the hereditary influence from the "back row" of secondary influences on insanity to the forefront of one of its main predisposing physical causes.[23]

The understanding of hereditary transmission of disease had of course a close connection to the idea that constitution and/or temperament somehow "run in the families" as well as in the wider genealogical groups. Both the way these influenced or predisposed the individual's body to react in given manners, and the fashion in which the physical state of both parents could actually influence that of the new being through their seminal fluids were main considerations. The complex transition from old humoralism to solidist and vitalist physiologies, during the 17th and 18th centuries, had the accounting for hereditary diseases as one of its battlegrounds.[24] One can find representatives of all these approaches in early 19th century France. This created some tension when French medics sought to unify their views under the common cause of general (pathological) *hérédité.* The outcome was that the general term physiological heredity became accepted as referring to the *normal* mechanism by which bodily resemblances are transmitted through the generations (whatever their actual instantiation). Pathological heredity was then to be

19 See Pick (1989); Chamberlin (1985); Borie (1981); Carol (1995); Dowbiggin (1991).
20 See López-Beltrán (1994) for the complete story about that competition.
21 See Fodéré (1813) "maladies hereditaires".
22 See Fodéré (1809); Baumes (1805); Portal (1808).
23 Pinel (1812); Fodéré (1817); and Esquirol (1820).
24 The major source for this story is Rey (2000).

seen as based on the same principles, but having as object the transmission of deviant particularities that predisposed to disease.[25]

Probably by 1820 most French medical men, and some physiologists and naturalists, considered biological heredity an important issue. For them, hereditary transmission of a whole range of characters occurred without doubt and what really remained to be understood was the reach, the power and the limitations this phenomenon had in both humans and other species. Particularly crucial for different reasons was to know 1) if some socially damaging diseases, specially mental insanity, were indefinitely preserved within genealogical lines (in this case families), 2) if the racial, national and other group differences between humans could be entirely ascribed to the preservation within genealogical lines of hereditary variations (or degenerations), and 3) if characters that affected the specific type of the living organisms could also be preserved within genealogical lines in such a way as to challenge the age old belief in the immutability of species. It was increasingly believed that these relatively different questions (concerning medical men and alienists, anthropologists and naturalists) could be confronted with a unified analysis of the phenomena: a general theory of hereditary transmission. This was the idea that occurred to several medical authors during the second decade of the 19th century. A very convincing register of this development can be found in the 60 volumes of the *Dictionnaire des Sciénces Médicales*, which from the period of 1812 to 1820 captured, in its different entries, this progressive generalization of the hereditary (in the loose metaphorical use) into a nomological approach to biological heredity. There is a sense then in which this dictionary can be described as a kind of forum where the positions of different influential physicians were being rehearsed and criticized successively. This dictionary opens a window with which we can look at the concept of heredity being shaped.

As late as 1812, Philippe Pinel, the grandfather of French alienism did not consider the hereditary cause important enough to deserve a mention in his inaugural paper on "aliénation", preoccupied as he was in giving his "moral causes" the leading role. The editors managed to give heredity a greater role by commissioning a further article on the overlapping subject of the "aliéné", to a disciple of Pinel's, Marc, who in his piece stressed the importance of hereditary predisposition to insanity. "Elle établit -he wrote- une des plus fortes présomptions en faveur de la realité de l'aliénation mentale."[26] But it was Esquirol, the crown prince among Pinel's followers (and teacher to the openly hereditarian generation that followed) who gave heredity the leading role as an influence for mental disease in his 13 articles for the *Dictionnaire.*[27] In both "folie" and "manie" he gave advances of what was to become his classic book on *Maladies Mentales* (1838).[28] As is well known, Esquirol was the first to organize in statistical tables the cases of mental insanity, with the intention of sorting out the importance of each causal influence. Heredity he found to be a major "physical" cause, and in certain circumstances a dominant one.[29]

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[25] Physiologists like Burdach (1837) and Flourens(1863) were among the most influential to propose a general physiological account of heredity.

[26] Marc (1812).

[27] Like Georget, Moreau de Tours, Baillarger, Morel. For accounts of Esquirol and his school's work see Ackerknecht (1959), chap.6, pp. 37-51. See also Semelaigne (1894).

[28] Esquirol (1816), (1818).

For the entry on "maladie héréditaire" a recently published essay by Antoine Petit (1817) was included in the *Dictionnaire*.[30] This piece remained the most influential analysis published on the subject until the 1840s. It was a clear and convincing attack on humoralist heredity. Echoes of Petit's precisely worded piece can be found in works written sixty or seventy years later. Petit summarizes what he considers to be the main achievements that medics had attained in the definition of the hereditary cause. Heredity, he asserts, has to be based upon particular states of the bodily constitution communicated to children by parents. These states give an "organic disposition" to re-produce a given effect, for instance a particular disease. He adds that they can be both localized states, or states of the whole *économie*, but he denies that some kind of general qualities of the constitution (like weakness) that establish in the body vague and indefinite tendencies (to disease) are to be seen as similarly hereditary. In heredity a specific, one to one connection must be shown to exist.

Petit praises insightfully the ancient distinction between predisposing and efficient causes as the main analytic resource to deal with the hereditary.[31] He summarizes, with more clarity than any previous author, the determinant features of heredity. Latency, homochrony (to use Haeckel's later term), atavism, all can be accounted for with a proper causal analysis. He upholds the importance of separating clearly congenital and connate influences, and accepts that only through the process of generation can real hereditary influence be transmitted. He however joins previous authors in condemning attempts to solve the mystery of heredity by an even deeper and more unsolvable mystery of generation. Hypothetical theories of generation ("systèmes") only confuse the issue. It is far more likely he adds that the proper observation of the patterns and nature of hereditary disease will illuminate the theorizing in generation, than the other way round.[32]

Although he is skeptical about the feasibility of any success, Petit leaves it to other specialists to decide over the real (intimate) nature of the inherited dispositions. The good observer however can on occasions find visible, exterior characters that are linked to the disposition, before its effects are noticeable. Generally, however, this is not the case, and though there is an organic base to hereditary causes, they usually remain hidden (latent) until the time, in the life pattern, comes for their expression. This theme of the hidden cause that exposes itself at a given time was to be retaken by different authors of the *Dictionnaire* of both medical and physiological orientation.

After Petit's solid defense of heredity, the articles of the *Dictionnaire* on all constitutional, chronic diseases gave a preeminent role to heredity. The entries on "scrophules" and "phthisie", for instance, join vigorously the attack on humoralistic, taint dependent explanations of hereditary transmission,[33] favoring without reserve the view that heredity is to be ascribed to inborn constitutional (organic) peculiarities, that predispose for certain conditions. There is a wish in several authors of the *Dictionnaire* to make it clear that there is nothing particularly

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29 Esquirol held heredity as an influential cause of insanity among the wealthy. His views were close to the solidist tradition; he spoke of it as a physical, predisposing cause, and believed that homochrony and latency were particular signs of the presence of an hereditary cause. Like Pinel, he was sure of a physical base for human mental states, but was not a fatalist and gave more importance to efficient, moral causes.

30 Petit (1817).

31 "Distinction lumineuse […] qui repose tout entière sur les faits, sera toujours une des sources fécondes où le médecin habile puisera les notions plus positives" (Petit 1817, p. 59).

32 Petit (1817), p. 63.

33 Fournier-Pescay and Begin (1820), pp. 278-386; Maygrier (1820), pp. 15-168.

pathological with the route (or mechanism) through which the structural anomalies are communicated from parents to children. Normal physiological processes were responsible for that. Once the constitution acquires a flaw, the natural trend would be to transmit it through generation, as are transmitted all other constitutional features and qualities responsible for general and particular resemblance between parents and offspring. The open end of the discussion (which Petit shied away from) was the question of how to understand *constitution*,[34] and how to describe its causal influence in the life of the organism. Where some medics saw *constitution* as a synthetic (cluster) term referring to the sum of the organic parts of the body (organs, tissues, etc,) and their organization, others saw the term as linked to functional qualities, non-reducible to general or particular dispositions. The different attitudes had a root in the tension between material and functional explanations. Between anatomy and physiology. And within physiology itself, between purely materialistic, and vitalist ontologies.

"Constitution" was traditionally a term with enough breath to encompass different, and relatively incompatible conceptions of the body, of its organization and function. Heredity, as a concept that was being integrated into the same semantic niche, acquired the same quality. "Constitution", with its relative synonyms "temperament" and "complexion", defined a general space whose details, whose actual goings on, had still to be fought over by the proponents of different physiological theories. De Montenegre, in his *Dictionnaire* piece on "maladie constitutionelle" provides a striking illustration of this view of the body as a battlefield:

> […] le corps animal peut être considerée comme formé de plusieurs êtres independens, jusqu'à un certain point les uns des les autres, par leur manière d'agir; mais concourans tous à former un résultat général qui est la vie. Il doit nécessairement exister entre ces différens un sorte d'equilibre d'action, […]. C'est ainsi que l'on peut concevoir ces dispositions individuelles qui s'étendent au moral comme au physique, et établissent entre tous les hommes une variété infinie.[35]

A constitution could be ascribed general states, or forms of being, that in turn would be responsible for reactions to stimuli, for dispositions, etc. Or it could be ascribed particular states or forms of organization responsible for localized reactions, in a given organ or part. The peculiarity of the constitutional variation could be material, and observable in principle, or it could be only a potentiality rooted in some emergent quality (like irritability) or a vital or dynamique state. Coincidence focused around the existence of a basically fixed set of physical dispositions that characterize each individual.

An important turning point seems to have been the adoption by French physiologists, influenced heavily by the work of Burdach, of a set of analogies from the physical sciences that aimed at framing difficult causal issues in dynamical terms. The idea that some dispositions in living beings were not to be explained solely in terms of their basic structural physical properties but also depended on particular sets of "dynamic" properties was used to reframe the ancient, and threatened, medical concepts of constitution and temperament, in order to give them a new

[34] Fournier (1820) tried to make the differences between these concepts explicit. "Il existe -he wrote- entre les mots tempérament, constitution et complexion, quelle que soit leur synonymie, dans certains cas, des nuances qui permettent pas les employer indistinctement les uns pour les autres."

[35] Montenègre (1820), p. 246.

respectability.[36] Both concepts were aimed at capturing the fixed set of physical dispositions (structural and dynamic) that each individual possessed through his life.

After Cabanis, few authors doubted that there was a link (a *rapport*) between the parents' constitution and that of the new beings they gave rise to. "Hérédité", after 1830, was ideal as a basic conceptual tool that could be deployed to highlight and investigate such relationship. As Michel Lévy summed it up:

> […] á l'étude de la Constitution se rattache essentiellement celle de l'hérédité dans la santé et dans les maladies […]. L'hérédité éclate chez l'homme dans sa forme génerale et dans la proportion relative des ses parties; elle se manisfeste par les propriétés intimes de la fibre organique.[37]

This close explanatory link with 'constitution' gave the notion of 'hérédité' a wide appeal both for the medical men and naturalists, and eventually transformed it into an common frame accepted by most, whose contents where being debated and defined en route. Resemblances, in form and function, in health and illness, in body and mind, could with its help be rooted in a historical causal chain. Eventually, naturalists and anthropologists that adopted *hérédité* participated in the struggle to fashion it into a broader rational explanatory scheme, for which the boundaries and ways of actions needed to be clearly defined. A part of that work was directed towards having clarity about the kinds of characters heredity would affect. A clearly defined set of types of characters in a hierarchical scheme was seen by many as crucial. From specific, through racial, to individual, features (on one axis); and from physical to moral characters (on the other axis), authors would debate the reality and relative importance of an increasing number of claims of hereditary transmission of traits. The main problem that most theoretical generalizations faced was, again, irregularity; the proliferation of exceptions. Besides, given the bad track record of general hypothetical systems, medics had strong feelings about not letting those outsiders impose definitions of constitutional dispositions and heredity without giving enough weight to their (medical) accumulated experience.[38] For them "l'hérédité pathologique" should inform "l'hérédité physiologique" before the latter could reciprocate. And so the definition of heredity itself should be based on medical men's assessments of what generally is the case. To which extent, for instance, were only general, non-localized constitutional dispositions (or characters) inherited; or were also very localized and particular ones (like moles, or bladder stones) transmitted. Such a question was better answered, some medics believed, observing the patterns of disease communication, given that a disease (or a malformation) was a much clearer sign than other normal resemblances, just like in the case of moral phenomena, it is easier to follow, in a family, a pattern of a distinctive set of symptoms, as those of insanity, than it is to follow vaguer, positive qualities, like honesty or strength of will.

It is a sign of the effectiveness with which contributors to the *Dictionnaire* made their cases that many of the matters they discussed around hereditary transmission were considered a given by most French medical men after them. Elaborations of their main tenets followed. The schools of

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[36] Some authors made complex analytical distinctions between these two concepts wheras others saw them as equivalent.

[37] Lévy ([1844] 1869) 1: pp. 114, 186.

[38] For this position of the medics see particularly Petit (1817); Lereboullet (1834); and Piorry (1840).

medicine of Paris, Montpellier, and Strasbourg were regularly producing theses, both by students and professors, dealing with different aspects of hereditary transmission of diseases. Works in which with increasing frequency a nomological attitude towards *l'hérédité* was assumed. D.A. Lereboullet (1834), M. Lévy (1844), C. Béclere (1845), and specially P.A. Piorry (1840), produced good expositions of how heredity worked in normal features and in the communication of disease. But by the time these medics wrote, the field was ceasing to be a purely medical and pathological one.

Slowly but constantly heredity was becoming a hotly debated social *and* scientific issue. What medical men and some physiologists had for decades been arguing about the hereditary base of human nature, finally captured the attention of broader sections of mid-19th century French intelligentsia, who saw the potential power of their ideas for accounting for the unaccountable: the human soul in its collective and individual dimensions, and its dependence upon the body's constitutional make-up, or organization.

D.A. Lereboullet summarized the general importance of heredity, outside the purely medical realm. He stressed the uniqueness of the human case, of which medics had the privilege of having more experience. Among humans, he wrote "l'organisation nous présente des différences individuelles" based on the innumerable combinations that different constitutions, temperaments, and idiosyncrasies can produce. Together with the many modifications that external factors (climatic, passions, education) can make they can "rendre raison des nuances infinies que nous observons entre les hommes […] sous le rapport de leurs charactères physiques et moraux." But, he added, these subtleties can be further analyzed

> […] si nous appliquons à l'étude physiologique de l'espèce humaine la méthode des naturalistes, nous pourrons encore distinguer, au milieu de ces nombreuses différences, certains caractères communs, certains types originaux dont plusieurs auront persisté à travers une longue series de siècles. Les points de ressemblance seront plus nombreux entre les individus d'une nation isolée et qui n'aura pas contracté d'alliances étrangères. Enfin, si nous portons nos regards sur les membres d'une même famille, nous trouverons entre les enfans et les parens une conformité des plus évidentes: traits du visage, taille, son de la voix, couleur de la peau, constitution, tempérament, habitudes, caractère, moeurs, penchans, tout se ressemble. C'est sous l'influence de cette loi immuable, en vertu de laquelle l'homme donne le jour à des êtres semblables à lui, que l'on voit aussi quelquefois des vices de conformation se transmettre de génération en génération. Ainsi nous héritons de la constitution et du tempérament de nos parens; nous héritons de leurs caractères physiques et moraux; nous héritons de leurs vices de conformation.[39]

The possibility, described by many 18th and 19th century authors,[40] of having stable, hereditarily and genealogically based, natural human groups *under* the level of the species (races, varieties), could easily be extended to other "socially useful" categories, like the family, and the nation. Genealogy as the basis for classification, with heredity as the main explanatory concept was profiling itself as a promising approach outside the medical realm. At the same time the vagueness

[39] Lereboullet (1834).
[40] Among them Maupertuis (1745); Hunter (1786); Joseph Adams (1814); Prichard (1813); Pujol (1802).

of key working concepts, like latency and predisposition, was an open invitation for all sorts of analogical reasoning among imaginative theoreticians.

After the 1840s, increasing attention was being paid to the 'moral', or later on 'psychological' aspect of heredity in humans. Heredity had ceased to be a pathological term with analogical links with normal resemblances. It ceased to be a simple concept and began to embody more than just a small sector of the medical community's view of the human body's original make and dispositions. Its empirical basis was expanded by its closer linkage to biological phenomena (like the origin of varieties), and its theoretical structure was also thoroughly expanded.

By 1834 D. A. Lereboullet, then a candidate for medical chair at Strasbourg, could confidently assert that the majority of authors understood *Hérédité* as the transmission of particular (bodily) dispositions that tend to re-produce in children the same characteristics their parents had (resemblances, diseases), at the same age, or in the presence of the same exciting cause.

More or less at the same period Charles Darwin began his lifelong effort to clarify the complexities of hereditary transmission within lineages. As Mary Bartley and others have shown, the features of the notion of heredity and hereditariness that he considered more useful to begin his explorations were basically the same that French and British medical men had been deploying for several decades: latency, homochrony, reversion.[41] A cursory look at Darwin's marginalia on his copies of medical works, like those of Lucas, Piorry or Henry Holland will eliminate any doubt about a robust connection.[42]

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41 See Bartley (1992) and Winther (2000).

42 See Di Gregorio (1990) and (1986).

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The Sheep Breeders' View of Heredity (1723-1843)

Roger J. Wood

> What can be revealed from horse breeding within a century can be achieved in sheep breeding within a decade. *(A. von Weckherlin 1846, original in German)*

Breeding sheep for desired characteristics has a long history. The ingenuity of generations of farmers ensured that the best of breeds, and the most 'noble' animals among them, would become valued objects of trade, war booty and gifts between monarchs. In eighteenth century Europe something new and radical occurred when advances in selective breeding technology became associated with improved rearing conditions and carefully designed feeding experiments. It was then that artists began to bring the evidence of breed variability and transformation to a fascinated public. Meanwhile an expanding army of agricultural writers was attempting to explain how the various breeding successes had come about. By the mid-nineteenth century, principles of breeding had been established that would serve the farmer for years to come.

Attempts made to discover patterns of relationship between generations, to predict the results of breeding, met with gratifying success in skilled hands although never to the point of providing a functional explanation of biological inheritance. Theory was restricted to practice-based axioms and breeding rules, and it evolved with technological advance. It is these technology-driven changes in the concept of heredity[1] that I shall be reviewing during the period under consideration (1723-1843). The purpose is to observe the relationship between experience and theory, as the latter becomes progressively modified as an aid to further practical advance. Three significant dates will serve to guide us through the period:

- 1723 when *Jonas Alströmer* (1685-1761) imported the first Merino sheep from the warm dry atmosphere of Spain to the cold dampness of Sweden, and thereby set a trend in fine wool production throughout Europe and beyond, even finally to the Antipodes;
- 1783 when *Robert Bakewell* (1725-1795) and his friends in the Midland counties of England formed the Dishley Society, the first breed association, set up to regularise the letting and exchanging of breeding stock of the 'New Leicester' or 'Dishley sheep', a new breed created by intensive selection and inbreeding;
- 1843 when Gregor Mendel was admitted to the monastery of St Thomas in Brno (Brünn) and first came under the influence of Abbot *Cyrill Napp* (1792-1867). As a prominent member of the Moravian and Silesian Agricultural Society, Napp had made several published pronouncements on heredity, all of which arose out of debates on sheep breeding.

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[1] The word heredity (*hérédité*) was not in vogue before the nineteenth century. It is nevertheless convenient to use it since the 'conceptual space' it would later occupy was already recognised. Traits that distinguished one variety from another were referred to as hereditary (Marshall 1790, 1: p. 419). The transfer of such traits between generations was spoken of in terms of leaving or receiving an 'empression' (impression) or 'stamp' (Marshall 1790, 1: p. 326-7).

1. The Background

'Like begets like'

To the eighteenth century farmer heredity meant the property of living organisms by which offspring received the nature of their parents or ancestors. According to received wisdom it was associated in some mysterious way with the animal's blood and also with its traditional environment. Differences between races (breeds), and also between individuals within a race, were explained ultimately by reference to accidents of development caused by influences over which the farmer had limited or no control. These might be changes of climate, vegetation or mode of life, or even dreams and passions, that deviated the generative process from its established course, that were *degenerative*.[2] The responsibility of breeders lay in regulating the generative process by seeking to preserve or create an ideal type. It was a result to be achieved by a combination of selective breeding, environmental management and other aspects of good husbandry. No good breeder could take the matter of heredity casually.

Blood and seed

The hereditary concept of blood, the essence of animal life, rested on the assumption that it must be transformed into semen (seed), the basis of new life.[3] As the scripture said, each new being is "fashioned in flesh […], being compacted in blood of the seed".[4] For many centuries the blood/seed concept had no serious rival, and it was frequently associated with the idea that "the blood bore in it particles, originating throughout the entire body, that were gathered up by the testicles."[5] But what about the female, did she too produce seminal fluid or substance from her blood? By the eighteenth century, authorities were increasingly ready to postulate that the embryo was formed by the fermentation in the womb of seminal particles, produced by the blood of both sexes.[6] The idea of inherited material drawn from all over the bodies of both parents, and united at conception, would be defined later by Darwin (1868) as 'pangenesis'. Ernst Mayr has explained why this mistaken idea had such a long history:

> If one believes in the effect of use or disuse or any form of inheritance of acquired characters, as did just about everybody from Hippocrates to the nineteenth century, one is virtually forced to accept such a theory.[7]

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2 For the basis of this idea see Roger (1997), pp. 460 f., quoting the works of Buffon and other eighteenth century authors.
3 Brown (1987), p.184; Wood and Orel (2001), p. 47.
4 *Wisdom of Solomon* 7: 1-2.
5 Roger (1997), pp. 42-43, quoting Highmore (1651), chap. 5.
6 The concept was presented in the 1730s in a printed booklet for sale in London, *The Secrets of Nature revealed, or the Mystery of Procreation and Copulation considered and Explained*, by 'Michael Scott', supposedly based on a thirteenth century text (Pinto-Correia 1997, p. 86).
7 Mayr (1982), p. 636.

Blood and locality

There was also a strong belief that blood was linked with locality. "Every soil has its own stock" wrote the English estate agent William Pearce in his *General Review of the Agriculture of Berkshire*.[8] The domestic animal could not select its own environment; it inherited it just as truly as it inherited its blood. A local breed's characteristics depended for their reproduction on the continuity of local conditions.[9] Problems with degeneration were expected when a breed was transported into a strange environment. Conventional wisdom insisted that the influence of a new climate and flora could not be escaped despite all efforts by the farmer to mitigate their influence by attempting to isolate his animals from external conditions, and to control mating. It had to be admitted that successful breeds were those in harmony with their environment.

> We have, at present, through time and the industry of our ancestors, various breeds; some of them adapted, though not perfectly, yet in very considerable degree, to the soil they are upon, and the purpose to which they are wanted […].[10]

Even so it became the practice to transport the best of sheep breeds more and more widely in the period under review, which allowed the theory to be tested. With experience, the intelligent farmer could establish the limits of natural environmental influence on heredity. Evaluating the connection between blood and locality was to prove a key issue in selective breeding, opening the way, step by step, to a greater understanding both of heredity and of adaptation to the outside world. An explanation was required about how external influences, interacting with the animal's own ancestral nature, brought about continuity within a race in one circumstance but led to changes in another. The final conclusion drawn from these 'natural experiments' would prove to be reassuring, that when mating was controlled, adaptation (degeneration) took place much more slowly than the pessimists predicted.

Maternal impressions and other disputed influences on heredity

Some modifying influences on the blood, and thus on heredity, were believed to be at their most effective at the moment of conception. An old and widespread myth, enjoying biblical authority,[11] held that visual impressions received by a mother ('maternal impressions') could affect aspects of the outward appearance of her young. Belief in the influence of maternal impressions on patterns and 'birth marks' in the new born, led to preventative actions by breeders, well into the nineteenth century.[12] In this and other connections, experts in England as influential as W. Youatt were ready to claim wide influences on heredity through the power of the imagination:

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8 Pearce (1794), p. 46; see also Young (1811), p. 6.
9 The same was believed for varietal differences in plants (Müller-Wille, this volume, quoting Linneaus 1751).
10 Youatt (1837), p. 494.
11 *Genesis* 30: 39.
12 Wallace (1893), p. 8, referred to by Wilson (1912), pp. 31-32.

> When in the higher species, the principle [of 'like-produces-like'] may not at all times seem to hold good, it is because another power, the intellectual- the imaginative- somewhat controls the mere organic one […].[13]

Another mistaken belief lay in what August Weismann would later call telegony, also referred to as 'infection of the germ,' by which was meant the supposed influence of the male upon the female, in such a way as to affect her future offspring by *other* sires.[14] Breeders also felt bound to consider the supposed relationship between healthy conception and the intensity of sexual activity, and whether this related to the degree of heat produced. The 'hotter' the male, the more potent he was supposed to be, i.e. more able to transmit his own characteristics. How to recognise 'hotness', in this special sense, was a matter of dispute.

Concerning the determination of sex, there was a traditional belief in astral or planetary influences.[15] Significance could also be attached to the weather, always a favourite topic among farmers. An ancient belief saw great significance in humidity and wind direction. Thus the seventeenth century agricultural pundit William Winstanley advised that "[i]f you would have your Yews [ewes] bring forth Ram-Lambs, then you must put the Ram to the Yew in the dry weather, and observe to drive the Yew towards the blowing of the North Wind."[16]

Nature and husbandry

For the conscientious breeder no potential influence on heredity could be ignored except on the basis of proven experience. With so many unanswered questions facing him, he had to be ever watchful to note anything at all that seemed significant. The central issue was the extent to which the blood could be moderated by rearing, i.e. by the farmer's system of management. As thus defined, rearing could include selective breeding, as well as the control of living conditions and the provision of special food to replace or supplement the natural diet. In this sense, rearing is obviously a more inclusive concept than that which Francis Galton would later define as "nurture".[17] Nature for the farmer was also a different concept from Galton's, for it included some natural elements added after birth, the most obvious being the native flora ('natural herbiage' (sic)) that the animals would be ingesting and assimilating throughout life. Who knew how much

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13 Youatt (1834), p. 522.

14 Charles Darwin (Darwin 1868, pp. 403-4) made the concept scientifically acceptable by giving credit to an example from horses reported by Lord Morton (Morton 1821). The story was that a mare had born offspring by a quagga (a now extinct species related to the zebra) from South Africa and later produced horse colts which showed some striping. The fact that Darwin was prepared to believe the story suggests that the concept was accepted by the practical breeders with whom he was in contact. See also Davenport (1907), pp. 185-189; Burkhardt (1979).

15 Roger (1997), p. 52.

16 Winstanley (1679), p. 118.

17 Galton did not accept that external nature (a change in conditions) had much impact on heredity during an individual's lifetime. In Galton's eyes nature referred principally to 'those inborn or congenital peculiarities that were also congenital in one or more ancestors' (Galton 1876, p. 329). He later added 'the unforeseen appearance of 'sports' or 'mutations' of a kind not hitherto observed, but which, for all of that, may become hereditary'. (Galton 1908, chapter 21). For Galton, selective breeding was simply a manipulation of nature. Nurture referred to non-heritable modification of inherited "germs " caused directly by the individual's conditions of life, so that "the law of heredity goes no further than to say that like *tends* to produce like " (Galton 1876, p. 338, my emphasis).

this and other natural influences would affect the nature of future generations? Experience suggested that environmentally induced changes would become increasingly fixed in heredity the longer the animals were bred in that environment.

Blood and grading

The most direct way for a farmer to obtain domestic animals of higher quality than those he already possessed, was to breed exclusively from blood stock of both sexes imported from wherever the best could be found. If this course of action had to be rejected, either on grounds of cost or caution (about possible degeneration), the alternative was to introduce superior blood by importing only males, to be crossed to native females and to their progeny for several successive generations. With each generation of such crossing, the proportion of superior ('noble ') blood would increase: 1/2 in the first generation, 3/4 in the second, 7/8 in the third, 15/16 (93.75%) in the fourth, rising to more than 99% in the seventh. This technique, known as 'grading' or 'grading up', based on *a proportionate concept of heredity*, as a fraction of the blood, probably had a long history, perhaps even back to Roman times.[18] It had gained special significance in English racehorse breeding in the seventeenth and early eighteenth centuries, when great sums of money and aristocratic patronage rested on the breeders' skill with Arab, Turkish and Berber livestock.[19]

2. Alströmer 's Achievement

When Spanish Merino blood-stock finally became available to countries north of the Pyrenees, the grading technique found a new application. This was after Jonas Alströmer, who had risen from humble beginnings in Sweden to become a wealthy businessman in London with British citizenship, decided to import Merino sheep into Sweden directly from Spain. His growing knowledge of the wool trade convinced him that the best way ahead for Sweden lay in producing the finest wool in home territory, from the best foreign sheep. With a flash of genius and a good measure of optimism, he shipped into the port of Göteborg a small consignment of Merino sheep taken from their long established habitat in Spain. Landed in 1723, they were housed, like English racehorses, in clean, dry, well-insulated stables. Only in the warmest weather would they be let out. Despite early losses of stock, Alströmer had the faith to persist and, on the basis of further imports, to build up Swedish fine wool production into a thriving business, under Royal patronage.[20] He and his successors were able to demonstrate that even a radical change in the Merino sheep's conditions of life was insufficient to cause degeneration of their wool when accompanied by good husbandry practices. Their satisfactory state of health demonstrated that they could attain a degree of harmony with their new environment. Shepherds were trained under Alströmer's guidance in the best techniques to ensure that numbers of the 'pure' Merino type would expand year by year. A 'mixed breed' was also created, the product of grading crosses.

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18 Anonymous (1811).
19 Russell (1986), p. 86.
20 Schulzenheim (1797), pp. 314-7; Wood and Orel (2001), pp. 126-7.

Alströmer's enterprise paralleled that of his compatriot and friend Carl von Linné (Linnaeus), striving to establish exotic plants in Sweden. By the time Alströmer was showing off his remarkable achievement to Linnaeus in 1746,[21] he had flocks at various stages of improvement. He was hoping that those he had built up on the basis of crosses with Swedish sheep, would be better suited to local conditions and thus less expensive to maintain.[22] Linnaeus deplored the xenophobia of Swedish farmers opposed to using the Merino stock for crossing.[23]

The Swedish Merino experience inspired other countries to follow Alströmer's example. For grading local Swedish sheep he recommended that none but 'foreign' (i.e. Merino) rams should be used for three generations, advice to be repeated many times by other writers, of various nationalities, in the coming years. Eventually, however, the number of generations the experts considered necessary to make a suitable transformation rose from three to four and then to five.[24] Even after five generations it proved necessary to practise selective breeding if stability was to be achieved. The risk of degeneration was ever present.

Degeneration and selective breeding

The constant threat of degeneration presented a challenge to the best skills of breeders, out of whose successes there developed a growing conviction that control of rearing conditions and selective breeding were complementary techniques to oppose it. In harsh Scandinavian conditions, the type of Merino sheep that finally emerged at the end of the century was larger and stronger than the original Spanish imports but still yielded wool of excellent quality, equalling or even excelling that from direct Spanish imports.[25]

In parallel with the Swedish experience, although starting later, came the development of specialised Merino varieties in Prussia, Saxony, Austria/Hungary and France, each one with its own particular characteristics. How to maintain the stability of selected strains of Merino sheep, to yield high quality wool on a consistent basis, never ceased to be a matter of debate, as information was exchanged. Experience of grading German sheep with Merinos convinced J. H. Fink (1730-1807), the King of Prussia's head bailiff, that fineness of wool was attributable more to breeding than to environmental influences.[26] The point was noted with approval by the English farmer George Culley in the fourth edition of his book *Observations on Livestock*.[27] Earlier published work had been inclined to stress the supremacy of environmental influences on wool, a belief that he and his mentor Robert Bakewell had already learned to question from their own experience.

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21 Suneson (2001).
22 Lasteyrie (1802); Schulzenheim (1797), pp. 307, 319-321; Kjellberg (1943), pp 304-5; Schulzenheim (1804), pp. 172-3; Culley (1807), p. 238; Rees (1819), section: Sheep; Martin (1849), p.61.
23 In 1746, Suneson (2001), p. 15.
24 Hastfer (1752a), (1752b), (1756); Daubenton (1782); Stumpf (1785); Fink (1799), p. 48; Parry (1806), p. 339; Tessier (1811).
25 Schulzenheim (1797), pp. 315-6; Lasteyrie (1802); Rees (1819), section: "Sheep".
26 Fink (1797), p. 278, (1799), p. 54.
27 Culley (1807), p. 260.

3. Bakewell's Revelation

Under the influence of a succession of breeders,[28] it came to be recognised that the force of heredity could be strengthened and also directed, trait by trait. Certain traits seemed to be inherited together, others to vary independently. Taking the lead in this activity was Robert Bakewell who farmed at Dishley in Leicestershire. By paying exceptional attention to detail, he was able to regulate the process in a manner that Walton (1983) has described as giving selective breeding "a formal shape", and to demonstrate publicly how rapidly a transformation could take place. Among his achievements was the creation of a new breed of sheep, known as the 'Dishley' or 'New Leicester', derived from rare individuals showing unusual or extreme characteristics ('accidental varieties').[29] As the new strain was being perfected, individuals within it could be compared and evaluated as breeding stock according to the quality of their progeny.

Male and female

No successful breeder from Bakewell's time onwards was in doubt that both sexes contributed to inheritance,[30] but less certainty was expressed about whether the two parents contributed equally.[31] Of course it was easier to evaluate a good male than a good female because of the much larger number of progeny he could produce. However by the 1830s most British experts were in agreement with Youatt who stipulated, with direct reference to sheep, that "no certain degree of excellence can be attained unless the female possesses an equal degree of blood with the male."[32] Both sexes contributed to inheritance of the same characters.

Individual trait selection, inbreeding and progeny testing

Bakewell had startled the farming world in the 1770s and 80s with the inflated prices he could demand for his breeding stock. What made his highly selected Dishley sheep so specially valued was their rapid growth rates, associated with a unique body shape, designed to minimise unprofitable parts of the carcass and maximise joints of meat that would gain the highest prices. The difference in their appearance from traditional breeds was remarked upon with astonishment. It seemed that he worked like an artist who created an image in his mind and then transformed it into reality.[33] His startling achievement depended on more than a proportionate, 'holistic' view of heredity such as underpinned the principle of grading. His was a 'trait-based' approach, one in which defined characteristics could be followed in families, sometimes independently, sometimes in association with one another.[34] By taking practical advantage of such hereditary interactions,

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28 Marshall (1790), 1: p. 338; Culley (1786), p.112; Trow-Smith (1959), pp. 45-69.
29 Bakewell's selective breeding of other domestic species is not being considered.
30 Berry (1826); W. Youatt, writing as Lincolnshire Grazier (1833), p. 171; and Sir John Sinclair, President of the Board of Agriculture in London (Sinclair [1817] 1832, p. 97-8).
31 Boswell (1829); see also Youatt (1834), pp. 523-4; discussion by Sinclair [1817] 1832, p. 97.
32 Lincolnshire Grazier (1833), p. 238.
33 Pitt (1809), p. 249; Somerville (1806); Wood and Orel (2001), p. 69. Despite the power of the artistic image in relation to Bakewell, it was not original. The same idea had inspired the Paris physician C. A. Vandermonde half a century earlier, in respect to the creation of new races of cats, dogs and horses, when he likened the breeder to a sculptor (Vandermonde 1756, p.155, quoted by Terrall 2002).
34 Culley (1786), p. 186; Marshall (1790), 1: p. 298; Wood and Orel (2001), pp. 6-7.

e.g. between small leg bones and rapid maturation,[35] he could push his selection programmes forward without delay.

As a natural accompaniment to selective breeding for growth and body shape, Bakewell carried out feeding experiments, by comparing different breeds side by side, to discover the best regime to maximise productivity at minimum cost. Because he was selecting intensively he was also inbreeding very closely, father to daughter, mother to son and brother to sister. His technique, given the name 'breeding in-and-in',[36] had to be used with great care, for it ran the risk of concentrating deleterious traits as well as favourable ones. And just as the latter were to be preserved, the former had to be rigorously excluded. Bakewell's own attitude on the matter was well known. Only animals in robust good health, as well as of the highest quality, judged by touch as well as eye, were considered suitable for breeding at this level. To minimise the potentially injurious effects of breeding in-and-in, Bakewell developed a progeny-testing programme in co-operation with fellow farmers who formed the Dishley Society in 1783. Through the interchange of stock, Bakewell and his friends were able to test their rams against a much wider variety of ewes than they could possibly have kept on their individual farms.[37]

Through his skill in defining economically significant traits, and employing the techniques of inbreeding and progeny testing, Bakewell became acknowledged as a true 'Prince of Breeders'.[38] His Dishley sheep stock was used by many other sheep owners for crossing into almost every British breed, and many abroad, to introduce its quick fattening quality.[39]

Heredity as a changing concept

When fellow farmers were asked about Bakewell's breeding philosophy, they would frequently stress his great faith in the old adage that 'like produces like':

> The simple observation that domestic animals possess a tendency to produce animals of a quality similar to their own was the groundwork of all Bakewell's proceedings.[40]

By observing successive generations of his breeding stock under controlled conditions, he determined which traits were most strongly inherited. The result, as William Marshall reported, was that "a number of traits were found, in some considerable degree at least, to be hereditary."[41] Bakewell's confidence in heredity extended to unmeasurable or less readily defined traits, including resistance to bad weather, tolerance of poor food ("hard fare") and even propensities to certain disorders. Visible traits of no economic value in themselves ('nicks' or 'marks') could be used as inherited markers of useful properties and propensities.[42] In no case could it be doubted that heredity arose from both sexes.[43]

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35 Young (1771), p. 111; Wood and Orel (2001), p. 75.
36 Marshall (1790), 1: pp. 300-301; Wood and Orel (2001), pp. 70-74.
37 Pitt (1809), p. 256 ff.; Wood and Orel (2001), pp. 82-85.
38 Young (1791).
39 Young (1791); Trow-Smith (1959), pp. 66-9, 269-74; Walton (1983); Wood and Orel (2001), pp. 85-8, 145-6, 148.
40 Berry (1826), quoted by Youatt (1834), p. 522.
41 Marshall (1790), 1: p. 419.
42 Wood and Orel (2001), p. 78; Culley (1786), p. 186.

Population thinking

All Bakewell's actions tell us that his aim was to produce a breed in which the same characteristic traits would appear in every individual, despite the uncertainties of heredity. To be 'well bred' from good parentage was not enough. Breeding stock had to be selected carefully on the basis of 'form', i.e. the expression of desired traits, as well as blood (i.e. ancestry). This had to be done in every generation, supported by wise and consistent husbandry. Only then would it be possible to 'concentrate' the desired traits within the breed and avoid detrimental ones, with the necessary degree of efficiency.[44] In his appreciation not only of parentage but also of form in a consistent environment, Bakewell avoided falling into the extreme hereditarian position taken by some other breeders of his day. Although the ancestry (blood) of an animal was of serious importance to Bakewell, particularly as his breed became progressively refined, its individual form had also to be considered and, more importantly, the form of its already existing progeny.

It was on this broadest possible basis that every individual animal used for breeding, female as well as male, had to be selected most carefully.[45] Through this course of action, successful breeders like Bakewell came to appreciate the significance of the whole flock as the ultimate target for improvement. Their attitude to breeding exemplifies what Ernst Mayr has defined as 'population thinking'. He believes that breeders were the first group to gain an understanding of the concept.[46] Bakewell's attitude on the matter was revealed in a conversation with Young, who quoted him as saying:

> The merit of a breed cannot be supposed to depend on a few individuals of singular beauty: it is the larger number that must stamp their character on the whole mass: if the breed, by means of that greater number, is not able to establish itself, most assuredly it cannot be established by a few specimens.[47]

To "establish itself" fully, in Bakewell 's terms, meant that the breed had to prove successful commercially in competition with other breeds, particularly the one it replaced.[48] Furthermore, as Marshall pointed out, a breed had to be adapted to "the farmer's *climature, soil* and *system of management,*" otherwise, as he stated, "if we reason from analogy, the improver appears to be setting himself up against nature, a powerful opponent."[49] How was opposition to nature to be avoided? Marshall had no doubt what Bakewell and his friends would answer: by carefully selecting all breeding stock against that particular environmental background. Only then could the highest levels of breeding excellence be achieved, when what we may call 'internal' and 'external' nature existed in harmony. "By this process […], the term blood became distinctively applied. When reference could be made to a number of ancestors of distinguished excellence the term blood was admitted."[50]

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43 Marshall (1790), 1: p. 481.
44 Ibid., pp. 464-5.
45 Lawrence (1809), p. 25.
46 Mayr (1971), (1972).
47 Young (1791), p. 570.
48 Wood (1973), p. 238.
49 Marshall (1790), 1: p. 464-5.
50 Berry (1826), quoted by Youatt (1834), p. 52.

Here the term is used in the sense of 'full blooded' or thoroughbred. The concept was becoming obvious to other farm animal breeders but Bakewell's superior breeding success was reflected in the uniquely high prices paid (or claimed to have been paid) for his breeding stock.

4. After Bakewell

Races and species

When breeders like Bakewell began to compare races native to different environments, side by side at a single location but isolated reproductively, they noted that they remained distinct for as many generations as there was time to observe them. The obvious conclusion was that any environmental effect on heredity must be slow and gradual. How then had the different races[51] come about? The influence of earlier human selection was a clear possibility. Another explanation to be considered was that races/varieties were natural divisions, like species, incapable of merging permanently into a single type.[52] William Marshall, the prominent agricultural writer from Yorkshire, felt bound to consider the idea:

> Whether in the Animal Kingdom *varieties* are altogether *accidental* or *artificial*, or whether they are not, or have been originally *natural subdivisions* of *species*, would, with respect to *domestic animals* be now difficult to determine.[53]

In his own opinion, which he believed to be "supported by naturalists," varieties arose "by climature [sic], soil, accident or art, under the guidance of reason or fashion, during a succession of centuries." Marshall's conclusion, supported by a mass of breeding evidence, was significant as a reaction against the widely held opinion by naturalists that members of a species differed only in superficial, non-essential characters.[54]

Inbreeding and prepotency

Farmers recalled Bakewell 's attitude to inbreeding by quoting his supposed dictum that "inbreeding gives prepotency and refinement."[55] "Prepotency" was the ability of certain individuals to pass on their traits with extra certainty. Inbreeding was seen to increase potency and thus accelerate the progress of improvement. It was recognised to be a result of hereditary stability, and thus as a "concentration of the blood." 'Concentration of the blood' became a breeding maxim demanding an explanation from science. In a pamphlet published in 1812 the surgeon John Hunt, a supporter of the 'Dishley System', deplored the idea of blood being the actual vehicle

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51 The terms 'race', 'variety' and 'breed' seem to have been used interchangeably by animal breeders at this time.

52 Home (1776), p. 309.

53 Marshall (1790), 1: p. 462, his emphasis.

54 Mayr (1972). Referring to British cattle, Darwin would later write: 'A large part of the difference [between domestic races], no doubt, may be due to descent from primordially distinct species; but we may feel sure that there has been in addition, a considerable amount of variation' (Darwin 1868, 1: pp. 86-87). Earlier, in a letter to A.R. Wallace in 1857, he had placed the emphasis in the opposite direction (Darwin 1887, 2: pp. 95-96), as Marshall had done in 1790.

55 Lush (1951), p. 501.

of heredity as "far exceeding the laws of nature". He agreed with the Merino breeder, Dr Parry of Bath, that "the word blood is nothing more than an abstract term expressive of certain external and visible forms which from experiment we infer to be separately connected with those excellencies which we most covet." Similar sentiments were expressed by other breeding experts at the time.[56] All that could be said for sure was that blood, in the hereditary sense, was divided between the parents in proportion. Thus a son mated to his mother would cause her to produce lambs with six parts of herself and only two of his father.[57] As noted earlier, the same argument was used to calculate the proportion of high (noble) blood in grading crosses.

By 1800 two traditions in animal breeding had been established: 1) the grading technique with its proportionate view of heredity; 2) selective breeding from accidental varieties, usually isolated from the progeny of controlled matings, sometimes between members of different geographical races. On the basis of experience, breeders were guided to success by a number of valuable breeding maxims, but even the deepest thinkers among them could suggest no causal explanation for heredity. Dr James Anderson, a Scottish farmer and scholar, who did business with Bakewell,[58] tried to face the issue in some of his writings but had to confess it to be a mystery, both in "origin and perpetuation".[59] For practical purposes, the priority for a breeder in the Bakewell tradition was to possess breeding stock with a recognised capacity to transmit desirable traits as surely and certainly as possible, through either sex. Theoretical explanations could wait till later.

The Bakewell approach to breeding is evaluated

A number of breeders in Britain benefited from Bakewell's example although by no means everyone who wished. For those with only a shadow of his judgement, and without the equivalent of a Dishley Society to evaluate their breeding stock, inbreeding could bring drastic penalties. Potential problems included loss of fertility and various constitutional weaknesses and disorders not easily eliminated. As more and more breeders jumped onto the inbreeding bandwagon, British experts like Sir John Saunders Sebright and Sir John Sinclair recommended caution.[60] Too many breeders were finding that close inbreeding "impairs the constitution and affects the procreative powers."[61] The care Bakewell had taken to avoid these deleterious effects by evaluating rams and exchanging stock with other Dishley breeders was widely recognised.

Bakewell's original and unusually systematic approach to breeding was also being evaluated on the other side of Europe. His combination of techniques was being taken most seriously in relation to fine wool production, even though his own interest did not lie particularly in that direction. By the end of the century the technical term 'breeding in-and-in' had entered the French, Austrian and German breeding literature, either in English or in translation.[62] In a German textbook on animal improvement, published in 1785, the author, Christian Baumann

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56 Parry (1806); Lawrence (1800), p. 44.
57 Sebright (1809).
58 Pawson (1957), p. 106.
59 Anderson (1799), p. 87; see also Marshall (1818), 1: p. 43.
60 Sebright (1809); Sinclair ([1817] 1832), pp. 93-5; Blacklock (1838), pp. 106-7; see also Knight (1799).
61 Berry (1926), quoted in a footnote to Youatt (1834), p. 526; Berry (1829).
62 Fink (1799), p. 73; Bourde (1953), p. 145; Klemm and Meyer (1968), pp. 139, 179; C.C.André (1804); Thaer (1804); Wood and Orel (2001), pp. 140,157,164,167, 212, 215, 231.

(1739-1803), a Cistercian monk, who spent most of his life in Würzburg, wrote in favourable terms about a fellow Bavarian who was evaluating his rams in conscious imitation of the famous Englishman. He was referring to the "talented economist" von Bori (Borie) who farmed at Neuhaus, close to Bad Neustadt. "Mr Bori hired his rams to his neighbours to evaluate their offspring, following the example of Bakewell."[63]

5. Sheep Breeding in Moravia

Towards the end of his life, Baumann moved to Moravia where he produced a new textbook on agriculture published in 1803.[64] Describing fine wool production in Central Europe, he picked out for special mention the estate of the noble Ferdinand Geisslern at Hoštice in Moravia.[65] Baron Geisslern made a practice of exchanging rams with neighbouring landowners, mating ram with ewe in carefully controlled matings.[66] By that time Geisslern had attracted sufficient notoriety to be called the "Moravian Bakewell."[67]

The Brno Sheep Breeders' Association

Most of what we know about sheep breeding in Moravia comes from the proceedings of an "association" for sheep breeders, created in Brno, the major Austrian centre for wool cloth production, in 1814, as a section of the *Moravian and Silesian Agricultural Society* (*AS*). The *Association of Friends, Experts and Supporters of Sheep Breeding* (hereafter abbreviated to *Sheep Breeders' Association* or *SBA*) was set up to discover "incontrovertible principles to ensure favourable results in sheep improvement."[68] Meeting annually for nearly thirty years, it stimulated numerous publications, written or edited by its secretary C. C. André. Unique in Europe not only for its length of existence, but for having among its membership representatives of every profession with an interest in the wool business, the SBA drew together progressive individuals from throughout the region, from Silesia, Bohemia, Hungary and Austria, as well as from Moravia itself. Several members had extensive knowledge of foreign breeding literature, including a mass of English books and journals through access to major castle libraries.[69] The

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63 Baumann (1785), pp. 217, 273.
64 Wood and Orel (2001), pp. 157-8, 211-2.
65 Baumann (1803), p. 706.
66 Köcker (1809); 'K in Mähren' (1811); C.C. André (1812); R. André (1816); Wood and Orel (2001), pp. 231-2.
67 Köcker (1809).
68 R. André (1816); Wood and Orel (2001), p. 229f.
69 One of these was Count H. F. Salm-Reifferscheidt (1778-1836), first President of the AS and a leading innovator in industrial textile production. His strong British connections included his marriage to a Scot. At his castle at Rájec (Raitz), a few kilometres north of Brno, the Count had a library of 59,000 volumes, rich in works on natural science and technical subjects, to which C.C.Andre, secretary of the SBA, had full access from 1811-1820, as Salm's economic advisor (*Wirtschaftrath*). Another member well placed to communicate foreign ideas was Count Imre (Emmerich) Festetics (1769-1847), from a Hungarian family with an exceptionally rich agricultural library owned by his brother Count György Festetics (1755-1819) at Keszthaly on Lake Balaton (Kurucz 1990). The library contained most of the major English agricultural works, including publications by Young, Culley, Sinclair and Marshall and, most importantly, the County Surveys produced by the Board of Agriculture in London. When dealing with animal breeding, these publications gave a major emphasis to Robert Bakewell.

secretary's son, R. André, produced a practical manual, *Instructions for the Improvement of Sheep*, published in Prague, based directly on Geisslern's methods.[70]

The Brno inbreeding debate

By 1817 an area of disagreement was developing within the *SBA* about the value of inbreeding as a means of 'fixing' traits, as a route to more constant inheritance. On the assumption that the continuity of heredity was determined partly by an "inborn component (*theils angeboren*)" and partly "by rearing (*durch Erziehung*)"[71], the question resolved itself into whether, and how, inbreeding affected these two influences. A leading expert from the Vienna region Baron J. M. Ehrenfels (1752-1843) called for caution, claiming that the pairing of nearest blood relatives must lead to "natural climatic degeneration (*natürliche klimatische Rückbildung*)" by disrupting "the principal plasma of the animal's organisation (*Hauptplasma der thierischen Organisation*)".[72] We may note how Ehrenfels linked inconstancy of inheritance with greater sensitivity to climatic influences because of a supposed physiological disturbance.

Reporting on the debate, the *SBA*'s secretary, C.C.André, was sure that deeper study would show consanguinity to have predictable consequences, behaving according to some "physiological, natural law", knowledge of which could bring benefit:

> What subtle problems are here to be solved before we can approach nearer to the truth [about inbreeding] with confidence. Here we are penetrating into the innermost secrets of nature.[73]

His son Rudolf had already suggested, in his *Instructions* (1816), that the answer lay in regulating the intensity of inbreeding according to the degree of improvement already achieved. He claimed this to reflect Geisslern's own views on the subject, i.e. that the more "noble" the stock, the more important it becomes to improve such animals "purely and simply through each other."[74]

Bartenstein, the SBA's president, wrote that he was convinced that inbreeding need not produce the ill effects that Ehrenfels feared, if members would follow the Bakewell principle of assessing the value of an animal not simply for its own qualities but for those of its parents and descendants.[75] As Bakewell had shown, an exchange of breeding stock of the same highly selected race, to 'progeny test' the males, also helped to prevent unwise inbreeding. A regular exchange of rams between stockowners had been a feature of the SBA from the beginning. Like Bakewell, the best breeders among SBA members were ready to adopt "population thinking" when dealing with selected stock, female as well as male, in order to produce the highly uniform product the cloth manufacturer demanded. As R. André had written in his *Instructions*:

> No animal should be perceptively better or worse than the others, particularly in wool. In this way one should work from the beginning of the improvement programme.[76]

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70 R.André (1816); Wood and Orel (2001), pp. 197-204.
71 Festetics (1819a).
72 Ehrenfels (1817).
73 C.C.André (1818), original in German; see also Wood and Orel (2001), p. 235.
74 R. André (1816), pp. 41-42, 94-96.
75 Bartenstein (1818).

'Genetic Laws of Nature'

C.C.André persisted in pressing for a compromise and ultimately a law (or laws) of breeding to guide them. Writing in 1818 on the effectiveness of the Agricultural Society, he identified a number of outstanding questions concerned with the supposed 'weakening' effects of inbreeding, in particular on wool fineness and susceptibility to disease. He was concerned about how to retain the characteristics of a pure breed without reversion while still retaining the potential for improvement. Count Festetics, a Hungarian member, stated his opinion that the potential for weakness was present within any non-inbred race before inbreeding took place, from which he concluded that weakness, if it occurred, was created not by the inbreeding process but by incorrect selection.[77] Sebright in England had made the same point earlier although he did not believe that breeding-in-and-in could be continued indefinitely without detriment.[78] Festetics summarised his own 15 years of experience of inbreeding under the heading "genetic laws of nature (*genetische Gesetze der Natur*)" in four parts.[79] Here he (1) associated pure "noble" breeding with good health, (2) appreciated that inherited traits could be recessive for one or more generations, (3) recognised the extent of variation, even within seemingly pure breeds, (4) stipulated that the precondition for applying inbreeding safely must be scrupulous selection of stock animals. As an aid to selection, R. André had refined a scheme to evaluate wool into seven grades, using a newly developed micrometer.[80] Festetics greeted André's "mathematical" evaluation of wool quality with enthusiasm: "It will be judged as marking the beginning of an epoch in the science of breeding that in 1819 the grades of wool fineness were established and defined with mathematical precision."[81]

In reflection of the successes achieved by Geisslern and his followers, the SBA continued to recommend close inbreeding for the totality of its existence (1814-1845). A later member J.K. Nestler (1783-1841) defended the practice on the basis of English experience when he wrote: "Without this technique [breeding in-and-in] Bakewell could never have existed nor could one exist in the future."[82]

The pure race concept and chance deviations

One of the lessons of experience from the *SBA* was that sheep derived from several generations of grading crosses, what the breeders called 'noble sheep stock (*edles Schafvieh*)', did not breed as true as those descended from uncrossed imported sheep, the 'pure noble race stock (*reines edles Racevieh*)'. Achieving the noble state by grading was evidently far from straightforward. Even when the sheep looked externally the same as the pure breed, they proved to be less consistent in breeding. In his *Instructions*, R. André wrote of how nobility was a relative matter, depending on ancestry. Optimistically he stated that the traits of the original pure breeding stock imported from Spain "remain constant even when external conditions are unfavourable for their preservation."[83]

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76 R. André (1816), p. 37, original in German; N.B. the population concept is here restated; see also Wood and Orel (2001), pp. 201-2.
77 Festetics (1819a).
78 Sebright (1809), p. 11.
79 Festetics (1819b); Orel and Wood (2000); Wood and Orel (2001), pp. 237-8.
80 R. André (1819).
81 Festetics (1820), p. 33, original in German.
82 Nestler (1839), original in German.

Like other breeders of his time, he pictured heredity in terms of the 'strength' of an animal's internal nature, represented in its blood.

If blood was the factor by which to judge a pure noble race, a major question for sheep breeders was whether a graded noble stock could be converted into a 'pure noble' one. Rudolf André was sure that Geisslern had proved it possible with fine wooled sheep in Moravia, based on Merino crosses, and he described the process:

> With care and attention a merely noble flock can be raised to the pure race if one refrains from mixing alien bloods and, through an appropriate control of pairings, brings together specific characteristics of body build and wool, to be transmitted to the progeny, and preserved to the same degree. In this way something constantly unique (*constant originelles*) arises, something fixed in the organisation of these animals, something derived totally and exclusively from pure blood relatives (*aus lauter Blutsverwandten hergeleitete*), which is characteristic of the lineage.[84]

This then was the secret, as it had been before to Bakewell and his followers, to match the parents for their traits, to practise rigorous selection and to fix the type by inbreeding. Individually controlled matings (*Sprung aus der Hand*) were the answer. Even so, as Bakewell had shown earlier, racial stability could never be absolute. The Moravian experience revealed that selective breeding was required even in the 'pure noble race'. Constancy of inheritance could only be maintained by matching the best rams to their close female relatives, each ram forming "a sire's family".[85] Even an apparently "genetically fixed race (*genetisch befestigte Rasse*)" was expected to degenerate. It could not be doubted that eventually a reversion (*Rückschlag*), a chance deviation (*Natursprung*) or freak of nature (*Spielart, Naturspiel*) would appear and multiply, and would have to be removed to regain the original "principal racial form (*Hauptsgeschlechtsform*)".[86] A potential existed for genetic changes to occur which in those days were attributed to a direct influence of the new environment in one of its many aspects. Hence the firm rejection by the *SBA* of the popular idea of inherent racial constancy, proposed by Justinus (1815) with reference to horses, that the noble race stays for ever noble when the purity of the blood is maintained, (i.e. without the need for persistent selective breeding). The concept was simply not justified by the experience of Moravian sheep breeders.

Improvement of the pure race

Sometimes a chance deviation could be advantageous, by providing an opportunity to make an improvement to the race, to add to its economic value. Selection would then be directed towards making such favourable accidental varieties endure (*zufällige Varietäten bleiben zu machen*).[87] It was a strategy that had its roots with Bakewell and his followers in the British Isles. Marshall had referred to Bakewell as having used accidental varieties as the basis of his selection of long horned

[83] R. André (1816), pp. 5-6.
[84] Ibid., pp. 6-7, original in German.
[85] R. André (1816), pp. 6-7; C.C. André (1804); Petersberg (1815); Nestler (1836); Stieber (1842), pp. 41-44; d'Elvert (1870), 2: pp. 48-49; Wood and Orel (2001), pp. 195-6, 244-5, 268.
[86] 'Irtep' (1812); Wood and Orel (2001), pp. 224-5.
[87] 'Irtep' (1812); R. Andre (1816), pp. 94-96; Nestler (1829); Wood and Orel (2001), pp. 224, 243.

cattle: "solicitously seizing the superior accidental varieties produced."[88] The possibility of exploiting favourable variants implied that there could be no fixed limit to the improvement of a race, taking into account the "predispositions for a higher perfection (*die Anlagen für eine höhere Vollkommenheit*)".[89] The possibility of such improvement was becoming evident all over Europe where different forms of so-called pure Merino stock were established, varying in size, degree of skin wrinkling and length of staple. To increase the efficiency of selective breeding, the SBA recommended that all animals in a flock should be numbered, with all parents and their progeny recorded, as a standard procedure.[90]

After 1819 when C.C. André's position was made difficult because of political opposition, requiring him eventually to move to Stuttgart, the discussion of breeding theory and heredity in the *SBA* lapsed for a brief time. It was revived by J. K. Nestler who occupied the Chair of Natural History and Agricultural Science at the Moravian University of Olomouc (Olmütz), from 1823 until his death in 1841. Nestler was the first in the Society to write about heredity (*Vererbung*).[91] He noted that resemblance between generations was most certain when parents were of the same sort (*Art*), and he also made clear that defects and weaknesses could be inherited.[92] Other active new members included the lawyer and estate manager F. J. Teindl and the recently appointed abbot of the Monastery of St Thomas, C. F. Napp. Together with Bartenstein and Ehrenfels, they took the discussion of sheep breeding and heredity into fresh areas.

6. Napp's Scientific Curiosity

Abbot Cyrill Franz Napp (1792-1867) was a dignified scholar, expert in Oriental Languages and the Old Testament, but also an energetic administrator with a shrewd sense of business and a strong interest in the useful applications of science. A contemporary wrote that he was "the supporter of every scientific effort."[93] His interest in breeding was long-standing and broadly based,[94] for although he took a particular satisfaction in plant breeding, it was sheep that provided the major source of income from the extensive monastic lands. The results of new approaches to breeding fired his intellectual curiosity, and made him determined to make practical use of them. Within a year of his arrival in Brno, he had been elected a member of the *Agricultural Society* (1825); two years later he was on its organising committee. Later he would become its president. By the time Mendel entered the monastery in 1843, advanced breeding was well established on efficiently managed monastic estates. In the *SBA*, discussions had recently been held on the nature of heredity, in which Napp had taken a leading part.

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88 Marshall (1790), 1: pp. 383-4; see also Anderson (1799), p. 23, referring to variations 'accidentally produced' being inherited, as well as the 'general characteristics of the parental breed'.
89 R. André (1816), pp. 95; Ehrenfels (1837); Wood and Orel (2001), p. 257.
90 Köcker (1809); R. André (1816), pp. 7, 35; Petersberg (1816), p. 113; Wood and Orel (2001), pp. 194, 200-2, 232-3.
91 McLaughlin (this volume) has pointed out that *Vererbung* in a biological sense was used by Immanuel Kant in 1793, who applied it not just to individual peculiarities but to sub-specific varieties that bred true, as in human races. McLaughlin notes that *Vererbung* takes the perspective of the donor and might best be translated as 'bequeathment'.
92 Nestler (1929).
93 Rohrer (1830).
94 Orel (1975b); Orel and Wood (2000b).

Inner and outer organisation

SBA experience had shown beyond doubt that constancy of "type (*Art*)" in a sheep, which was believed to reside in its "internal organic structure", was more influenced by selective breeding than by favourable conditions.[95] In one of the debates Napp had commented that when pure breeding was the aim, it was important not only that parents should be of the same type, but that they should also correspond in "both inner and outer organisation":

> The highly esteemed Abbot and Prelate of St Thomas's Monastery, Cyrill Napp, asserts that, according to his view, heredity of characteristics from the 'engenderer' (*Erzeuger*) to the 'engendered' (*Erzeugten*) consists above all in the 'mutual affinity by kinship' (*gegenseitige Wahlverwandschaft*) of paired animals. As a result of this, a ram chosen for the ewe should correspond to it in both inner and outer organisation. This process deserves to be the subject of an important physiological study.[96]

The use of the term "inner and outer organisation" does not appear to be a reference back to traditional ideas about separate influences coming from the two sexes, because the ram and ewe are expected to correspond in both respects. Superficially it might seem to recall a statement made thirty years earlier by the English surgeon Henry Cline, that "the external form [of a sheep] is only an indication of the internal structure."[97] However, Napp's words are probably more in tune with those of B. Petri expressed in a lecture to the 1837 meeting of German Naturalists and Physicians in Prague. Speaking on the subject of animal breeding, he attached particular significance to selection from crosses, i.e. blending (*Vermischung*), "where the inner cohesion of the external formation of the individual in its different varieties has to remain hidden from the eye."[98] Neither Petri nor Napp seem to be assuming that the inner organisation is determinable simply by examining the animal's outward appearance. Napp sees the relationship between inner and outer organisations as a problem for physiological study.

Inheritance capacity

Among the mysteries of heredity to be investigated was the observation of differences in the capacity of individual animals to transmit their traits. On this basis British breeders had coined the term 'prepotent' for the most reliable males for breeding. Under the influence of Nestler, members of the SBA became convinced of the importance of determining the 'inheritance capacity (*Vererbungsfähigkeit*)' of each individual used for breeding, measured as the strength of transfer of inherent characteristics from that individual.

> Professor Nestler believes that the most essential matter of all, as well as the most pressing question at this time, in relation to improved sheep breeding, is the 'inheritance capacity' of noble stock animals.[99]

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95 R. André (1816); Ehrenfels (1831); Wood and Orel (2001), pp. 225-6.
96 Teindl et al. (1836), quoting Napp, original in German.
97 Cline (1805); Sinclair ([1817] 1832), p. 87.
98 Petri (1838).

Could this capacity be enhanced by inbreeding? Nestler (1839) asked. His conviction about the significance of inheritance capacity stimulated Napp to bring discussion back to the subject in relation to what might be its physiological basis:

> Prelate Napp continued the course of the continuing debate with rigorous brevity…and drew attention to the fact that they had completely deviated from the proper theme of inheritance capacity. 'What we should have been dealing with', he pointed out, 'is not the theory and process of breeding. But the question should be: what is inherited and how?'[100]

Napp's words, briefly reported, do not allow us to distinguish between the inherited traits themselves and what lies behind them, in terms of inner organisation. However the context makes clear that he was reacting against an inductive approach to investigating heredity, based on examinations of existing sheep breeding records. Attempts by the breeders to trace patterns of inheritance from their stock registers were proving incapable of solving the problem. It seems clear from Napp's various reported statements that he is hoping that further understanding of hereditary transmission will result from new developments in physiology.

Crossing/hybridisation

At a time in biological history when the boundary between race and species was not always clearly defined, the progeny of crosses between races/varieties could be referred to as hybrids.[101] It had long been recognised that whereas the first generation from an inter-racial cross (hybridisation) could be quite uniform, and often more or less intermediate between the parents, the second generation could be highly variable and often unpredictable: "It is a universal property of hybrids that in their progeny there appear traits reminiscent of the parental forms with great variability."[102]

The breaking down of essential characteristics in the progeny of hybrids was a strong argument against hybridisation beyond the first generation, and in favour of grading a 'common' flock with a 'noble' race to 'fortify' or 'fix (*befestigen*)' noble traits in the progeny. The supposed long history of the major races advised a conservative approach to breeding from hybrids between them. The fact remained, however, that many highly bred races could be crossed and it was intriguing to discover whether something economically advantageous might arise from their progeny.

Instructive examples of crosses between highly bred races were being reported from the British Isles where farmers competed for access to Dishley stock to cross to their local breeds, their aim being to develop new breeds combining the best characteristics of both parent races. The derivation of one of these, the 'Improved Cotswold', has been traced by Walton (1983), whose analysis of breeding stock sales reveals the first example of the new breed in 1811.

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99 Teindl et al. (1836), original in German; see also Bartenstein (1837); Bartenstein et al (1837); Wood and Orel (2001), pp. 246-7.
100 Bartenstein et al., original in German.
101 As by Mendel (1866).
102 Elsner (1826), original in German; see also Wood and Orel (2001), p. 251.

Thinking along similar lines, SBA members recognised that hybrid progeny provided the basis for selection in new directions, e.g. to improve wool, body form and meat quality together, or to associate superior wool with a high fleece weight.[103] The first of these two aims was claimed to have been achieved in Moravia before 1811, by Geisslern.[104] Later there were crosses made between the Negretti and Escurial races of the Merino, to create the highly successful Escurial-Negretti *Vollblut* race in Austrian Silesia. Partly based on Geisslern's stock, it was eagerly purchased by certain Australian colonists and greatly admired by the Prussia-based breeding expert Hermann Settegast.[105] Attempts to analyse patterns of heredity in crosses were strongly encouraged by Nestler but were largely unsuccessful.[106] All that could be concluded was that any two sets of parental characters, considered as a whole, appeared to "blend (*verschmelzen*)" in the progeny.[107] Nestler led the way in calling for specially designed experimental crosses.[108] He and other enlightened members of the SBA, including Napp in particular, hoped that an understanding would be reached concerning the actual basis of heredity, not only its principles and rules but its physiological basis, and that such knowledge would aid in breed improvement.[109] However, as Nestler admitted, most breeders were still stumbling in the dark.

Co-operation with plant breeders

The Sheep Breeders were not the only group to react to a commercial stimulus. A *Pomological and Oenological Association* (*POA*) was established in Brno in 1816. Instigated by C. C. André, it drew inspiration from British achievements in producing new varieties of fruit by controlled pollination,[110] reported by T. A. Knight (1759-1838), president of the *London Horticultural Society,* and on the application of hybridisation in creating new varieties of cereals, reported by the secretary of the Pomological Society of Altenberg (near Leipzig), C. C. L. Hempel.[111] An article by Hempel published in 1820 included a call to uncover "the law of hybridisation"[112] Sedláček von Harkenfeld, second president of the *POA*, published an article on inter-varietal crosses based on his personal experience with vine hybridisation. He expressed his expectation that new varieties derived in this way would be capable of producing better quality wine than that from any known varieties, "even from abroad".[113]

The membership of the *POA* and *SBA* overlapped, with Napp highly active in both of them from 1825 onwards. Under his influence Franz Diebl was called to the Chair of Agricultural Science at the Brno Philosophical Institute. Nestler, and others proposed that further enlightenment about heredity in sheep would be gained by swapping information with plant

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[103] Bartenstein, reported by Löwenfeld (1835).
[104] 'K in Mähren' (1811); R. André (1816), p. 7; Wood and Orel (2001), pp. 185.
[105] Settegast (1861); Wood and Orel (2001), pp. 184,185, 188-9.
[106] Nestler (1837).
[107] Nestler (1829), pt. 1.
[108] Nestler (1837); Orel and Wood (2000); Wood and Orel (2001), pp. 252-9.
[109] Nestler (1839) and (1841), p.337, quoting Napp; Bartenstein (1837), quoting Napp; Teindl et al. (1836), quoting Napp; Wood and Orel (2001), pp.246-7, 258.
[110] See 'Irtep' (1812); Wood and Orel (2001), p.24.
[111] Hempel (1818); Orel (1978); Mylechreest (1988); Anonymous (1816).
[112] Hempel (1820); Orel (1974).
[113] Sedláček (1826); Wood and Orel (2001), pp. 239-40.

breeders, placing faith in "the power of science". Also recommended were contacts with naturalists, anatomists and physiologists, in order to put sheep breeding on a "rational" basis.[114]

The physiological basis of heredity

By 1843 when Mendel entered the monastery, it was accepted in Moravia that heredity was brought about by the meeting of two parental 'germs', located in the egg of the female and the semen or pollen of the male.[115] The subject was still wide open for investigation if a way could be found. It continued to puzzle Napp that "nothing certain can be said in advance as to why production through artificial fertilisation remains a lengthy, troublesome and random affair." He remarked on a problem that all breeders faced when attempting to produce new varieties by artificial fertilisation, the significance to be attached to mere chance.[116] The chance element demanded to be understood and, if possible controlled. Napp's statement of 1836 that the process of heredity "deserves to be the subject of an important physiological study,"[117] has obvious significance in the light of further events, instigated by his dependant Mendel.

7. Summary

The traditional concept of heredity as functioning through the blood, which was converted into semen (seed) at the start of each new generation, had logical consequences in relation to what was supposed to affect genetic continuity. Any change in an animal's physiological state, for whatever reason, was perceived to have a good chance of influencing either the blood itself or its seminal derivative. A shift of emphasis, leading to a 'harder' view of heredity, came as a result of practical experience when breeds were moved over long distances into new locations, to be maintained under carefully controlled conditions of housing and nutrition. This happened with Merino sheep transported north of the Pyrenees, first to Sweden in 1723 by Jonas Alströmer, later to Saxony, Prussia, France and Austria. Such economic experiments established the extent to which breed characteristics might be maintained in the face of nutritional and climatic pressures. With growing confidence that external pressures could be contained, breeders began a trait-based approach to selective breeding, which further established the limits within which breed characteristics were able to vary. The most adventurous among them found ways to exploit some aspects of variability to create new breeds, even exceeding the best traditional races in economically important characteristics. Even so, their selected breeds had to exist in harmony with (be adapted to) the natural environment.

Strictly regulated, trait-based selective breeding at an intensive level introduced the potential for inbreeding depression, which had to be avoided without disrupting progress towards the improvement desired. The answer was found to lie in interchanging stock with other farmers, and selective breeding for fitness traits, as well as those of specific economic interest. Fitness was assessed by progeny-testing which, to be efficient, required the organised co-operation of farmers willing to enlarge their knowledge about heredity. Robert Bakewell and fellow members of the

[114] Nestler (1829); Diebl (1839); Fraas (1852); Orel (1975a) and (1978); Wood and Orel (2001), p. 255.
[115] Purkyne (1834).
[116] Nestler (1841), p. 337, quoting Napp.
[117] Teindl et al. (1836).

Dishley Society, formed in 1783 in England, were pioneers in this respect. Progeny-testing revealed that certain males, referred to in Britain as 'prepotent', were better at transmitting desired traits than others. In Moravia interest developed in the 'inheritance capacity (*Vererbungsfähigkeit*)' of noble stock animals. Nestler speculated on whether this capacity could be enhanced by inbreeding, just as Bakewell claimed with respect to prepotency.

Inter-racial crosses took two forms. From the beginning of the eighteenth century the grading technique was much in evidence, being the means by which a local breed was improved by successive generations of crosses to males of a superior one. With growing experience the first attempts were made to combine the qualities of two superior breeds by selecting among the progeny of their hybrids. In practice it proved very difficult to select the right combination of traits among the great array of possible types that segregated in the second and subsequent hybrid generations. However there were some significant successes, including the Escurial-Negretti *Vollblut* Merino race in Silesia.

Unpredictable variability observed in crosses confirmed in the minds of breeders the difficulty of formulating any general law of heredity. Even so the practical advantage of discovering such a law drove them to further effort, and encouraged animal and plant breeders in Moravia to join together to see if they could resolve the problem by co-operation. By 1843 when Mendel arrived on the scene, discussions on this important topic had been intensively pursued in the Brno Sheep Breeders' Society for many years, with Abbot Napp recently playing a leading part, but had reached no obvious conclusion. It seemed that although heredity could be manipulated by selective breeding, following certain defined procedures, there was no escape from the element of chance invisible in the germ.

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Abbreviations

Folia Mendeliana. Published yearly by the Moravian Museum in Brno since l966. Issues l-9 appeared as special volumes. Issues 10-20 were published as a supplement to Acta Musei Moraviae, sc. nat. with the pagination of these volumes. The part Folia Mendeliana were also reprinted separately. Folia Mendeliana Volume 21 and further volumes are being published again as special volumes with their own pagination.

Hesperus. Belehrung und Unterhaltung für Bewohner des österreichisches States - Hesperus, Prag.

Mittheilungen. Mittheilungen der k.k.Mährisch-Schlesischen Gesellschaft zur Beförderung des Ackerbaues, der Natur- und Landeskunde in Brünn.

ONV. Oekonomische Neuigkeiten und Verhandlungen, Prag

PTB. Patriotisches Tagesblatt oder öffentliches Corrensponden z- und Anzeiger-Blatt für sämtliche Bewohner aller kais. köng. Erbländer über wichtige, interessierende, lehrreiche oder vergnügende Gegenstände zur Beförderung des Patriotismus, Brünn.

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Characters written with invisible ink. Elements of Hybridism 1751-1875

Staffan Müller-Wille

In his inaugural lecture for the *Collège de France*, held December 2, 1970, Michel Foucault characterized Gregor Mendel as "a veritable monster (*un monstre vrai*)", who "talked about objects, put methods to work, placed himself on a theoretical level, which all were alien to the biology of his epoch." Mendel was not "in the truth (*dans le vrai*)" of his time, said Foucault, borrowing a concept from Canguilhem.[1] But why a monster? Foucault brought up Mendel's "discovery," as we are used to call it, in a discussion of the notion of "discipline" as the "principle of control in the production of discourse."[2] "Within its limits, each discipline knows of true and false propositions; but it repels, to the other side of its margins, an entire teratology of knowledge."[3] Mendel seems a prominent case in point.

Foucault's remarks about Mendel were directed against those historians "who ask themselves how botanists and biologists of the nineteenth century could have done so much as not to see that what Mendel said was true."[4] However, inadvertently, I guess, Foucault's answer reproduced a view wide spread among historians of science: the view of Mendel as an isolated figure tragically ahead of his time. Due to the historical work of Viczeslav Orel (1996) we now know that this view is thoroughly flawed: that Mendel's work was contiguous on the thorough and up-to-date scientific education he had received at the universities of Olomouc and Vienna, that he was in close contact with a local community of naturalists and scientifically educated breeders, and that the questions he was trying to answer had been raised in this community. Other contributions to Mendelian scholarship have discussed late eighteenth and early nineteenth century "hybridism," the work of Linnaeus, Kölreuter, Gärtner, as a research tradition that framed the questions guiding Mendel's research.[5] If, in view of these findings, we should still want to follow Foucault's characterisation of Mendel as a "monster," it would have to be in the sense of Mendel's own theory: in his work we find an exceptional combination of disciplinary elements – statistics, breeding techniques, cell-theory, to name just the most obvious – none of them, taken in isolation, being abnormal for their time, all of them together, however, bringing about an extraordinary constellation.

My aim in this paper is rather modest in trying to sketch out the genesis and historical legacy of one of these elements. It has sometimes been maintained that one of the things that made Mendel exceptional was that he did not – as the hybridists before and around him – care for the distinction between species and varieties in his experiments: He chose to experiment with plants which did not differ in a complex of characters – as "good" species should – , but in single and easily identifiable character pairs, while his predecessors had always been occupied with the

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1 Foucault (1971), pp. 36-37.
2 Ibid., p. 37.
3 Ibid., p. 35.
4 Ibid., p. 36.
5 Olby (1979); Monaghan and Corcos (1990); cf. Orel and Hartl (1994), pp. 451-457 for a critical review.

hybridisation of "good" species.[6] Mendel himself pointed out explicitly in his 1866 paper that the distinction of species and varieties was irrelevant to his experiments:

> Uebrigens bleibt die Rangordnung, welche man denselben [i. e., the *Pisum*-varities used in Mendel's experiments] im Systeme gibt, für die in Rede stehenden Versuche völlig gleichgiltig. So wenig man eine scharfe Unterscheidungslinie zwischen Species und Varietäten zu ziehen vermag, eben so wenig ist es bis jetzt gelungen, einen gründlichen Unterschied zwischen den Hybriden der Species und Varietäten aufzustellen.[7]

This statement is troublesome to those interpreters who have maintained that Mendel, as the hybridists before him, was primarily interested in the question if new species could arise from hybridisation.[8] For if the role of hybrids in the genesis of new *species* was indeed at stake, then the taxonomic status of the plants used for and produced in the experiments *should* matter. Moreover, the resolution of this problem seems pertinent to the related question if Mendel was interested in inheritance as such at all, or only in so far as it "bore on his analysis of the evolutionary role of hybrids."[9] It is a well-known fact that Mendel used the term "inherit (*vererben*)" only once in his paper.[10] If, however, the species-variety distinction did not matter to him, then it seems that he *should* have been ready to discard the age-old distinction of specific and individual inheritance as well, as he, and others before him, had also done in regard to the distinction of paternal and maternal inheritance. "Pure" inheritance – inheritance of particular elements abstracted from the generic forms they belong to – would then have been the object of his experiments.

One possibility to resolve these problems is to doubt the assumption that plant hybridists before and around Mendel were working on the basis of a simple opposition of specific and individual (varietal) difference. And indeed, Mendel did address a current taxonomic determination of his experimental plants that clearly undercut this distinction:

> Wollte man die schärfste Bestimmung des Artbegriffes in Anwendung bringen, nach welcher zu einer Art nur jene Individuen gehören, die unter völlig gleichen Verhältnissen auch völlig gleiche Merkmale zeigen, so könnten nicht zwei davon [i. e. of the *Pisum*-varieties used in Mendel's experiments] zu einer Art gezählt werden.[11]

In the Linnaean tradition, species and varieties had been distinguished along a nature-nurture divide: species comprise individuals characterised by a form that remains constant, i. e. does not change in the course of generations, no matter what external conditions individuals are subjected

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6 See, e.g., Stubbe (1963), p. 108; Dunn (1965), p. 18 quoting Correns (1905); Jacob (1970), pp. 220-222; Bowler (1989), p. 99.

7 Mendel (1866), pp. 6-7; translation by Bateson (Mendel [1866] 1902), 44: "The positions, however, which may be assigned to them in a classificatory system are quite immaterial for the purposes of the experiments in question. It has so far been found to be just as impossible to draw a sharp line between the hybrids of species and varieties as between species and varieties themselves."

8 See, e.g., Olby (1979), p. 67.

9 Olby *loc. cit.*

10 Mendel (1866), p. 14.

11 Mendel (1866), p. 6; translation by Bateson ([1866] 1902): "If we adopt the strictest definition of a species, according to which only those individuals belong to a species which under precisely the same circumstances display precisely similar characters, no two of these varieties could be referred to one species."

to from generation to generation and from place to place. These constant forms obey, as Linnaeus put it, "inherent laws of generation (*generationis inditas leges*)." They are due to internal forces that lie hidden in the organisation of living bodies, ultimately in the interaction of the generative substances produced by the male and female reproductive organs in fertilisation. Varieties, on the other hand, comprise individuals of the same species that differ in form due to the influence of external factors, as climate and soil, varying with time and place. Varieties, that is, are due to the physical forces governing the environment of organisms.[12]

From this distinction of species and varieties it would follow, that members of a species brought under a regime of perfectly homogenous external conditions should be perfectly identical in all respects – the species criterion Mendel refers to in the above quote. *Any individual* difference – as the character pairs round-wrinkled, yellow-green etc. used by Mendel in his experiments – separating individuals under such circumstances would, therefore, have to count as a *specific* difference. The Linnaean species concept thus offers, in principle, the possibility to distinguish species according to differences in individual characters: if plant forms, cultivated and propagated under conditions homogenous at any given point in time, should happen to exhibit an individual difference, in all other respects remaining perfectly identical, they should be counted as belonging to different species. Specific heritable difference, that is, may, under this condition, coincide with individual heritable difference. And this is exactly the condition under which Mendel referred to the plants he experimented with as different 'species (*Arten*)': In the paragraph preceding the one quoted above he made sure to stress, that the 22 pea varieties (*Erbsensorten*) he selected for his experiments had proven good under two years to constantly produce identical descendants (*durchaus gleiche und constante Nachkommen*).[13] Throughout his paper, Mendel should refer to his experimental plants as different "species (*Arten*)"[14] in this sense, using the taxonomically neutral expression "forms (*Formen*)" interchangingly with it.[15]

In the following I want to sketch out, how the tension of individual and specific difference came into play in the "hybridist" tradition before Mendel. My aim with this is to show, that Mendel's step to deal with varieties different in respect to single character pairs was not as dramatic as it seems in retrospect, but rather contiguous on the hybridist tradition.

1. Constant Varieties

The first systematic discussion of plant hybrids was published in 1751 by Linnaeus under the title *Plantae hybridae*. As it formed the major target of critique in Kölreuter's experiments from the 1760s, it can be regarded as the founding document of the hybridist tradition. In stark contrast to that later tradition, however, it shows a surprising lack of experimental evidence: The only experiment in plant hybridisation, that Linnaeus should ever perform, dates from a much later time, 1758/59, and was executed in answering a prize question of the St. Petersburg Academy of Sciences asking for proofs of plant sexualtiy.[16] The hybrid plants of the 1751 *Plantae hybridae* were

[12] Müller-Wille (1998), pp. 351-358.
[13] Mendel (1866), p. 6.
[14] E.g. ibid., p. 6, 9, 11.
[15] E.g. ibid., p. 24; Bateson's translation is sometimes misleading in this respect, by using "variety" (Mendel 1866 [1902], 47) or "stock" (65), where Mendel has *Art*.
[16] For a discussion of this experiment see Müller-Wille (1998), pp. 370-372.

surmised on a completely different basis, which, in general terms, was explained by Linnaeus in the following words:

> Cardo argumenti pro statuendis plantis hybridis, videtur tamen a posteriori corroborari. Constat enim omnibus, Botanicos, utpote Tournefortium, Boerhavium, Mitchelium, Pontederam, Helwingium cum reliquis sub finem prioris seculi, & quidem ad tempora Cl. Praesidis, hujus seculi, innumeras collegisse novas plantas Europaeas, veteribus ignotas; sed quod observandum, qua maximam partem similes veterum, ut vix figuris distingui potuerint. Cum itaque characteres sufficienter defecerint in hisce plantis, non potuit non Cl. D. Praeses has referre ad matres suas, sub nomine VARIETATUM, quae *colore, odore, sapore, magnitudine, tempore, pubescentia* &c. differebant, quod acutissimi quoque Botanici, ut *Jussieus, Royenus, Gronovius, Hallerus, Gmelinus, Guettardus, Dalibardus, Wachendorffius, Gorterus, Bütnerus* &c. post illum approbarunt & continuarunt. Dictum quidem est has varietates ex *solo, loco, climate* ortas esse, ideoque tantummodo accidentales; Interea tamen huic reformationis variae subjectae sunt, quae Botanicos plurimum sollicitabant in determinandis speciebus, ad quam scilicet speciem merito referendae essent, quando duabus similes erant, & quidem ita, ut ne unica nota in planta quaestionis, etiamsi distinctissima, & maxime singularis inveniatur, quae non in alerutra ambarum occurit. Crescuitque haec hybrida in eodem solo cum ambabus & tamen a veteribus non observata. Haec primum nos ad hoc Problema deduxerunt, utrum duae diversae plantae tertiam produxissent, an ut hybridae considerandae essent, cum Botanici his primum temporibus generationem plantarum optime norint, & quales mutationes in plantis hinc deducantur, observarint in Brassica aliisque.[17]

This passage testifies that the problem of hybrids was not constituted for Linnaeus by a record of more or less authorative tales and reports. It rather resulted from a systematic and continuous taxonomic practice that tried to correlate the reproduction of plants, a vital process, with the structural differences they exhibit: Differences among individuals related by reproduction – individuals referrable "to their mother" – are varietal differences in the sense of depending for their reproduction on the continuity of certain local environments – "soil, locality, climate" – while differences among species depend on reproduction as such, or, as Linnaeus put it in a paragraph preceding the one quoted above, depend "on that natural law", according to which

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[17] Linnaeus [1751] 1764, pp. 32-33: "The main argument for proposing hybrid plants, however, seems to be corroborated a posteriori. It is certain to everyone, that botanists like Tournefort, Boerhaave, Michel, Pontedera, Helwig and others at the end of the last century and certainly in these days have collected innumerable new European plants, unknown to antiquity; but that it was observed, that these were so similar to those of antiquity, that they could hardly be distinguished from them by figures. As therefore sufficient characters were missing in them, [Linnaeus] could only refer them to their mothers under the name of varieties, which differ by *colour, odour, taste, magnitude, time, thorns*, etc., and this was continued and attested after him by the more acute botanists, like *Jussieu, Royen, Gronovius, Haller, Gmelin, Guettard, Dalibard, Wachendorff, Gorter, Büttner*. It has been said, that these varieties were brought forth by *soil, locality, climate*, so that they by all means are accidental. Meanwhile, however, various [plants] have been subjected to this reform, which have troubled botanists in determining species, as to which species they should be rightfully referred, when they were similar to two others, in such a way, that no single character of the plant in question, even if most distinct and singular, could be found, which not also occurred in one of the two others. These hybrids also grow in the same soil as the others, though they were not observed by the old. This has first lead us to the problem, if two different plants have produced a third, or if they can be considered hybrids, as botanists only now are learning about the generation of plants, and deduce such mutations in plants, as had been observed for cabbage and others."

members of a species "celebrate their marriages and propagate their families, such that they rarely deflect (*abeunt*) from that law to other species."[18]

Taxonomic analysis, carried out along these lines, however, reaches a twofold limit in phenomena whose very possibility is determined by the presupposition that guides it. On the one hand, plant forms may exhibit a constellation of specific differences, which appears as a mere combination of other plant forms, making it impossible to identify them as really distinct forms: each of their individual characters is not only reproduced within their own species, but will also be found to be reproduced in either one of two others. On the other hand, reproductively contiguous plants – "growing in the same soil" – may exhibit differences which do not depend on external factors for their reproduction as they remain different under homogenous conditions and, each respectively, identical under heterogenous conditions. This point is only implicitly hinted at in the passage quoted above, but made perfectly clear in another essay on the "metamorphosis of plants" which Linnaeus published in 1754:

> Cum botanici vidissent eandem speciem in diverso climate vel solo, variare, primum ex illis novas species constituerunt; quo accidit, ut numerus plantarum nimis augeretur, nulii dum limites essent. Recentiores itaque botanici varietates ad species suas reducere coeperunt, ne entia praeter necessitatem multiplicarentur. Botanici, qui videbant solum & coelum tam multas fecisse varietates, intelligebant quoque, quod solum & coelum eas reducerent, quam ob caussam in hortis botanicis eas seminabant; at, cum viderent nonnullas in uno eodemque solo & climate, aeque constantes esse, contendebant aliqui, eas non pro varietatibus, sed distinctis speciebus habendas esse […].[19]

As in the *Plantae hybridae*, this observation is used as a starting point to speculate about the hybrid origin of such "constant varieties". The two cases of dubious species, "constant varieties" and species of a combinatory appearance, served Linnaeus in the enumeration of 101 hybrid plants contained in the *Plantae hybridae* as a principle for their classification: The hybrids no 1 to 17, and the hybrids no 18 to 34 were called *Bigeneres* and *Congeneres*, expressing their origin from the hybridisation of plants of different genus and species respectively, while the hybrids no 35-40 were classified as "deformed (*deformatae*)", in as much as "individuals of the same species had acquired a structure different from their mother or ancestors."[20] The remaining sixty hybrid plant species were classified as "obscure (*obscurae*)" and "suspect (*suspectae*)," obviously as a result of the fact that they could not as easily be referred to one of the preceding classes.[21]

While Linnaeus's descriptions of hybrid species were based on a highly unclear and speculative theory of sexual reproduction – "adventurous and against all reason (*abentheuerlich und wider alle*

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18 Ibid., p. 30.

19 Linnaeus, ([1755] 1788), p. 380: "When botanists saw that the same species varied in diverse climate or soil, they first made different species of them; with the consequence that the number of plants was so excessively multiplied that there were no limits. Recent botanists have therefore begun to reduce varieties to their species, as to not multiply beings beyond necessity. Botanists, who saw that soil and sky make so many varieties, understood also, that soil and sky would reduce them, and therefore sowed them out in botanical gardens. However, when they saw that some nevertheless remained constant in one and the same soil and climate, some contended that they should not be held for varieties but for different species."

20 linnaeus ([1751] 1787), p. 50.

21 Müller-Wille (1998), pp. 366-368.

Vernunft laufend)" as Kölreuter would call it in 1766,[22] – they disclose the highly specific institutional conditions that allowed for their detection. Specific forms of living beings, especially of exotic animals, had been assumed to hybridise and transmute since antiquity, but such events were tied to the exceptional nature of certain environments, as the oasis of the Sahara, or conditions of domestication and cultivation. Even hybrids had their "natural places", so to speak. In the system of botanical gardens, to which Linnaeus referred in the above quote form the *Metamorphoses plantarum*, this close dependence of place and the reproduction of forms was loosened in a regulated practice by which different plant forms were actively reproduced under a variety of controlled environments.[23] Plant form, under this condition, was broken down to a system of minute structural differences that proved to be distinctively reproducable under all circumstances; and plant reproduction was broken down to individual genealogical lines populating the controlled beds of a variety of garden localities. The dichotomy of specific (essential) and varietal (accidental) form thus opened to include a complex array of phenomena where the reproduction of plants as such, independent of place and time, seemed to engender variation.

2. Hybrid-like Nature

Joseph Gottlieb Kölreuter may very well have been inspired to his hybridisation experiments by the prize essay Linnaeus had submitted to the St. Petersburg Academy of Sciences: with this essay, Linnaeus had sent seeds of the *Tragopon*-hybrid he had produced experimentally, so that the hybrid might be reproduced in the botanical garden of St. Petersburg, which it was. Kölreuter discussed the specimens raised there in his *Vorläufige Nachricht von einigen das Geschlecht der Pflanzen betreffenden Versuchen* (1761),[24] doubting, however, their hybrid nature by arguing that they were "half-hybrids", that is, that male pollen from the maternal species had inadvertently been involved in their production.

Kölreuters publications on hybridisation experiments, which appeared with three further *Fortsetzungen* can, over all, be read as an attempt of refuting Linnaeus's claim that new species can arise from hybridisation. Expressing a veritable fear for the "astoninshing confusion (*erstaunliche Verwirrung*)" and the "monstruous swarm of imperfections (*ungeheuren Schwarm von Unvollkommenheiten*)" that would be the consequence of plants "unchangingly and constantly conserving their bastard species"[25] he basically followed two lines in demonstrating experimentally the impossibility of hybridisation giving rise to new species: Firstly, by demonstrating, that plants raised from artificially hybridised species do not exhibit a combination of parental and maternal traits, as Linnaeus had ventured to say, but that their traits occupied the "middle proportion" between the parental traits. And secondly, by demonstrating, that true species hybrids always are infertile, and thus cannot reproduce, a fact, that Linnaeus sometimes noted, but seems to have been surprisingly indifferent to.[26]

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22 Kölreuter (1766), p. 37.
23 Cf. Müller-Wille (2001).
24 Kölreuter (1761), pp. 41-42.
25 Kölreuter (1763), p. 9.
26 Ibid., p. 37.

Kölreuter summarised the results of his experiments in a classification of hybrid plants which, other than the one proposed by Linnaeus, was not based on the kinds of evidence he had for them – a quite external criterion – but on the dependence of the fertility of hybrid offspring on the similarity of their parental species, which formed the core of Kölreuters theoretical claims:

> Nachdem nun alle die Bastarte, die ich hervorzubringen und zu erziehen das Glück gehabt habe, angezeigt worden, so will ich sie nach ihrer verschiedenen Natur in folgende Klassen, Ordnungen, Geschlechter und Gattungen abtheilen.
> Erstlich theile ich sie in drey Klassen: unter die I. Kl. Gehören die vollkommenen Bastarte, die aus zwo oder drey verschiedenen natürlichen Gattungen eines Geschlechts entstanden sind, und bey deren Erzeugung der eigene männliche Saame gänzlich ausgeschlossen worden. Unter der II. Klasse hingegen stehen die unvollkommenen, die zwar aus zwo verschiedenen natürlichen Gattungen eines Geschlechts entstanden sind, bey deren Erzeugung sich aber außer dem fremden auch noch etwas weniges von ihrem eigenen männlichen Saamen zugleich mit eingeschlichen hat. Die III. Kl. begreift die Bastartvarietäten unter sich, die aus zwo Varietäten einer natürlichen Gattung entstanden sind, und bey deren Erzeugung der eigen männliche Saame gänzlich ausgeschlossen worden ist.[27]

This classification is based on a distinction of "natural species (*natürliche Gattung*)"[28] and "varieties of a natural species (*Varietäten einer natürlichen Gattung*)" that the ensueing "systematic table of all hybrids hitherto produced by art" discloses: While the perfect and imperfect hybrids, both produced from different "natural species", are further subdivided according to way in which they exhibit infertility or strongly reduced fertility – from "maternal", "paternal" or "both sides" – hybrid varieties are characterised as "perfectly fertile". By adopting an additional criterion for specific contiguity beyond mere genealogical descendence (as in Linnaeus), namely the production of fertile offspring, Kölreuter is able, so to speak, to save nature from the "monstruous swarm of imperfections" that would follow for her if Linnaeus had been right: Hybrid varieties do reproduce successfuly, but as they always occupy the "middle proportion" between their parental traits, their unions remain within its bonds. "Perfect" hybrids, on the other hand, uniting two "natural" species, do not reproduce successfully. There is a natural limit to the reproductive union of plant forms so dissimilar as to constitute different species, a central tenet that Kölreuter expressed in the following words:

> Bey vielen […] Pflanzen […] habe ich ihrer ziemlich nahen Anverwandtschaft ungeachtet , doch durch dergleichen Versuche nicht das geringste ausgerichtet, und es ist, in Absicht auf den Erfolg, eben so viel gewesen, als wenn ich sie gänzlich verschnitten, oder gar nicht mit Saamenstaube belegt hätte: Woraus ich zur Genüge ersehen, daß sich die Bastartpflanzen

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[27] Ibid., pp. 47-48: "Since all the hybrids, which I happened to produce and educate, have now been indicated, I want to divide them according to their different nature into the following classes, orders, genera, and species. Firstly, I divide them into three classes: to the first class belong the perfect hybrids, which originated from two or three different natural species, and where their own male seed was completely excluded from their production. Under the second class stand the imperfect, where although generated from two different species of a genus something of their own male seed, besides the alien one, crept in durign generation. The third class comprises hybrid-varieties, which were generated from two varieties of a natual species, and where their own male seed was completely excluded during generation"

[28] The term *Gattung* designated species in eighteenth century German, other than in modern German, where it designates genera. For "genus" *Geschlecht* was used, while *Art*, corresponding to "species" in modern German, was used to refer to kinds in general.

> nicht so leicht erzeugen lassen, als sich manche einbilden mögen, und daß eine widernatürliche Befruchtung eine weit größere Ähnlichkeit voraussetzt, als sie von einigen, wider alle Wahrscheinlichkeit, als hinreichend angenommen.[29]

As with Linnaeus distinction of species and varieties, Kölreuters classificatory move produced, however, the very possibility of observing problematic cases. For one thing, he operated in his hybridisation experiments with what Linnaeus had designated as "constant varieties", i. e. varieties which preserved their distinctive characters in the course of generations. In some cases he expressly addressed them as such – *natürliche und beständige Varietät* – , and expressed himself to be unable to "state the effective cause (*wirkende Ursache*) of this minute difference" as they often occured side by side in the field;[30] in others he seems to have instituted control experiments to assure himself of the constancy of their characters.[31] Kölreuter thus was forced to admit the omnipresence of a "generation among varieties", with admittedly unforeseeable consequences.[32] And in one of the hybridization experiments he instituted with colour varities of *Dianthus* he did encounter unexpected results:

> So sicher sich sonst bey denjenigen Bastarten, deren natürliche Mutter und Vaterpflanzen, sie seyn nun verschiedene Gattungen, oder nur bloße Varietäten, noch auf keinerlei Weise aus der Art geschlagen sind, die mittlere Farbe einzufinden pflegt: so unregelmäßig scheint es in diesem Stücke bey solchen herzugehen, die, wie z. E. die Gartennelken und mehrere andere Gattungen aus diesem Geschlechte, durch die Cultur auf mannigfaltige Art verändert werden. Es erhellet solches nicht nur aus den gegenwärtigen Beyspielen, sondern auch vornehmlich daraus offenbar, daß von einer aufs sorgfältigste mit ihrem eigenen Saamenstaube belegten Blume dieser Art öfters nicht eine geringe Anzahl ganz verschiedener Sorten entspringen, wie ich aus einer zuverlässigen Erfahrung versichern kann. Vielleicht giebt die mannigfaltige Veränderung, die in der Natur fast aller, seit einer langen Reihe von Jahren her einer widernatürlichen Behandlung und Lebensart unterworfener Pflanzen und Thiere vorgeht, zu Aufhebung des Gleichgewichts bey der ordnungsgemäßen Erzeugung nicht nur in Absicht auf die Farbe allein, sondern auch so gar in Ansehung der Gestalt, Lage, Zahl und Proportion aller Theile untereinander selbst, eben so viel Anlaß, als der erste ab- oder aufsteigende Grad bey der Bastardzucht. Wenigstens lassen sich viele dergleichen Varietäten und Mißgeburthen so wohl im Thier- als Gewächsreiche aus der ungleichen Mischung einer Saamenfeuchtigkeit mit der anderen, und aus ihrer wechselweisen ungleichen Wirkung und Einfluße auf einander, auf eine ganz ungezwungene Weise herleiten. Sollte wohl z. E. die größere oder geringere Ähnlichkeit der Kinder bald mit dem Vater, bald mit ihrer Mutter, und die denselben zu Theil gewordene größere oder geringere Fruchtbarkeit, nebst verschiedenen anderen Eigenschaften mehr, einen anderen Grund haben? Die Natur der Thiere und Pflanzen wird gewissermaßen bastartartig, so bald sie sich auf irgend eine Weise von derjenigen Bestimmung entfernen, zu der sie eigentlich erschaffen worden. Und wer weiß, ob unter den Menschen selbst eben so gar viele vorkommen, die in diesem Verstande nicht halbe Bastarte sind? [33]

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[29] Kölreuter (1761), p. 44: "In many plants, despite their rather close affinity, I have not been able to effect anything by such experiments, and it is, in regard to their success, as if I had castrated them completely or had not pollinated them at all. From which it follows with sufficient reason, that hybrid plants are not produced as easily, as some have imagined, and that an unnatural conception presupposes a much closer resemblance as it it is supposed to be sufficient by some, against all propbability."

[30] Kölreuter (1766), p. 35.

[31] Kölreuter (1763), p. 46; Idem. (1766), p. 35.

[32] Kölreuter (1763), p. 44.

The source for Kölreuter's dismay with the result of his *Dianthus*-cross – which found its expression in an eloquent and speculative digression unusual for the otherwise very sober descriptions of experimental results – is stated in the first sentence: Counter to Kölreuters theoretical expectation,[34] the offspring from this cross proved to display an array of varieties, combining traits of their parental species in various ways, instead of occupying the "middle proportion". Kölreuter was used to this phenomenon from the "first descending or ascending grade in hybrid breeds" or "half-hybrids" – i. e., what we nowadays would call a first back-cross – but he accounted for these cases by the "unequal mixture" and disruption of the "balance" of the male and female "seed fluids (*Samenflüssigkeiten*)", which, in "perfect hybrids", resulted from the union of different "natural species" and was also responsible for their infertility.[35] In terms of fertility, the *Dianthus*-cross behaved like a "hybrid variety", in terms of the distribution of character traits like a hybrid of two "natural" species. The only resort from this consequence is the relegation of such cases to conditions of domestication and cultivation. The same is the case with an experimental result, that formed the inverse of the one just discussed: In crossing two species of *Cucurbita*, which, in regard to their dissimilarity, Kölreuter had obviously expected to behave as belonging to two different "natural" species, he acquired perfectly fertile offspring, accounting for this by designating the parental forms as "essentially as little different, as a lap-dog and an English mastiff".[36]

As in the case of Linnaeus, the opposition of species and varieties is opened in a regulated experimental practice – a "workshop of varieties (*Varietätenwerkstätte*)", as Kölreuter once designated his experiments in producing "half-hybrids" by back-crossing – this time characterised by the attempt to correlate the physiological function of fertility with taxonomic affinities in hybridizatrion experiments. And as with Linnaeus's "constant varieties", it is opened to include an apparent oxymoron, the *bastardartig* nature of plants, animals, and humans.

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[33] Kölreuter (1766), p. 85 (transl. partly based on Mayr 1986, 170)**:** "As surely as otherwise the middle colour occurs in those hybrids, whose natural mother- and fatherplants, be they different species, be they different varieties, have degenerated in no way; as irregular does the play go on in those hybrids, which, as in the case of garden carnations and other species of this genus, which have been changed by cultivation in manifold ways. This is not only illuminated from the present examples, but also clear from the fact, that a flower of this kind, most carefully impregnated with its own pollen, often produces a considerable amount of very different sorts. Perhaps the manifold changes which take place in the nature of nearly all plants and animals subjected for a long series of years to an unnatural treatment and mode of living give cause to an unsettling of the balance in regular generation not only in respect to colour, but also with respect to form, position, number, and proportion of all the parts to each other, as much as in the first de- or ascending degree in hybrid breeding. At least it seems possible to explain quite naturally many such varieties and monstrosities among animals as well as plants as caused by an unequal mixture of their seed fluids and by the reciprocally unequal effect and influence on each other. Why should the greater or lesser similarity of the children with either father or mother, and the greater or lesser fertility that fell onto them, as well as other attributes, have any other cause? The nature of animals and plants becomes, so to speak, hybrid-like, as soon as they have departed in some manner from that destination, for which they had been created. And who knows whether even among humans themselves many occur which, in this sense, are half-hybrids?" Mayr calls the last statement "rather prophetic […] when translated into Mendelian language."

[34] Cf. Kölreuter (1764), p. 11.

[35] Cf. Mayr (1986), pp. 168-170.

[36] Kölreuter (1766), p. 119; cf. p. 93.

3. Types of Hybrids

When Carl Friedrich Gärtner published his *Versuche und Beobachtungen über die Bastarderzeugung im Pflanzenreich* in 1849, he could, other than Kölreuter, already look back on a rich and varied literature on plant hybridisation, both produced experimentally and inferred from taxonomic analysis. Sageret had presented his results on the hybridization of melons and pumpkins (*Cucurbitaceae*), rejecting the view that the "similarity of hybrids to their two ascendants [consists] in the intimate fusion of diverse characters proper to each of them in particular, but in a distribution, equally or unequally, of the same characters."[37] And William Herbert had proposed to view genera as the stable units of living nature "disport[ing] themselves in numerous forms of species and local or accidental varieties, which are more or less capable of intermixture according to their constitution and diversity, with various degrees of fecundity and sterility in the united produce."[38] Kölreuter's simple dichotomy of "perfect" hybrids and "hybrid varieties" had given way to a complex picture of various degrees in the combination, segregation and atavistic reappearance of varietal traits on the one hand, and various degrees in the physiological capacity of hybrids to produce fertile offspring.

In attempting to clarify this picture, Gärtner made sure to choose a different perspective than Kölreuter had done, though he acknowledged his authority. Instead of viewing hybridisation as a basically chemical process, as Kölreuter had done, Gärtner chose a "biological" point of view).[39] Most explicetly, this point of view came to the fore, when Gärtner discussed the distinction of species and variety:

> Die Frage, worin sich die Art von der Varietät unterscheide, ist daher, wie E[lias] Fries bemerkt, eine rein biologische: indem ein sicherer Grund der Artbestimmung nicht bloß in der Abstraktion gefunden werden kann, weder in den Merkmalen noch in den Uebergangsformen, sondern man muss ihn in der Reflexion suchen, d. h. in der individuellen Geschichte einer jeden Art, deren ganzen Entwikkelung, und nicht in einem gewissen Moment.[40]

In other words: there is no external criterion by which species are distinguished from varieties, but it is rather the life of the species itself, its "individual history" and "whole development" that determines it as a particular species. This is to be sought "in reflection" as its history and development has to be seen in relation to other species, as the definition of species, which Gärtner provided after all, testifies:

> Das Wesen der Art besteht daher in dem bestimmten Verhältniss ihrer sexuellen Kräfte zu anderen Arten, welches Verhältniss neben der specifischen Form bei jeder Art ein eigenthümliches, besonderes und constantes ist; Form und Wesen sind in dieser Beziehung Eins.[41]

The consequence of this species definition is a distinction of two kinds of "affinities (*Verwandtschaften*)" among plants: an "external (*äußere*)" one, consisting in the "conformity of

[37] Sageret (1826), pp. 300-302.
[38] Herbert (1837), p. 17.
[39] Gärtner (1849), p. x.
[40] Ibid., p. 151.
[41] Ibid.

habitus, i. e. in its growth form, in the figure and form of leaves and in the harmony of flowers and reproductive organs;" and an "internal (*innere*)" one, consisting "in the lesser or greater tendency (*Geneigtheit*) for sexual union among species in hybrid fertilization."[42] The "chemical" view, "in analogy to dead nature," would suggest "that similar substances produce similar forms and forces."[43] Yet the fact that both varieties and species always produce the same "types of bastards (*Bastardtypen*)" speaks against this analogy.[44] One has to suggest, therefore, as Gaertner put it

> […] dass in den beiden Substraten der Geschlechter der Pflanzen und in ihrer gegenseitzigen Anziehung der Grund der Fähigkeit zur Bastardzeugung liegt: worin aber die specielle Beschaffenheit des einen wie des anderen Faktors besteht, wird weder durch mikroskopische, noch durch chemische Untersuchungen zu beantworten sein; indem es sich hierbei um eine rein vitale Thätigkeit handelt, welche wir mit keinem passenderen Wort, als mit dem der Wahlverwandtschaft zu bezeichnen wissen.[45]

Gärtner therefore suggested a new classification of hybrids in place of the one proposed by Kölreuter, which had been based on the distinction of (fertile) variety bastards and (infertile) "perfect hybrids" between species and which Gaertner considered as "unnatural (*nicht naturgemäß*)". Instead, the "natural classification (*naturgemäße Eintheilung*)" should be established according to the "composition and descendence (*Zusammensetzung und Abstammung*)" of hybrids solely. The taxonomic status of the parental forms does not play a role anymore in this classification, and Gärtner made sure, in a separate chapter on "varieties and variety bastards", to point out that hybrids of varieties, as long as the latter prove to be "stable" and "constant" behave in many respects exactly in similar ways as species bastards.[46] And it is in this respect, that "species constancy" counted for Gaertner, namely in as much as the "types of hybrids are not vague and variable, but constant, obeying certain invariable laws of formation (*Bildungsgesetzen*)," and in as much as they are "constantly and regularily (*constant und gesetzmäßig*) produced from the same factors again and again."[47] Species appear as a reservoir of "factors", which combine, reappear, and distribute in a regular fashion in hybridisations. As a consequence, Gaertner accepted all but one – which had proved to be variable under cultivation – of Kölreuter's varietal hybrids as species hybrids.[48] What distinguishes species, is their "inner nature" by which each of them produce "different types of hybrids".

4. Concluding Remarks

In this paper, my main aim was to draw a more complex picture of the work of the hybridist tradition of the late eighteenth and early nineteenth century, especially in regard to the status of the taxonomic categories employed in this tradition. In each case, the apparent oxymorons of "constant varieties", "hybrid-like natures", and "types of hybrids" resulted from a use of these

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42 Ibid., p. 166.
43 Ibid.
44 Ibid., p. 168.
45 Ibid., p. 186.
46 Ibid., pp. 576-577.
47 Ibid., pp. 243-235.
48 Ibid., p. 581.

categories in attempts to structure nature not by identifying the "natural places" of things, but by identifying regularities in their motion. The apparent stability of a hierarchy of living forms broke down under this condition, laying bare heredity as one of the central forces in the development of life, both as a source of its diversity and its regularity. Mendel's contribution was, in this specific respect, perfectly "in the truth" of this tradition, as shown by his own conviction to have contributed to the *Entwicklungsgeschichte der organischen Formen*. The decision to deal – in a *Detailversuch* (even that a Gärtnerian expression),[49] as he made sure to specify – with "constant varieties" was not as dramatic a deflection from the tradition culminating in Gärtners voluminous book. In Gärtners understanding, the pea varieties Mendel experimented with, though only differing in respect to single character pairs, *were* different species, and the conclusions Mendel drew from them in regard to his predecessor's work in the "concluding remarks" of his paper were therefore quite naturally phrased with respect to "species". That Mendel did take a decisive step towards twentieth century Mendelian genetics is therefore not simply a myth, but based on a historical coincidence, that did, in fact, occur.

For the theme of this conference, the "cultural" history of heredity, there is one important consequence that I would like to draw from the "internal" history I have tried to sketch out: Heredity becomes central in the early nineteenth century not as a result of social processes in which dichotomic exclusions become cemented, but rather as a result of processes in which such structures become dissolved. Science played an important role in this, though obviously not science alone. In no other statements from the hybridist tradition, I believe, does this come to the fore more clearly than in the sentences with which Charles Darwin summarised the results of the chapter on reversion or atavism in his *Variation of animals and plants under domestication*:

> The fertilized germ of one of the higher animals, subjected as it is to so vast a series of changes from the germinal cell to old age – incessantly agitated by what Quatrefages well calls *tourbillon vital* [the maelstrom of life] – is perhaps the most wonderful object in nature. It is probable that hardly a change of any kind affects either parent, without some mark being left on the germ. But on the doctrine of reversion, as given in this chapter the germ becomes a far more marvellous object, for, besides the visible changes which it undergoes, we must believe that it is crowded with invisible characters, proper to both sexes, to both the right and left side of the body, and to a long line of male and female ancestors separated by hundreds or even thousands of generations from the present time: and these characters, like those written on paper with invisible ink, lie ready to be evolved whenever the organization is disturbed by certain known or unknown conditions.[50]

[49] Ibid., pp. 291, 580.
[50] Darwin (1875), 2: pp. 35-36.

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Comments on the papers given by Roger Wood and Staffan Müller-Wille

Raphael Falk

I wish to start by noting the major contribution of Víczeslav Orel to our understanding of the history of heredity at and prior to Mendel's time, and especially of heredity and of breeding, dealt with in this session. It is with much frustration that I deplore his inability to attend this meeting and I wish to extend to him my – and I am sure all of your – wishes for better health and many more contribution to our understandings of the cultural history of heredity.

In a way, this session, and perhaps the whole workshop may appear to be disappointing to a Mendel scholar: It was nice to stick to the legend that Mendel's work sprung out of nowhere, like *deus ex machina*. But, of course, every serious person knows that this was not the case. Foucault's comment on Mendel as *un monstre vrai* notwithstanding, outstanding an individual as Mendel was, his contributions were not "alien to the biology of the epoch," but rather deeply rooted in his intellectual and social surroundings – as Orel has been emphasizing for many years.

The topic of this session, "Heredity and breeding," on which I wish to comment, was appropriately represented by a two prong assault: Roger Wood's, from the perspective of the *breeder,* and Staffan Müller-Wille's from that of the *academics*. Not less significant, both approaches utilized *hybridization* as the major tool of their assault.

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Carlos López-Beltrán, in his Introductory Remarks, pointed out that interest of scientists in heredity happened only towards the beginning of the nineteenth century, when, from a secondary, disposing component it became a main, if not *the* main, cause of human "nature". Obviously, no single event in the eighteenth century could bring about the shift that precipitated such a centrality of the problem of hereditary. Developments like Altströmer's 1723 initiative to breed high quality Spanish sheep in Sweden in spite of this country's inhospitable environment, the publication of Linnaeus's 1735 *Systema naturae* on the classification of animals and plants according to their immanent characteristics, as well as Kant's 1775 *Races of Men* notion of the organism as an autonomous entity, were undoubtedly major consequences of the causes that changed the attitude to the notion of intrinsic, essential characters of living beings. Heredity was always a notion of a duality of both *continuity* and *change*; and I would like to suggest that it was an increasing consciousness of the inherent *variability* of human nature during the eighteenth century that was the process, which eventually propelled heredity to the center of intellectual discourse towards the end of the century. Stephen Toulmin epitomized this process in his thought-provoking book, *Human Understanding*, by an event that took place on April 13 1769. On that day Captain James Cook arrived in Tahiti on H.M.S. *Discovery*. This event acquired "a retrospective significance that no one could have recognized at the time." This was not so much because of the party of scientists assembled under the auspices of the Royal Society for astronomical observations "needed to make good one last key detail hitherto missing in the orthodox Newtonian picture of God's astronomical Creation," as to the discovery that

> Life on Tahiti, though tranquil enough, was surprisingly free and easy: the inhabitants got along happily, disregarding many of the taboos and commandments regarded in Europe as essential elements of god's Order […] From this point on, it became progressively more difficult to square men's factual knowledge about theories and practices of their own fellow humans with accepted views about the impartial standpoint from which rational judgement and appraisal were to be conducted.[1]

This increasing awareness of natural variation between human societies, and particulate uniqueness of the individual, at odds with the prevailing social and scientific law-given Godly classifications culminated a century later, on November 24, 1859 in the publication of Charles Darwin's *The Origin of Species by Means of Natural Selection*, and on February 8 and March 8, 1865 in Mendel's presentation of his *Versuche über Pflanzen-Hybriden*. Darwin as well as Mendel coped with the mechanisms of *inherent change and continuity* on a new ideological and theoretical background than their predecessors a century earlier.

Of course: The duality of continuity and change of living beings struck humans as far back in history as we can follow. In biblical times, however, these were conceived as patterns of *reproduction*, denoting repetition of conserved qualities, and *generation*, denoting creation of new qualities: "And Adam lived thirty and a hundred years, and begot a son in his own likeness, after his image; and he called him Seth."[2]

Inheritance was a concept of material and social transmission of commodities, land, and eventually titles, from person to others:

> And the Lord gave unto Israel all the land which he sware to give unto their fathers.[3] But Zelophehad […] had no sons, but daughters; […] And they came before […] Joshua the son of Nun, […] saying, "The Lord commanded Moses to give us an inheritance among our brethren." Therefore, according to the commandment of the Lord he gave them an inheritance among the brethren of their father.[4]

> Rachel and Leah answered [Jacob] and said to him, "Is there yet any portion or inheritance for us in our father's house? Are we not counted of him strangers? […] For all the riches which God hath taken from [Laban] our father, that is ours, and our children's".[5]

Only rarely did inheritance refer to the transmission of traits of creatures, and then as a rule, metaphorically. Until the eighteenth century passive conservation as opposed to active creation had been the leitmotif in the notion that is subsumed toady under "biological heredity".

As Wolfgang Lefèvre has already indicated in the "Abstracts" of the Workshop, the scientific interest in heredity has always been shaped by the social and political theoretical context in which it acted. It appears that the "biologization" of heredity reflected the traditional society's power-centers embracing themselves, through a kind of God-given typology, against the imminent rocking of the social and political boat; claiming for the inborn nature of their privileged status. I

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1 Toulmin (1972), p. 42.
2 *Genesis* 5:3.
3 *Joshua* 21:43.
4 *Joshua* 17: 3-4.
5 *Genesis* 31: 14-16.

think that this is also what Staffan Müller-Wille meant in his conclusion that "Heredity becomes central in the early nineteenth century not as a result of social processes in which dichotomic exclusions become cemented, but rather as a result of processes in which such structures become dissolved".

* *

Hybridization, the time-honored tool of animal and plant breeders, was considered an act conflicting with the God-given order of natural reproduction. However, just because hybridization violated a basic notion of life that *like engenders like*, it also high-lightened the important property of living matter that whereas progeny *resemble* their progenitors in some properties, they may *vary* from them in others. It was this realization that eventually turned hybridization into a tool for defining discrete characteristics and provided a heuristics for investigating them.

Müller-Wille traced the academic prong of the employment of hybridization. The problem of the fixity of the "species" concept in spite of the observed variation became a central issue of academic research in the century following Linnaeus's *Plantae hybridae* of 1751. To the extent that it was considered at the level of experimental manipulation, the main tool available was the breeders' hybridization: Linnaeus reasoned that the only way to change God's species was by such non-godly acts as hybridization. Indeed, by the very nature of the problem, when dealing with the transformation of species, most of the crosses were made between species. And although the definitions of species and varieties were based on other criteria than the current ones, the dominating experience was that the great majority of the crosses was sterile or produced sterile offspring. Of the 62,688 flower hybridizations carried out by C. F. Gärtner in the years 1823-1848 only 23,335 or 37.22% gave fruits, and in only 257 of these, or 0.41%, the fruits were normal in form and seed number.[6] This kind of academic research could hardly resolve the problems of the hereditary identity or dissimilarity of "element characters." Although Kölreuter tried to discern between "natural species" and "varieties of natural species," the breakthrough came only in 1859 with Darwin, who, not surprisingly, took his cues from "variation under domestication," i.e., from the breeders' rationality.

Darwin abandoned the Linnaean distinction between species constant characters and non-species' variable characters, which led him to doubt the demarcation of species and subspecies. Yet, it must be recalled that Darwin never challenged the conception of natural types. His notion was essentially neo-Aristotelian: The properties that maintained species as distinct typological entities came from within, and were inherent in the hereditary-sociological relationship of the members of the species in their environment. His attack on the problem of heredity, like that of Kölreuter or Gärtner, was an academic one, and not a too successful one at that.

Now, breeders too encountered from the beginning of time the paradoxical reality of constancy and change of animals and plants. If there was no constancy, breeding must be started anew every generation. Indeed, they believed that unless you provide the bred animals and plants with the proper conditions all the time, they would not yield the expected products. Yet breeders

6 Falk, (1991), p. 460.

were able to demonstrate some hereditary stability. Whereas the scientists got stranded with problems of fertility, like Kölreuter, with his *Dianthus* color variations, breeders were practical persons emphasizing the constancy of their products over generations, i.e., *biological inheritance sensu stricto*. Breeding and controlling the environments were going hand in hand. Their practices, although affected by scientific ideas, were mainly based on traditions and common beliefs and personal experiences and constrained by economic demands. As has been pointed out by Roger Wood the tradition of transmission of traits through the blood and then through the semen was more or less the unchallenged breeders' concept of inheritance until the eighteenth century.

It must also be kept in mind that although many of the more successful breeders, like Bakwell, were versed in the developments in the sciences especially of physiology and embryology, and in the methodology of controlled experiments, their work as a rule did not allow them to apply many of these: Certainly they could not afford the luxury of running "controls", as every biologist trained in the reductionist tradition of the physical sciences would have been expected to do. No wonder that Wood repeatedly referred to Bakwell as working "like an artist", rather than as a scientist. In line with this, Bakwell's approach to problems of heredity was more 'holistic' than that of the academics who strove to reduce problems to their elements, or as Müller-Wille called it, to the "atomization" of species, shifting "the level of analysis from specimens to differential characters as the 'elements' of the species".

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Thus, the changes in eighteenth century European breeders' concepts were largely technology-driven and toward improved rearing conditions rather than theory-driven. By and large, they could not be expected to keep pace with discoveries in physiology.

On this background the one exception in Roger Wood's description is most remarkable. As he notes, the Moravian "Association of Sheep Breeders" established in Brno in 1814 was interested in *genetische Gesetze der Natur*. Thanks to some outstanding persons, Brno became the hotbed for a new *science* of heredity, combining the traditions of the art of animal and plant breeding and the newly achieved developments in scientific reasoning and experimentation. The exertion for the conceptual bridging of the dichotomy may best be summarized in the quotation that Wood brings from Napp in 1837: "What we should have been dealing with is not the theory and process of breeding. But the question should be: What is inherited and how?"

Being a member of the Brno Society, Mendel the scientist had access to the breeders' mentality and, contrary to the academic hybridists before him, he was not handicapped by the taxonomic status of individual variation and the question of whether new species could arise from hybridization. On the other hand, being trained in the physical sciences, Mendel was able to sublime the breeders' holistic conceptual framework and to adopt a strict reductionist analytic attitude, following the inheritance of discrete characteristics *per se*. Thus, coming back to Foucault, even on this background, Mendel's work, exceptionally combining diverse disciplinary elements, such as statistics, cell-theory with advanced breeding techniques, tags him not as a "monster" but as a real giant, in his attempt to discover God's laws "written in the language of mathematics."[7]

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7 Falk (2001).

Acquired character: the (pre-genetic) material of the 'self-made man'

Paul White

> It is Character which builds an existence out of circumstance. Our strength is measured by our plastic power […] thus it is that in the same family, in the same circumstances, one man rears a stately edifice, while his brother […] lives for ever amid ruins. (G. H. Lewes, *Life of Goethe*)

Historians have located a widespread shift in Victorian Britain from models of hierarchical order based on innate capacity – the blue blood of nobility – to one in which character of the highest sort could be acquired. Debates of this sort were much older, but the story is often told as part of the rise of the middle-classes and the professions and the consequent decline of the hereditary aristocracy.[1] This social transformation was far from straightforward, and models of inborn and acquired character often overlapped or were employed in different ways according to setting. Ongoing debates about the role of ancestry, of landed property, of money, and of moral conduct in the constitution of social status often focussed on the figure of the gentleman. The inheritance of acquired characteristics, prior to the isolation of chromosomes as the material of hereditary transmission, has often been treated virtually as a timeless theory with an inherent plausibility, and therefore requiring no historical explanation.[2] And yet the natural historical concept of character as developed in studies of breeding and hybridization was closely linked to prevalent concerns among the middle classes of the Victorian period about inborn or acquired character in the wider, moral sense. Research on heredity in Victorian Britain may thus be situated within a wide-ranging set of debates about self-formation, individual improvement, and the formation of gentlemanly character. The concept of the hereditary transmission of acquired characters, so crucial to progressive theories of evolution and to theories of degeneration in the period, must itself be understood in relation to the broader controversy over the acquisition of (moral) character.

Breeding character

The term "character", together with "characteristic", has been used in natural historical contexts to signify a distinctive feature of a species or variety since the mid 18th century, although its wider meaning as an "essential quality" and its use with reference to moral and mental attributes begins much earlier. In Victorian discourses of breeding, these two senses, the natural historical and the moral, are considerably intertwined. What was "character" for the breeders? At one level, it was simply a physical or behavioural trait, taken as distinctive of a given variety: a particular shape of beak or horn, the sheer size and mass of an animal's body, a manner of masculine display, such as the inflating of the chest. Such traits were not only variable, but mutable, and breeders often

1 For example, Perkin (1989); and Reader (1966).
2 On the inheritance of acquired characteristics, see Bowler (1989); Churchill (1976) and (1987); Lomax (1979); Robinson (1979); Windholz (1991); and Zirkle (1946).

presented themselves as able to shape a plant or animal's character, almost at will. Thus the veterinary surgeon, William Yuoatt, spoke of selection as "that which enables the agriculturalist, not only to modify the character of his flock, but to change it altogether. It is the magician's wand, by means of which he may summon into life whatever form and mould he pleases."[3] This power to mould character through the manipulation of conditions and the exercise of will, was in fact the operative principle of another Victorian creature: the self-made man. Elaborated in numerous didactic works and novels of the early Victorian period, the culture of self-help and self-fashioning was epitomised in the writings of Samuel Smiles, first in his biography of the manufacturer George Stephenson, in many subsequent lives of working men-made-good, and a series of companion volumes on particular virtues such as thrift, duty and, in 1871, on *Character* itself.[4] According to Smiles, character was "formed by a variety of minute circumstances, more or less under the regulation and control of the individual." Every action, thought, and feeling contributed to its formation: "man is not the creature, so much as he is the creator, of circumstances […] energy of will – self-originating force – is the soul of every great character." By locating the virtues of moral character in individual deeds and habits, rather than in ancestry, Smiles legitimized, indeed lionized, the rapid social ascent of Britain's industrial and commercial leaders, while holding out the promise of improvement to many. Revealed in the "transactions and commonplaces of daily duties", a respectable character could be acquired by anyone.[5]

How then was this culture of individual improvement and character formation operative in the discourse and practice of breeders? One way of getting at this connection is to look at the various forms by which character, both in its natural historical and moral senses, was displayed.

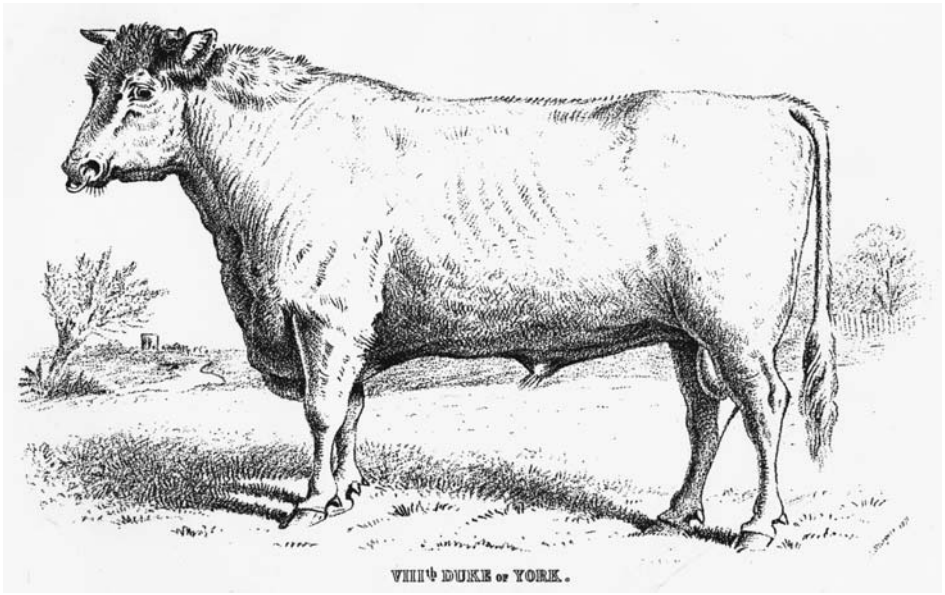

Fig. 1: Short-horn bull from Bates, *The history of improved short-horn or Durham cattle, and of the Kirklevington herd,* (1871), p. 354 facing.

3 Youatt (1837), p. 60.
4 For a general discussion of Smiles's work, see Jarvis (1997). On the literary construction of the self-made man by Smiles and others, see Meckier (2001); Pettitt (1999); Rodrick (2001); and Wyke (1999).
5 Smiles (1871), pp. 1-6.

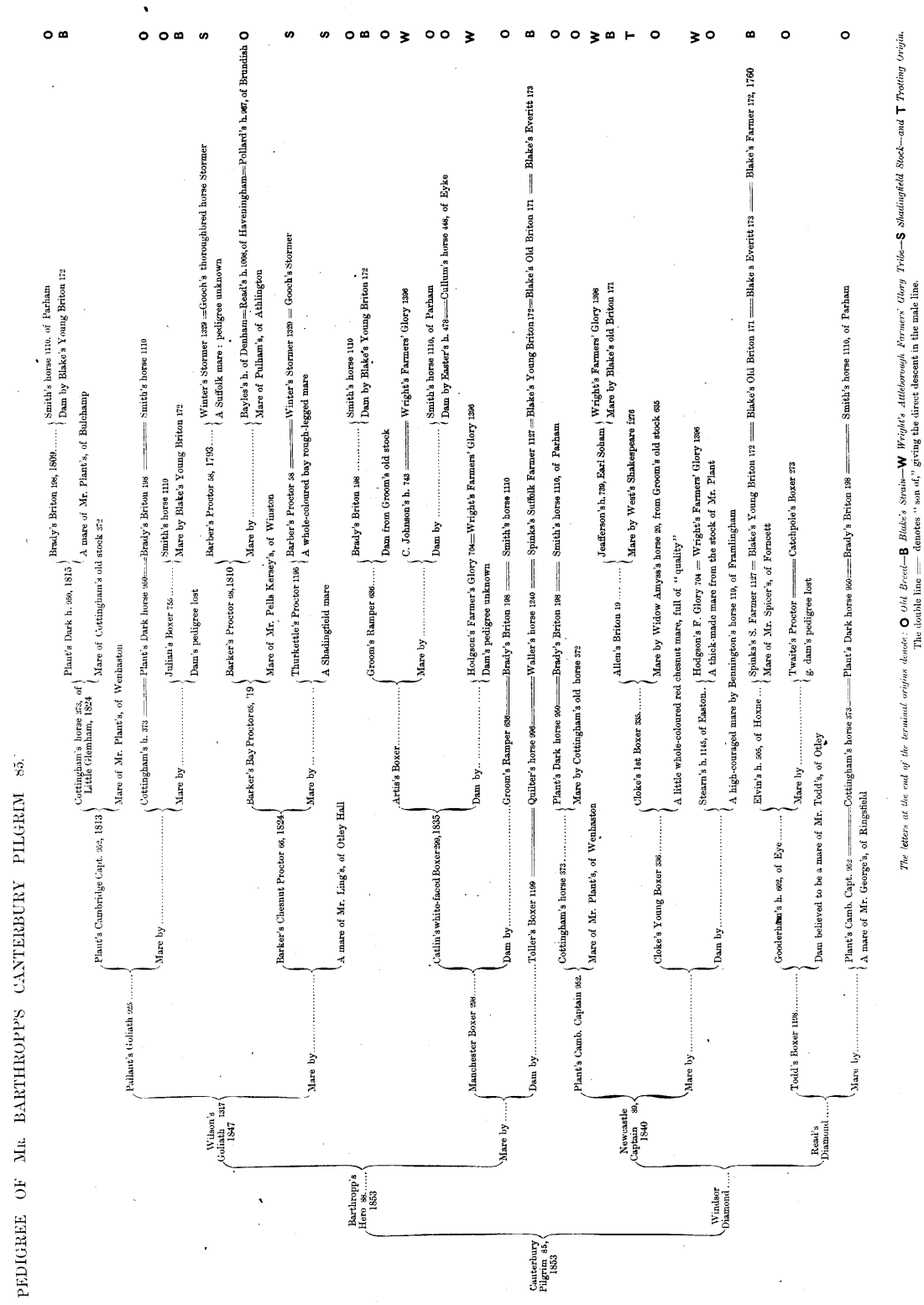

Fig. 2: Pedigree from Biddell, *The Suffolk stud-book: a history and register of the county breed of cart horses,* (1880), p. 654 facing.

This prize short-horn bull (fig. 1), the VIIIth Duke of York, is exhibited here in Thomas Bates's 1871 history of the improved Durham cattle. Harriet Ritvo's work on animal husbandry in Britain has shown that breeders often affixed their own social status to that of their animals; in breed characteristics, no less than prize competitions, the criteria of social hierarchy were defined, and the boundaries established between a person (or animal) of noble pedigree and a parvenu.[6] The nobility of a creature was always demonstrated by its ancestry and progeny, as in this pedigree (fig. 2) of Canterbury Pilgrim from the Suffolk Stud Book. Such registers typically added a further layer of representation, in the form of biographical entries, noting the prizes that the animal had won, the prices it had fetched, and also its leading characteristics. Thus Cup-Bearer (fig. 3) was depicted as "a large horse with a grand fore end, great depth of girth, and splendid muscular shoulders. […] although not an elegant walker," its sons were legion, numbering many prize winners. The animal is shown here with its owner, Mr. Crisp.

Fig. 3: "Cup-Bearer" from Biddell, *The Suffolk stud-book: a history and register of the county breed of cart horses,* (1880), p. 166 facing.

6 Ritvo (1987), pp. 45-63. On general breeding practices in Britain, see also Russell (1986).

Fig. 4: Prize bull of Sir Charles Morgan from Ritvo, *The animal estate: the English and other creatures in the Victorian age,* (1987), p. 49.

Fig. 5: Charles and Robert Colling from *Shorthorn transactions,* (1868-9), frontispiece.

This sort of iconography could assume a more elaborate and costly form, as in this oil on canvas (fig. 4), drawing on the tradition of gentry portraiture, in which lords of the manor were foregrounded against their estates.[7] But this animal, the prize bull of Sir Charles Morgan, baronet, is not just part of the gentleman's large holdings; its distinguishing properties – its formidable size, beauty, and elegance – were those of nobility, and were also distinctive of its owner. Corpulence, in conjunction with elegance, was a virtue among the English gentry, signifying power, wealth, and generosity.[8] Typically displayed by a rounded, decorous body on slender legs, as in this portrait of Charles and Robert Colling (fig. 5). These "fathers" of the short-horn cattle manifest the same prodigious girth and delicacy of limb (or calf) as their noble breed. To complete this system of representation, on the page opposite in this volume of *Shorthorn Transactions*, their own moral pedigree is given. Thus Robert, "from his enlarged views, generous disposition, love of order, nobility of bearing, and extensive means […] was called the'Prince of Skerne'".[9]

The role of breeders in modifying structure through habit and conditions thus bore equally on their own status as gentlemen and conservative improvers. These forms of representation, the family tree, portraiture, and biography, together enforced the view that gentlemanly character was natural historical – composed of heritable traits, rooted in good breeding – and yet highly malleiable in the breeders' art. The great estate owners who commanded this culture of improvement, some of whom were new members of England's ruling classes, were, as much as their prize animals, living examples of the power of selective breeding to modify character, and thereby enrich the stock of the nation.

Powers of discrimination

In response to criticism that in *Origin of Species* he had described natural selection as an agent, productive of species, Darwin replied that he had merely adopted the language of breeders.[10] James Secord has shown the attention to the work of animal and plant hybridists in the framing of Darwin's theory; and indeed, the skill and art of breeders in fashioning their stock was repeatedly emphasized in Darwin's acknowledgements of individual fanciers and horticulturalists in the *Variation of Plants and Animals Under Domestication*.[11] As Darwin wrote in *Origin*, they "habitually speak of an animal's organisation as something quite plastic, which they can model almost as they please."[12] In drawing the analogy between natural and artificial selection, Darwin conceded a power to breeders that was a source of consternation among some of his gentlemanly correspondants, such as Charles Lyell. On reading the first chapter of *Origin*, Lyell remarked:

> Your comparison of Selection to the Architect […] I […] cannot accept. The architect who plans beforehand & executes his thoughts & invents […] must not be confounded in his functions with the humble office of the most sagacious of breeders […] it is the deification of Natural Selection.

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7 Barrell (1986).
8 On the virtue of corpulence, see Porter and Rousseau (1998).
9 *Shorthorn transactions*, (1868-9), frontispiece.
10 Darwin (1859), p. 30; Darwin to Charles Lyell, 22 January 1865, in Burkhardt et al. (1985-2002), vol. 13.
11 Secord (1981), and (1985).
12 Darwin (1859), p. 31.

> The idea of [selection] being ever allowed to play such pranks as the breeder has played & to sport with God's creatures & the laws of reproduction so as to perpetuate pouter pigeons, & other monstrosities, would have been scouted by a philosopher of the Wealden Period.[13]

The deification of natural selection, and by implication, the elevation of breeders to creative status, remained an ongoing dispute. Darwin actively defended his analogy as appropriate. Yet Darwin's views on the relative power of external agency to shape the character of species and varieties differed substantially from those of the leading breeders whom he consulted. While agreeing that the conditions of life, especially those of domestication, had profound effects on the variability of character, Darwin urged "we must never forget that the nature of the organisation which is acted on, is by far the most important factor in the result."[14]

Unlike the horse and cattle breeders, the majority of the poultry men with whom Darwin associated were or had been artisans, a point of considerable importance to a community which prided itself on gentlemanly character. Though a tailor and thus an artisan by trade, John Matthews Eaton, one of Darwin's leading authorities in *Variation*, clearly regarded himself and his fellow fanciers as gentlemen – not by birth, or wealth, but by virtue of their pasttime. Some gentlemen, even nobleman, were indeed breeders – a fact reiterated in countless treatises on domestic animals; and breeding pigeons did allow tradesmen and others of more humble status to imitate the genteel and noble. Yet the crucial point of Eaton's claim, however, was that the practice of breeding was itself gentlemanly in character. It was a "study and science" especially "adapted to the professional gentlemen of law, physic, and divinity, or any other person engaged in long continued and excessive exertion of the intellectual faculties."[15] Breeders were renowned for their unsurpassed powers of observation and discrimination, able to detect differences of character between individuals that were invisible to anyone not a master of the art. Their way of seeing, their watchfulness, vigilance, and discrimination were as important to Darwin as their knowledge of variation and inheritance; for they embodied nature's selective power. Darwin's own account of the changes wrought by breeding practice in *Origin of Species* culminated in a character-sketch of the breeders as self-made men, succeeding according to the Smilesian virtues of perseverance, hard work, and the resolute pursuit of a single goal:

> Not one man in a thousand has accuracy of eye and judgment sufficient to become an eminent breeder. If gifted with these qualities, and he studies his subject for years, and devotes his lifetime to it with indominatable perseverance, he will succeed, and may make great improvements; if he wants any of these qualities, he will surely fail. Few would readily believe in the natural capacity and years of practice requisite to become even a skilful pigeon-fancier.[16]

And yet Darwin's own relations with breeders such as Eaton clearly indicates that he regarded them as social inferiors, joking privately about their diminutive stature and their bad grammar. To his eldest son, he wrote: "NB all Pigeon Fanciers are little men."[17] When the zoologist Thomas

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13 Charles Lyell to Charles Darwin, 15 June 1860 and 19 June 1860, in Burkhardt et al. (1985-2002), vol. 8.
14 Darwin (1868), 2: p. 502. See also Winther (2000).
15 Eaton (1851), pp. iii-vi.
16 Darwin (1859), p. 32.
17 Charles Darwin to William Erasmus Darwin, 29 November 1855, in Burkhardt et al. (1985-2002), vol. 5.

Huxley asked Darwin for information on breeding for a talk at the genteel Royal Institution, Darwin included some extracts from Eaton's treatise on the Almond Tumbler that he thought "would make the audience laugh." After citing passages that displayed the gentlemanly pretenses of the fancy, together with the "little tailor's grammar" to comic effect, Darwin cautioned Huxley not to mention Eaton's name, "as he is my friend."[18]

As a man of wealth and property, and the recipient of a traditional classical education, Darwin could have rested his superiority to the breeders on these grounds, and yet he made common cause with Huxley, of relatively humble birth, poor, and largely self-educated. That Darwin and Huxley could laugh at the breeder's expense, and yet regard them as friends, and look to them as authorities on questions of science, raises questions about the social status of their own experimental practice, and the grounds on which they distinguished themselves from such associates. The particular gifts that Darwin praised in breeders, their accuracy of eye, and powers of concentration and discrimination, were also widely regarded as characteristic of the Victorian 'man of science'.

Hereditary genius

How then did the 'man of science' stand in relation to models of innate and acquired character? In fact, just like the breeders, the status of men of science as gentlemanly, and as self-made, was also uncertain. A romantic tradition was still operative in Victorian scientific biography and self-presentation, in which the practitioner was distinguished by specially endowed powers of mind. In his essay *Characteristics*, Thomas Carlyle described genius as a heroic intellectual force: innate, like nobility, but often residing in those of humble birth. Its characteristics – intuition, mental suppleness, refined discrimination – marked out a few individuals as destined to be leaders of men and spirits of the age.[19]

Such romantic models were appropriated by practitioners such as Huxley, and John Tyndall, whose backgrounds did not confer gentlemanly status. And yet in the Victorian period, genius was transformed by the culture of industry and work.[20] What had been conceived as a largely effortless and innate capacity by 18th century writers became an endowment of the self-made man, who had to labor and struggle after truth. Even Darwin, a gentleman of secluded leisure, continually characterized his scientific activity as "hard work" and "hard labour", tallying up the months and years, right up to the day, at which he spent in the production of each of his books.[21] Francis Galton's 1874 survey of men of science compiled over a hundred comparable accounts: men who walked 50 miles a day without fatigue in search of specimens, men who worked habitually until two or three in the morning. Using autobiographical testimony, Galton documented their leading characteristics as perseverance, steadiness, determination, and "the secretion of nervous force" – that is, energy: "many have laboured as earnest amateurs in extra professional hours long into the night […] they have climbed the long and steep ascent from the lower to the upper ranks of life."[22]

[18] Darwin to Thomas Huxley, 27 November 1859 and 13 December 1859, in Burkhardt et al. (1985-2002), vol. 7.
[19] Carlyle (1831).
[20] On the cult of genius and work amongst Victorian men of science, see White (2002), ch. 1. See also Tyndall (1868).
[21] Darwin (1958).

Yet, despite this emphasis on self-fashioning through hard work, certain characteristics of men of science remained inborn. In his 1869 work, *Hereditary Genius,* Galton used his own family history, and the pedigrees of others, to argue that intellectual aptitude was hereditary. Galton drew heavily on the tradition of family trees to map out the inheritance of illustriousness over generations, as in this pedigree of the natural philosopher, Robert Boyle (fig. 6). Like Carlyle, Galton viewed men of genius as great forces of the age, but recast their influence in terms of hereditary transmission, as the sports of nature by which the new higher types of mankind were established. In his theory of sports, a new character suddenly made an appearance in one individual and was transmitted, causing a change in the typical centre of the race and a step forward in the course of evolution.[23]

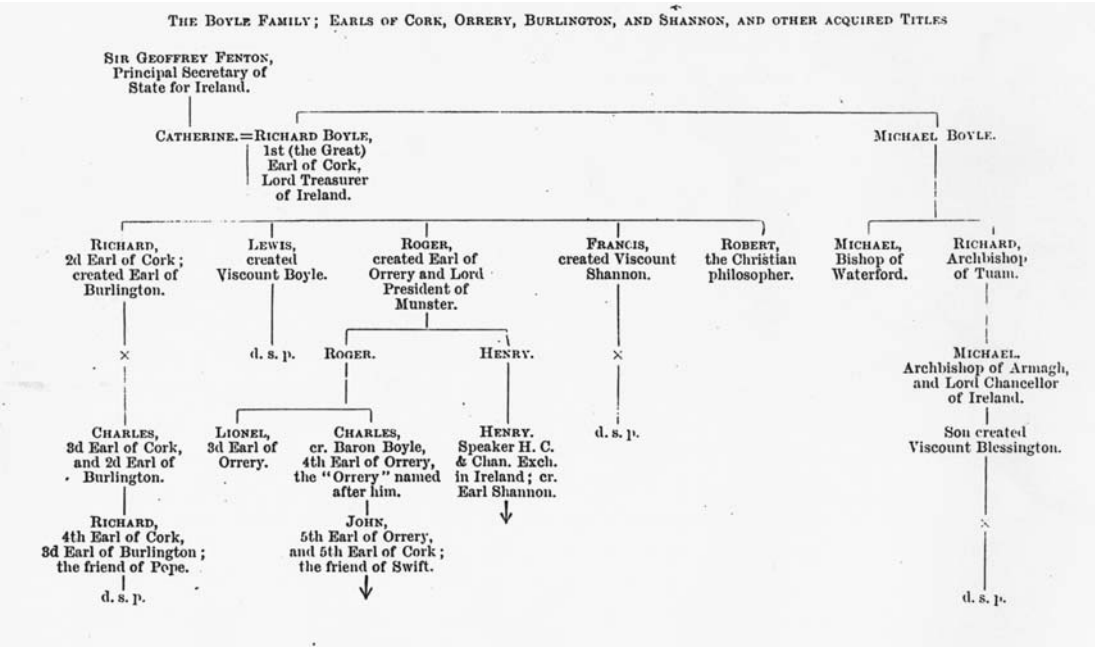

Fig. 6: Pedigree of Robert Boyle from Galton *Hereditary genius, an enquiry into its laws and consequences,* (1869), p. 197.

Diseases of character

In the Preface to the 1892 edition of *Hereditary genius*, Galton noted recent work by Lombroso and others that traced the proximity of genius to insanity, commenting that he did see some evidence in families for a "painfully close relation between the two" conditions.[24] The very characteristics of mind possessed by leaders of humanity, the geniuses and self-made men, brought them close to less favourable qualities, commonly identified with degeneration. I want to look at one form, or stage, of degeneration – alcoholism – for it became in the Victorian period a particular malady of the self-made man. This appears expecially prominent in the medical literature and novels of the mid-Victorian period, decades of great prosperity for the middle classes.

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22 Galton (1874), p. 75.
23 Galton (1892), pp. xvii-xix. See also Cowan (1985).
24 Galton (1892), p. ix.

Anthony Trollope's *Doctor Thorne* problematizes the simple Smilesian version of character as a product of self-determination, as well as the traditional equation of gentlemanly character with noble descent.[25] The novel contains two self-made men: one a paragon of Smilesian heroism, a lowly stonemason who rises to be a captain of industry, building bridges, canals, and railroads across the British Empire, and is made a baronet – a hereditary title, though significantly not an aristocratic one. Though conquering the world, Roger Scatcherd succumbs to the habit of drink and dies, leaving a sickly son, who inherits the craving for drink, suffers delirium tremens, and dies at the age of twenty, extinguishing the family line. The other, of ancient family, who prides himself on being a poor man of high birth, and yet who rises to eminence as a physician through displays of great generosity, honesty, and duty. It is Thorne's belief in his superior birth, rather than any necessary inherited tendency, that motivates his gentlemanly conduct. Similarly, Scatcherd's hereditary malady is closely linked to his own entrepeneurial manner of self-fashioning. Thus Trollope implies that inheritance can operate as a cushion against degeneration in a period of rapid social change; but it does so as a form of culture – as a structure of beliefs, values, and behaviours.

The problem of alcoholism is medicalized to some degree in the novel. Dr. Thorne is Scatcherd's physician. The physical effects of the toxin are delineated and inescapable. And yet the doctor is ultimately powerless to effect a cure without the patient's cooperation. His methods, consisting largely in severity and admonishment, are ultimately ineffectual either on the father or the son. Nor is the condition, following the pattern of a congenital disease, clearly separated from the social world it inhabits. As Trollope remarks, had Scatcherd or his son been born a duke or an earl, provision would have been made for such behaviour – it would have been redefined and accomodated within the culture of aristocracy: great bouts of drinking were appropriate at the parties and banquets of great houses, and within gentlemen's clubs. Within the highest circles, occassions for such social drinking could be multiplied almost indefinitely. But Scatcherd has no place in this level of society. He is an alcoholic, at least in part, because he is *not*, despite his social climb, a gentleman. Alcoholism is in fact a disease of the self-made man. Though a propensity in Scatcherd when still an apprentice mason, the condition is worsened during the course of his rise to eminence, with each bout of heavy drinking coinciding with the winning of a new government contract.

Trollope's account is borne out by medical literature of the period, which linked the onset of the condition to the pressure of work, noting its high concentration among the merchant, manufacturing, and professional classes. Once widely regarded as a problem of the lower orders, of the poor and destitute, medical theory now suggested that poverty was a result of habitual drinking, not a cause. Widely treated as a hereditary or congenital condition from the early Victorian period onwards, alcoholism remained the most controversial of 'diseases' because of its relationship to the will. Medical treatments and physiological research that identified alcohol with a material toxin nevertheless continued to regard alcoholic subjects as morally responsible for their illness or cure.[26] In an 1850 essay, the physiologist and medical author William Carpenter, characterized the disease as a premature exhaustion of nervous power, a weakening of the

[25] Trollope (1858).
[26] Bynum (1984); Huertas (1993); Levine (1978); Valverde (1997); and Warner (1994).

controlling power of the will, and an augmenting of the automatic or impulsive part of nature, giving a constitutional predominance to the lower feelings and passions. Habitual intemperance thus produced a progressive degradation of moral character by repeated excitement of the lower propensities and diminution of the will, leaving the person in "a state of complete [self-induced] slavery".[27]

Alcoholism was a preeminent case illustrating how habits acquired by individuals, and transmitted to their offspring could progress over generations into more degenerate conditions, such as criminality and madness.[28] In the second half of the century, a medical speciality grew up around the condition, closely allied with alienists and asylum culture, and more elaborate medical treatises were produced over the course of the second half-century. Perhaps the most exhaustive study, by the physician Norman Kerr, pronounced that no "natural law was more patent than [that] of alcoholic heredity". Men and women of the highest culture, the most irreproachable morals, and the strongest will, had come to know that they could "never dally with strong drink", and that doing so would in fact alter their character, and turn "perfect gentlemen" into criminals or lunatics. And yet, despite the inexorable material and hereditary basis of the disease, Kerr cast the alcoholic within the terms of the Smilesian self-made man, his cure an epic struggle of will against an oppressive disease: "The continuous and victorious struggle of such heroic souls with their hereditary enemy – an enemy the more powerful because ever leading its treacherous life within their breasts, presents to my mind such a glorious conflict, such an august spectacle, as should evoke the highest efforts of the painter and the sculptor."[29] Other treatises on alcoholism typically included chapters on the treatment of the disease through a strict moral regime, involving the modification of habits and conditions of life in order to reinvigorate the will.[30]

Such medical accounts of alcoholism bring to the surface the fundamental circularity of the Smilesian account of character: it was both a property (a "noble estate") and a product, a cause and an effect. The self-made man was formed through a process of struggle, and the overcoming of hardships; and yet one could only succeed amidst life's difficulties if one's heart was strong and upright, and one's spirit lively – in other words, unless one was already endowed with a noble character.

Conclusion: a new biometrics

Tying together theories of heredity, acquired character, and degeneration, the medical literature on alcoholism would figure prominently in early eugenic writings. Like the pedigrees of prize animals, noble families, and hereditary genius, eugenics-inspired studies of the hereditary effects of alcoholism were displayed as family trees (fig. 7). This chart of alcoholic degeneration was drawn at the beginning of the 20th century by the research committee of the Eugenics society. Significantly, the other modes of representation through which the characters of the great and good had been displayed – biography and portraiture – were now absent.

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27 Carpenter (1850), p. 47.
28 Huertas (1993); Lubinsky (1993).
29 Kerr (1894), pp. 17, 55.
30 Carpenter (1853); Clouston (1884); Maudsley (1874); Sankey (1884); Talbot (1898).

The families themselves were not sired by self-made men, merchants, or professionals, but by paupers. Like the social surveys and industrial novels of the 1840s, the problem of alcoholism at the end of the century, a period which saw the rise of socialism, of the labour movement, and the formation of a Labour Party, was again located in the lowest ranks of society.[31] And the pedigrees themselves, which had served partly as forms of self-fashioning for members of the gentry, professionals, and some artisans, were now generated in biometrics laboratories, asylums and work houses, with the aim of enlisting the State to direct the improvement of the race or nation. In order to determinde the laws of heredity, Galton urged, it was essential both to deal statistically with populations, and to regard human characters like the traits of a pea (figs. 8 and 9). These tables from Galton's *Natural Inheritance* show the distribution of eye colour across three generations, and the diameters of parent and filial seeds of the sweet pea.

This paring down of 'data', in favour of symbols denoting the presence or absence of a single characteristic, is of course a style of representation that would become fundamental in modern genetics and population biology. The hyperbolic claims of Victorian breeders to shape an animal's nature would make few genetic engineers of today blush, while physicians, alienists, and eugenicists like Galton, the new custodians of the poor, seemed to appreciate that good breeding depends very much on who descriminates between desirable and undesirable characters, and on what grounds.

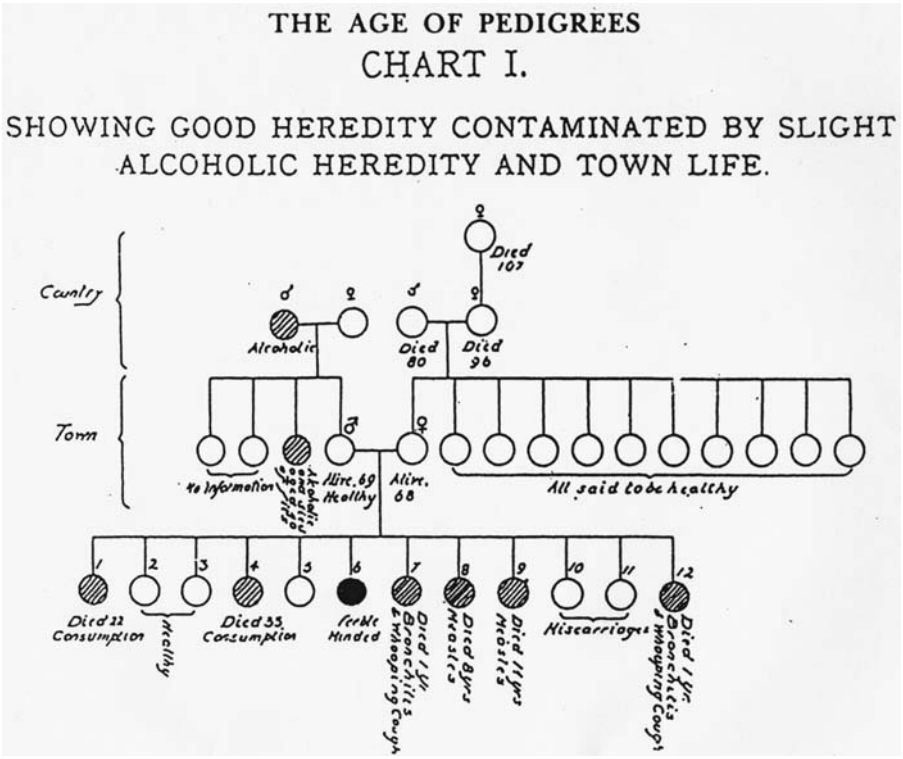

Fig. 7: Pedigree from Mazumar, *Eugenics, Human genetics and human failings: the Eugenics Society, its sources and its critics in Britain,* (1992), p. 81. The original source is A. F. Tredgold, *Mental Deficiency*, (London, 1908).

31 Hawley (1989); Mazumar (1992).

TABLE 20.

OBSERVED AND CALCULATED EYE-COLOURS IN 78 SEPARATE FAMILIES, EACH OF NOT LESS THAN SIX BROTHERS OR SISTERS.

Eye-colours of the						Total children.	Number of the light eye-coloured children.			
Parents.			Grandparents.				Observed.	Calculated.		
Light.	Hazel.	Dark.	Light.	Hazel.	Dark.			I.	II.	III.
2	...	...	4	...	...	6	6	5·3	5·3	5·6
2	...	...	4	...	...	6	6	5·3	5·3	5·6
2	...	...	4	...	...	6	6	5·3	5·3	5·6
2	...	...	4	...	...	6	5	5·3	5·3	5·6
2	...	...	4	...	...	7	7	6·2	6·2	6·6
2	...	...	4	...	...	7	7	6·2	6·2	6·6
2	...	...	4	...	...	7	7	6·2	6·2	6·6
2	...	...	4	...	...	7	7	6·2	6·2	6·6
2	...	...	4	...	...	7	7	6·2	6·2	6·6
2	...	...	4	...	...	8	8	7·0	7·1	7·5
2	...	...	4	...	...	8	8	7·0	7·1	7·5
2	...	...	4	...	...	8	8	7·0	7·1	7·5
2	...	...	4	...	...	8	8	7·0	7·1	7·5
2	...	...	4	...	...	8	7	7·0	7·1	7·5
2	...	...	4	...	...	8	7	7·0	7·1	7·5
2	...	...	4	...	...	12	12	10·6	10·7	11·3
2	...	...	3	1	...	7	7	6·2	5·8	6·4
2	...	...	3	1	...	10	4	8·8	8·3	9·1
2	...	...	3	1	...	12	12	10·6	10·0	10·9
2	...	...	3	...	1	7	6	6·2	5·1	6·0
2	...	...	3	...	1	8	8	7·0	5·8	6·9
2	...	...	3	...	1	9	9	7·9	6·6	7·7
2	...	...	3	...	1	9	9	7·9	6·6	7·7
2	...	...	3	...	1	9	7	7·9	6·6	7·7
2	...	...	3	...	1	10	10	8·8	7·3	8·6
2	...	...	2	2	...	7	7	6·2	5·4	6·2
2	...	...	2	2	...	10	9	8·8	7·7	8·8
2	...	...	2	1	1	6	6	5·3	4·0	5·0
2	...	...	2	1	1	10	10	8·8	6·7	8·3
...	2	...	2	1	1	7	4	6·2	4·7	4·6
...	2	...	2	...	2	8	5	5·4	4·6	4·8
...	...	2	3	...	1	6	2	1·7	4·4	2·2
...	...	2	2	...	2	9	1	2·5	5·1	2·5
...	...	2	1	...	3	6	1	2·7	2·5	1·2
...	...	2	1	...	3	11	3	3·1	4·5	2·2
...	...	2	1	1	2	6	...	1·7	3·0	1·5
...	...	2	1	1	2	7	4	2·0	3·6	1·8
1	1	...	3	1	...	6	6	4·7	5 0	4·9
1	1	...	3	1	...	7	6	5·5	5·7	5·7
1	1	...	3	1	...	8	6	6·2	6·6	6·6
1	1	...	3	1	...	9	7	7·0	7·5	7·4
1	1	...	3	1	...	11	10	8·6	9·1	9·2

Fig. 8: Table over eye-colour from Galton, *Hereditary genius, an enquiry into its laws and consequences,* (1892), p. 206.

TABLE 2.

PARENT SEEDS AND THEIR PRODUCE.

The proportionate number of sweet peas of different sizes, produced by parent seeds also of different sizes, are given below. The measurements are those of their mean diameters, in hundredths of an inch.

Diameter of Parent Seed.	Diameters of Filial Seeds.								Total.	Mean Diameter of Filial Seeds.	
	Under 15.	15–	16–	17–	18–	19–	20–	Above 21–		Observed	Smoothed
21	22	8	10	18	21	13	6	2	100	17·5	17·3
20	23	10	12	17	20	13	3	2	100	17·3	17·0
19	35	16	12	13	11	10	2	1	100	16·0	16 6
18	34	12	13	17	16	6	2	0	100	16·3	16·3
17	37	16	13	16	13	4	1	0	100	15·6	16·0
16	34	15	18	16	13	3	1	0	100	16·0	15·7
15	46	14	9	11	14	4	2	0	100	15·3	15·4

Fig. 9: Table over seed-size from Galton, *Hereditary genius, an enquiry into its laws and consequences,* (1892), p. 226.

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Kant on Heredity and Adaptation

Peter McLaughlin

The consideration of heredity in the latter eighteenth century seems to have focussed primarily on the transmission of defects, especially hereditary disease. Immanuel Kant, too, uses the concept "Vererbung" in this context: he analyses the discussion of the transmission of defects as carried on in the three "higher" university faculties (law, medicine, and theology) with their notions of *Erbschuld, Erbkrankheit* and *Erbsunde* (hereditary debt, hereditary disease, and original sin). But he also deals with the concept of "Vererbung" in biology, where it was used in an area with decidedly positive connotations: adaptation. My presentation will deal with the relation of heredity to adaptation in the biological writings of Kant. Individual adaptations – as opposed to the appropriateness of the species form for its place in nature – did not constitute a central theme in eighteenth century biological thought. And even for Lamarck they are of only secondary interest. Kant's position may be an important point of departure for the study of adaptive heredity and for the quite different relation of nineteenth century thought to the problem of adaptation.

Heredity and Adaptation

Neither the heredity nor the adaptation of individual traits was a primary concern of eighteenth century biology. The fit between organism and environment was most often conceptualized as an intrinsic aptitude (of the species form) for life accompanied by a contingent and superficial adaptation of individual characters to aspects of the environment. The realm of the regular, the lawlike, the vitally significant was the basic species form – and this at the time had little to do with heredity. It was unusual to speak of individual traits as adaptations – in fact the first use of the word "adaptation" in this sense mentioned by the *Oxford English Dictionary* is Darwin's *Origin of Species* (1859).

Seventeenth and eighteenth century science inherited from classical antiquity a threefold classification of kinds of inter-generational similarity. *Individual peculiarities*, *species form*, and *sex* mark off different ways in which progeny can be similar to parents. The distinction between the first two forms – the lawlike transmission of species form and the contingent disturbance or supplementation of the results of this transmission through the transmission of individual traits – structured early modern theorizing. For instance, the spermatic parts could form an outline that is then fleshed out by the sanguinous parts (Everard), or the inherited species soul could direct the pangenesis of the individual body (Gassendi), or the pangensis of the somewhat etherial species form by "spiritual" or "formal" atoms might govern the pangenesis of the body by the "material atoms" (Highmore), or the species form is encased in the germ while individual peculiarites are transmitted pangenetically with the first nourishment (Bourguet).[1] As a rule the two levels were kept distinct and the species form was what was scientifically interesting. Buffon's *moule interieur,* for instance, guaranteed the unity of the species and the boundary lines between different species

[1] Gassendi (1658); Highmore (1651); Bourguet (1729), pp. 154-156.

in spite of all the individual peculiarities that can arise and can be accumulated. Even Lamarck's later transformation theory still displays this distinction in the two basic processes of organic change: the progressive tendency to increased complexity of organic structure – so to speak a great escalator of being – and the collective adaptation of the individuals to changing environmental conditions that distorts the otherwise lawlike linear progression of forms. In all these theories the species form is fixed either by divine preformation or by natural law; and pangenesis provides a simple mechanism for the transmission of acquired characters: either directly to the newly formed germ or indirectly to a preformed germ's first nourishment. But the individual peculiarities that may genuinely be said to be inherited are just that – individual and peculiar; they are important not for theoretical science but for the application to individual cases in medicine and agriculture. The species characters, on the other hand, were not in any sense products of a contingent process of heredity.

The individual hereditary traits were also normally not viewed as being particularly beneficial to their bearers. The best studied cases in the species that interests us most were the transmission of sixth digits and of hereditary diseases. The fitness of an organism for its environment, adaptation, purposiveness, etc. were properties of the species form. And here too there was a certain tension – at least in the materialistic theories that dominated the second half of the eighteenth century. Whereas deistic preformation theories could imagine that there were innumerable possible organic forms that might have been actualized and that God elected only some of these (presumably the better ones), the materialistic theories of Buffon, Blumenbach and others were committed to the natural necessity of all actually existing species. Their emphasis was on *viability* not *adaptedness*, on living, not on living well. According to Buffon, every kind of organism that *can* exist does exist. The sloth, for instance, is a border-line case; it has just barely everything that it needs for life, but if it had one more defect, it would become extinct.[2] In such a scheme the nature of matter determines species form and its continuity over time: if a catastrophe were to occur and wipe out some or all species, they would return again by spontaneous generation as soon as the environment returned to normal. There is no serious role for heredity or adaptation in such a scheme.

We might want to look for the beginnings of adaptationism in physico-theology; the purported influence of Paley's "argument from design" on Darwin's theorizing is widely cited. And it is true that this argument did increasingly put single adaptive traits at the focus of attention – though there were limits. While the detailed fit of particular traits to aspects of the environment might evoke amazement at the skill of a technician, it was the greater systems that inspired awe at the grandeur of the Creator. Although there were originally two basically different versions of the design argument – one involving the "design" or plan of the world system and the other involving the "designs" or intentions of the Creator for particular organs –, it was the *final cause* of particular traits not the *formal cause* of an orderly world system that to some extent survived Hume's critique of the design argument.[3] But here, too, it is species characters that give occasion to speculation

[2] "We formerly remarked that every thing that possibly could be, really did exist; of which the sloths are a striking example. They constitute the last term of existence in the order of animals endowed with flesh and blood. One other defect added to the number would have totally prevented their existence" (Buffon (1765), p. 40. ["The Sloth," Smellie translation, 9: pp. 7-8]).

[3] See Hume (1779), pt. 2 and 3.

about the intentions of the Creator. Even physico-theologians had difficulty with individual peculiarities. Albrecht von Haller at one point in his preface to the German translation of Buffon's *Histoire naturelle* has God's general plan produce the species, while his special providence produces the individual details and differences. At other times (in the same text), however, he leaves the details to chance and only the species form to God. What remains constant in Haller's exposition is the distinction between the two levels of transmission.[4] There wasn't much theological milage to be gotten out of the individual peculiarities that could be inherited. Since the physico-theologically-minded tended to be preformationists even well into the nineteenth century, and since preformation excludes the species form from the domain of the hereditary, we should not expect much in the way of inheritance of adaptations from this field.

"Vererbung"

The concept of heredity seems to have entered German science in the same breath as the concept of race – in the writings of Immanuel Kant. Kant lectured on physical geography once every year for half his life, and in these lectures the concept of race played an important role. In 1775 – announcing what seems to have been his *twentieth* run through the material – he published a short broschure on human races and their origin: *On the different human races.*[5] Ten years later he published a paper in a Berliner journal trying to defend and clarify his concept of a human race "Determination of the concept of a race of humans".[6] When this paper occasioned severe criticisms by Georg Forster, Kant returned again to the subject in a third essay entitled "On the Use of Teleological Principles in Philosophy" published in early 1788 in the journal *Teutscher Merkur*. In this paper Kant uses the German term *vererben* for the first time (in the verb form).[7] There is some reason to believe that his use of the term is prototypical – at least I know of no previous biological uses outside of medecine. In the *Critique of Judgment* of 1790, which contains his philosophy of biology, Kant says little or nothing on the subject of either race or heredity. Finally in a slightly later work entitled *Religion within the Bounds of Mere Reason* (1793) Kant also uses the concept *Vererbung* (in the noun form) in a context in which it was already somewhat familiar. Much of the discourse on heredity in latter eighteenth century France was focussed primarily on the transmission of defects, especially hereditary disease. In this work on religion, in the course of an analysis of the origin of moral evil and its transmission, Kant discusses the explanations of this phenomenon offered by the three so-called "higher" faculties of the university (law, medicine, and theology). Each of these faculties, he tells us, has developed a notion of the inheritance of defects: the concepts of *Erbschuld, Erbkrankheit,* and *Erbsunde* (hereditary debt, hereditary disease, and original sin).[8] But the question of biological mechanisms of heredity is

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4 Haller (1752), vol. 2: "If nature were not the hand of creative wisdom, then there would be differences just as much in the basic constitution as in the small and numerous parts of the structure, but nonetheless the latter occurs constantly and the former never at all."

5 Kant ([1775] 1964), 6: pp. 9-30. This was Kant's only publication during his so-called "silent decade" preceding the *Critique of Pure Reason.* It was revised and republished in *Der Philosoph für die Welt* (ed. by J.J. Engel) Leipzig 1777.

6 Kant ([1785] 1964), 6: pp. 63-82. Originally published as "Bestimmung des Begriffs einer Menschenrasse." (*Berliner Monatsschrift*, Nov. 1785).

7 The term *Vererbung* also occurs in the *Physical Geography* published in 1801 based on Kant's lectures.

8 Kant ([1793] 1964), 4: p. 689.

only obliquely raised in long and speculative footnotes on how various theories of generation might handle the inheritance of original sin and how they might explain the lack of transmission of this defect to Jesus. There also exist some elaborate manuscript drafts of these passages where Kant weighs the merits of epigenesis and the ovist and spermist forms of preexistence on this question; but I am not sure how seriously all this should be taken – it all seems to me to be somewhat facetious.[9] What is important is that with Kant the notion of the hereditary moves from the higher or applied faculties to the lower, philosophical or theoretical faculty and that it is not confined to or even oriented towards *defects*.

The German term for heredity (or inheritance), as I have mentioned, is *Vererbung*. *Vererbung* is slightly different in meaning than the English "inheritance" inasmuch as it takes the perspective of the donor not the recipient: it should actually be rendered as "bequeathment" – but this is seldom done. In the mid-eighteenth century the concept *Vererbung* was a somewhat complicated notion in German property law. An heir to property had a calendar year in which to accept or to reject the inheritance definitively. Problems could arise if the prospective heir were to die during this grace period. In such cases the tentatively inherited property was passed on to his or her heirs. It was specifically this procedure that was called *Vererbung*. Thus, use of the legal term *Vererbung* was restricted to situations in which one person received from another something that person had received by inheritance.[10] There can, for instance, be no *Vererbung erworbener Eigentümer*, no inheritance of acquired properties because only property acquired by birth falls under the concept as defined. Now this is precisely the meaning that Kant wanted for the biological concept he was groping for in the race papers.[11]

Far more interesting than the religious speculations using the term is Kants use of the concept of heredity within the philosophical faculty – in biology –, where he uses it in an area with decidedly positive connotations, in connection with adaptation, and applies it to traits that are neither species typical nor merely *individual* peculiarities. Kant's biological writings bring together heredity and adaptation. He develops his ideas on heredity and adaptation on the example of *human races* and all the context of anthropological discourse is relevant to an historical

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9 Kant (1964), 4: p. 736: "For, according to the hypothesis of epigenesis, the mother, who is descended from her parents through *natural* generation, would still be tainted with this moral blemish, and would bequeath [*vererben*] it to her child, at least half of it, even in case of a supernatural generation. Consequently, in order for this not to be the case, the system of preexistence of the germs in the parents must be assumed, but not the [system] of development on the female side as well (because through this the above consequence is not avoided) but only on the male side (not the [system] of *ova* but of *spermatic animalcules*); which side is omitted in case of a supernatural pregnancy, and thus this way of representing [generation] can be defended theoretically appropriate to that idea [i.e., virgin birth]." See also the drafts in AA 23, pp. 105-108.

10 See Zedler's *Lexikon* (1746): "*Vererbung* […] is when an heir, before he accepts or rejects the inheritance accrued to him, dies and that inheritance which he neither really accepted nor rejected is transmitted and further bequeathed […] to his heirs. […] And this occurs first of all when someone receives an inheritance from his parents or from elsewhere […] and dies within the year's period after acquiring notice of the inheritance […] in such a case this kind of tranmission is called in Latin *transmissio ex jure deliberandi*."

11 As we know, the ploy didn't quite work. It may be a contradiction in terms to speak of the inheritance of acquired properties in an eighteenth century German courtroom, but in the outside world it is hard to impose the meaning constraints of technical terms out of their technical context. Even Kant himself relented: in his own last will and testament he speaks of "bequeathing his household goods" (*von der Vererbung meines übrigen Hausgerätes*) few of which, I presume, were acquired by inheritance.

explanation of Kant's theorizing here. But I shall be dealing only with one small aspect of his racial thought, an aspect that applies just as well to dogs and to pigs. Races of dogs for Buffon, races of pigs for Blumenbach and races of men for Kant were also occasions to discuss the question of *subspecific* variations that breed true. I shall stick to the more narrow biological context.

Hereditary Adaptations

In the three papers on race Kant is primarily concerned with introducing and justifying a distinction between various kinds of *subspecific* classes: in particular between races and varieties. The theoretical background of the distinction is "Buffon's rule" that animals that can produce fertile progeny together belong to the same species. The ostensible empirical phenomenon that Kant takes as the point of departure for his reflections (besides massive amounts af anecdotal travel literature) is the experience of the Portuguese colonists in Africa and of black Africans transported to Europe. Conclusions are drawn about other races as well, but the central question is about blacks and whites.

Theoretical background – From Buffon's breeding criterion and the ability of all humans to interbreed Kant draws the conclusion that all humans whatever their morphological differences should be viewed as descendants of one common stock and thus not only to belong to the same species but to constitute one family. Kant wants to distinguish between two kinds of disciplines: a purely descriptive and classificatory discipline – which he calls *Naturbeschreibung* – and a causal explanatory discipline – which he calls *Naturgeschichte*. (Linnaeus and Buffon provide the prototypes of these two disciplines.) The first gives us a school system for our memory, the second a physical system for our understanding. But Kant's causal, physical natural history also has something contingently historical about it. The classificatory traits he is interested in are not explained only by natural law but also by the contingent family history of man.

Empirical Phenomenon: skin color – The direct effect of the climate in Africa according to Kant is to darken the skin, but the Portuguese who had been living in tropical Africa for many generations were just as white at birth as their countrymen in Lisbon. And the blacks transported to Europe did not seem to be turning white – there was much literature from Paris about blacks and one of the Hessian Dukes had his own little imported colony of blacks established near Kassel. Furthermore, it is assumed that dark skin is *beneficial* in the African climate and white skin in the European, that is, that skin pigmentation is adaptive. The basic questions that arose were: Why don't the Europeans in Africa turn black? Why don't the Africans in Europe turn white (again)? And how did the blacks get black in the first place? The easy way out of course would be just to deny the phenomenon and assume that the timespan needed to adapt skin color is very very great. But Kant takes the occasion to ask a principled question: How can something purposive like a *new* adaptive trait arise, become heritable, and become heritable in such a way that it cannot be removed?

Kants first step is to distinguish at least four kinds of subspecific taxa, which can be arranged on a sort of scale according to how invariably (*unausbleiblich* is Kant's term) the identifying characters are transmitted:

	Strain (*Schlag*)	Variety (*Varietät*)	Sport (*Spielart*)	Race (*Rasse*)	
Low					**High**
	Variable, dependent on Environment	Generally transmitted	Invariably transmitted in in-crosses	Invariably transmitted even in out-crosses	

The most important difference is between races and the other categories: varieties, sports, and strains, in as much as this difference also correlates more or less with that between natural history and natural description. The possession of a character defines a *race* only if it is *invariably* bequeathed to the next generation even when the organisms are transplanted to a new environment and even when they are crossed with individuals from another race. In the latter case all progeny are halfbreed (Kant's term is *halbschlächtig*); that is they, express a middle position between the two racial characters. In *sports* some traits, like blond hair and blue eyes, are passed on invariably and independent of change in environment, but they don't produce halfbreed forms when crossed with other (say brown eyed) types. And in *varieties* the characters are generally but not always passed on in in-crosses; not all children of brown eyed pairs have brown eyes. In what Kant calls a *strain* some traits may be dependably passed on and even invariably appear when their possessors are crossed with similar individuals and always produce halfbreed traits when the bearers are crossed with other forms, but they may just disappear if the organisms are transferred to a different environment.

Kant then tells a speculative story about how the original (and presumably white) humans spread out from their original habitat to all parts of the globe. On the way they adapted to the local climate. The problem is how to explain this adaptation in such a way that it is compatible with his other ideas about the explanation of organisms. Kant doubts that the laws of mechanics can explain the first origin of a purposive organic form – though they might be able to explain its replication – and thus he is committed to some kind of original organization in animals. If the environment could directly change organisms *to their advantage* in such a way that the changes could be passed on, preserving or even improving the purposivensss of their structure, there is no reason why it should not in time also be able to change the organism to any arbitrary extent (even beyond the species boundary) or, for that matter, why it could not have produced them in the first place. There would be no limit to the bizarre forms that creatures might take and it might become impossible to reconstruct the original species form. But Kant claims that it is impossible to imagine how environmental conditions could be able to *cause* beneficial changes that can be passed on. Thus, he insists that all beneficial and hereditary traits must have been included in the original purposive organization. All adaptations to any particular environment must have been part of the original species equipment; they were just not expressed – or, in Kant's terminology, they had not yet been "unfolded". Kant asserts that the lineage must have contained "germs" or "natural dispositions" for any adaptive trait that arises and then breeds true. The *germs* unfold into particular organs or traits; the natural *dispositions* are responsible for new relations among given parts. Once brought to expression they are permanent and thus other alternative possibilities are

excluded for the future: the unfolding germs for black skin, for instance, close off the developmental possibilities for other colors. But only beneficial traits already contained potentially in the species form will breed true. The environmental, climatic circumstances cannot produce the new traits they can only trigger their release. Everything passed on invariably in generation is itself inherited. In somewhat anachronistic terms, every hereditary adaptation is a preadaptation. As Kant puts it in the first race paper:

> Accident or universal mechanical laws cannot produce such fitnesses [*Zusammenpassungen*]. Therefore we must consider such occasional unfoldings [*Auswickelungen*] as *preformed*. However even where nothing purposive is displayed, the mere capacity to propagate its particular assumed character is itself proof enough that a special germ or natural disposition was to be found in the organic creature. For external things can be occasional causes but not productive causes of what necessarily is propagated and breeds true [*anerbet und nachartet*] Just as little as accident or physical-mechanical causes can produce an organic body can they add something to its generative force, that is, effect something which propagates itself, if it is a particular shape or relation of the parts.[12]

The adaptive traits that Kant is interested in here do not occur in every current individual of the species nor did they occur at all in the original ancestral form: they are historically new, but now permanent. But they are also not mere individual peculiarities. These are not the adaptations of one Immanuel Kant to the cold winter in Königberg of 1774. It would have been fairly implausible to assume millions upon millions of little germs for this or that possibly useful adaptation. The skin is seen to be the major adaptive interface between organism and environment and it is skin color and texture that make up the primary racial character. As it turns out Kant assumes only *four* racially relevant sets of germs in humans. He maintains that the human species possessed germs and dispositions for traits preadapted to four basic climates. Where Linnaeus explains his four races by means of the distibution of four galenic humors, so that the dominance of sanguinous or phlegmatic aspects might even be taken causally to explain the racial differences between whites and blacks, Kant on the other hand goes back even farther to the presocratic doctrine of elements and the qualities derived from their combinations – cold and wet, hot and wet, hot and dry, cold and dry – and uses them as part of a teleological explanation of races. Europe is of course cold and wet; Africa hot and wet; and the other races are somehow assigned to the other two climates. (And just exactly what the two non-white, non-black races are changes over time). As humans radiated out of the Garden of Eden – or whatever it was that Kant thought was located between the 31st the 32nd parallels in the Old World – the germs and dispositions appropriate to the new climate they encountered were unfolded and their skins assume the appropriate color and structure. Kant also stipulates that this is an historically irreversible choice. The chosen germs shut off the others – that is why the blacks cannot become white again. The process of adaptation is irreversible even if the end product, due for instance to later transplantation, should turn out to be detrimental.

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[12] Kant ([1775] 1964), 6: p. 18.

To recapitulate briefly: the relevant assertions are:

1. that all humans belong to one species,
2. that racial differences are primarily due to adaptation to different climates,
3. that any trait that is dependably passed on in this way is presumed to be adaptive, and
4. that any trait that arises at some point in time and afterwards breeds true must have been contained as a potency in the original equipment of the species.

In trying to deal with these questions Kant introduces a complicated and basically untranslatable jungle of special terms to distinguish various aspects, permutations and combinations of hereditary phenomena. (And thus it is not surprising that the term that later came to be used for heredity is among the crowd.) Here is a list of the major entries:

erblich – hereditary (traits are hereditary)

erben – to inherit (an organism inherits a trait)

ererben – to inherit (an organism inherits a trait)

anerben (intrans) – to be propagated (a trait is propagated)

sich vererben – to pass on (a trait passes itself on)

vererben – to pass on (an organism passes on a trait)

forterben – to continue (a trait is continued)

Abartung / abarten– to degenerate (deviate from the original form)

Ausartung / ausarten – to deviate beyond the possibility of reversal (literally to speciate, but used here for change within the species establishing a race)[13]

Nachartung / nacharten (trans.)– to take after (F_2 trait takes after an F_1 trait)

Nachartung / nacharten (intrans.)– to continue

Anartung / anarten (intrans) – to be propagated (said of a trait)

Anartung / anarten (with dat. object or with *an* + dat./acc) – to adapt to (said of an orgnism)

eingeartet – acclimatized (adapted to an environment)

What is important in this terminological morass is that Kant is systematically groping for conceptual tools to deal with phenomena that we conceptualize using the notions of heredity and adaptation. For our purposes the following results of Kant's speculations seem to be historically relevant:

1. The characters focussed on are not species characters determined by divine preformation or physical natural law. The germs and dispositions still fit the deterministic eighteenth century model of pre-given potentialities, but at least the fact of their expression as traits is a product of contingent history.
2. Some of the contingent traits that an organism possesses solely because its parents possessed them are not just accidental modifications but rather choices among species-given possibilities and thus are perhaps susceptible to rules and may be explainable by the same kinds of mechanisms as species-wide traits.
3. The realm of the hereditary is not confined to defects or mere peculiarities but also includes beneficial traits – and, as pursued in the "philosophical" faculty, it includes only beneficial traits.

[13] Note that this does not refer to the sterility of hybrids but only to the fixation of the racial character. Kant at one point calls real speciation "wahre Ausartung"; see Kant, ([1775] 1964), 6: p. 19.

4. Hereditary characters of the kind discussed must themselves be inherited. Genuinely acquired characters are not hereditary.

It is true that for Kant historical contingency remains within the species lineage, but Kantian races have all the characteristics of traditional species except the sterility of hybrids. They provide examples of lawlike purposiveness conceptualized as improvements on a given species form relative to contingent actualizations of basic climatic possibilities. The racial characters are neither completely determined by species membership nor are they merely arbitrary or accidental. They present an opportunity or occasion for the application of available concepts to situations for which they were not originally devised or intended and thus may force some change or development in these concepts.

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Inheritance of Acquired Characters in Lamarck's and Geoffroy Saint-Hilaire's Zoology

Wolfgang Lefèvre

INTRODUCTION

The question of heredity became only late a scientific topic that was systematically pursued by sustained research – probably not before the turn of the nineteenth century, that is, not before the discovery of Gregor Mendel's (1822-84) discoveries. Up to this point of time, heredity was only occasionally a subject matter of scientific considerations. Moreover, it was almost never such a subject in its own right but only as an aspect of other issues of interest such as breeding, race, actually or allegedly hereditary diseases, investigations into hybridisation or generation and development.[1] Thus, the issue of heredity often was not more than a facet of conceptions about races, diseases or generation, and, accordingly, inseparable from those concepts. Our recognition of concepts of heredity in eighteenth and nineteenth century theories, thus, may be slightly anachronistic since marked-out concepts of heredity came into being only later. Because of this danger of an anachronistic approach, it seems well-advised to state first what is understood by heredity in this paper.

In the following, I take such concepts to be concepts of heredity that assume that traits of living beings are dependent on traits of their parents or even farther ancestors. Such conceptions need not comprise explanations of these dependencies. On the contrary, I just would like to distinguish heredity proper from all past and present physiological theories of generation, genetics, and development that provide an account of the mechanism by which the transmission of traits is brought about. True, this separation of heredity proper from explanatory theories and, consequently, its confinement to patterns of trait occurrences among living beings of subsequent generations is conceivable only after Mendel. It is no actors' category with respect to life scientists of the eighteenth and nineteenth century. Rather, it is an analytical category of the historian that allows both, the comparison of otherwise incomparable theories, which imply assumptions about heredity, and their distinction from ideas that only seemingly do so.

The topic of this paper is heredity in the zoological theories of Jean Baptiste Lamarck (1744-1829) and Etienne Geoffroy Saint-Hilaire (1772-1844). These theories, remarkable in so many respects, deserve attention not at least as the first serious attempts to explicate and explain adaptation to changing environmental conditions. Today, no such theory of adaptation is conceivable without heredity concepts in the tradition of population genetics. The more remarkable is the casual manner in which Lamarck and Geoffroy touched the question of heredity. It is for this casualness, that I regard their theories a noteworthy example of the manner in which heredity was treated in scientific discourses before the end of the nineteenth century. With respect to a history of heredity, these theories deserve attention not so much for what they state about the

[1] Bowler (1989), p. 23.

inheritance of acquired characters than as symptoms of the inferior significance of heredity concepts in biological theories of this age.

In my view, this inferior, casual, and secondary status in and for biological theories constitutes a characteristic feature of heredity concepts before the discovery of Mendel that deserves to be explicitly addressed by a workshop dedicated to this period. For this reason, I will not immediately start with Lamarck and Geoffroy. Rather, I will first touch briefly upon some of the other contexts mentioned above – breeding, the problem of race, theories of generation and development – in which the question of heredity became a topic of scientific inquiry although only as a secondary aspect of the main conceptions in question. The purpose of these preliminary excurses is the indication of a broader frame for my argument regarding Lamarck and Geoffroy.

1. Occasions for Reflections on Heredity

Since time immemorial, man, himself an animal who propagates his genus through sexual reproduction, experienced phenomena of heredity. However, the experiences made with the own biological procreation did not yield a clear pattern. This is not at all surprising in view of the complexity of the generation process. True, the offspring very often resembles its parents, but equally often it does not. There is something like family resemblance and even tribe resemblance, but there are also a lot of individuals who do not fit this pattern. Moreover, regarding the plants and animals men are familiar with, it seems safe to claim as a rule that the progeny will always belong to the species of the parents. But what about malformations, and what about hybrids? Do they not violate this rule? Obviously, every-day experiences are not sufficient for singling out stable patterns of heredity, and, one should add, every-day practice is probably not in need of a more distinct picture of this realm of phenomena.

1.1 Breeding

One would expect that the professional practice of breeders[2] must have brought about a base of experiences broad and stable enough for correcting wrong assumptions of the laymen as well as for establishing certain rules of heredity – and perhaps even a stock of experiences on which scientific investigations into heredity could start and rest. In a way, this was indeed the case. Mendel's research as well as that of his re-discoverers around 1900, that is, the very beginnings of the modern biological science of heredity, was imbedded in the context of the breeding practice of this age. Although this relation between professional breeding and the beginnings of modern genetics seems quite natural, it deserves doubtless attention for many reasons and provokes many questions.[3]

With respect to the topic of my talk, it is of special interest to ask whether heredity did become a scientific topic in its own right just because scientists became curious of heredity patterns when the practice of professional breeders provided essential preconditions for a promising research. Was this scientific interest not also, and perhaps even primarily, structured and driven by open questions in other fields of biological research – for instance, by the question whether or not Charles Darwin's (1809-82) assumption of minimal variations is viable as part of his account of

2 In this paper, the term breeding is used for both, breeding of animal stocks and growing of plants.

the process of speciation?[4] To put it more general: were certain theoretical constellations in late nineteenth century biology responsible for the commencement of not only periodical but continuous and sustained research activities on heredity? Or, to put the question more speculative: Would the practice of nineteenth century breeders have caused scientists to study heredity as a subject matter in its own right if these scientists had not had their own theoretical reasons for an exploration of this question?

1.2 Human Races

Whatever the answer to these questions may be, the professional practice of breeding was in any case more than just an occasion for addressing scientifically some related issues of heredity. Heredity constituted the very centre of this practice, which provided additional means and ways for its investigation. This does not hold for the debates on races in the context of anthropology. These debates were certainly only an occasion for contemplations on patterns of heredity; and perhaps, one can add, an unfit one. Modern anthropology originated in the colonial conquest and domination of large parts of Africa, America, and Asia by European nations and was therefore coloured by ideological, political, economic, and moral discourses from its beginnings. Even the question whether and in which manner issues of heredity became prominent in this context

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[3] Why did the experiences of professional breeders become subject of scientific consideration only that late? Where those experiences not ripe for scientific scrutiny before the second half of the nineteenth century? If so, what is so special with the breeding practice of the nineteenth century in contrast with the more than ten thousand years of breeding that preceded it? Or, to face an alternative possibility, were perhaps the life sciences not ripe for, or not interested in, the heredity topic before the second half of the nineteenth century? If so, why exactly did breeding attract the attention of scientists in the end, and, more important, what did enable them to tackle the subject successfully? Recently, in a "heredity reading group" here at the Max Planck Institute for the History of Science, we studied a series of articles about sheep breeding written, in the 1830s, by a certain J.K. Nestler, an Austrian professor for agriculture and farming, and published in the journal of the Moravian-Silesian society for the advancement of agriculture. (*Mitteilungen der k. k. Mährisch-Schlesischen Gesellschaft zur Beförderung des Ackerbaues, der Natur- und Landeskunde in Brno.* Issues 34ff.) Apart from all their details and right or doubtful observations, what these articles conveyed impressively was a picture of the high complexity of the breeding business. Obviously, breeding is more than just organizing the mating of individuals with desired properties. Thousands of other things were regarded of equal significance by the professionals – the right season for mating, the age of the two mates, whether the male should be younger, older or of the same age as the female, the question of the best food, influence of the environment when a stock was moved into a new locality, the problems of selection in view of the principal fact that the breeding goal almost never consists in the preservation, transmission and enhancement of just one single trait but in that of a complex of traits which could only be approached by way of compromises, etc., etc. Leafing through these articles, it became immediately clear that stable patterns of heredity could not be established without a radical reduction of this complexity, and that detachment from the immediate practical goals of the breeding business was an essential precondition of such a reduction. This leads to further questions. How exactly did breeding practice and science interact and contribute to the emergence of modern genetics? Certainly, what regards the distance to immediate practical goals needed for the reduction of complexity, breeding experiments like those of Mendel show detachment from practical goals of growers. The colours of pea blossoms were without any practical value. But does this mean that we must credit the scientific side alone with the reduction of complexity necessary for the establishment of heredity patterns? Did the breeding practice contribute nothing to it? What about the keeping of pedigrees by the breeders? Is a scientific examination and contemplation of breeders' experiences conceivable without such pedigrees? And what about the scientific breeding experiments? Were they not based on techniques of professional breeders? For an expert's view of these issues, see the paper of Roger J. Wood in this volume.

depended to a large extent on ideological orientations. For those who regarded the various aboriginals of the colonised countries different species rather than varieties of the human species, heredity questions came up only because of the so-called half-bloods which raised the special question of hybridisation if the contended species difference was taken consequently. For those, on the other hand, which believed in the one human species and, additionally, that the variety of human races was brought about by a historical process of divergent developments of the descendents of a single primal tribe, this variety could, indeed, provoke speculations on issues of heredity.

The anthropological context appears thus as an ambiguous cause and rather sterile soil for raising and pursuing scientifically questions of heredity. It is probably not by chance that no continuous exploration of these questions flourished on this background, and also not that the trend of biological anthropology drifted in the direction of a science of measurement that engendered eventually the "mismeasured man" – to allude to a famous book of the late Stephen J. Gould. I could, therefore, leave anthropology as an occasion for studies on heredity at this point. But I want to mention additionally at least one example of an anthropologically informed speculation on heredity.

My example is the speculations on heredity comprised in Immanuel Kant's (1724-1804) anthropology. Since Peter McLaughlin's paper explores these speculations, I can confine myself to one single aspect, which is of interest for my story on heredity in Lamarck's and Geoffroy's zoology. Kant considered the human races as varieties of a single human species.[5] For him, these races descended from one single primal tribe and developed their distinctive features under the impact of the different climates of the continents in which they finally, at the end of a long period of migration, dwelled. But – and this is the interesting point – Kant did not assume that men acquired the genetic dispositions – *natürliche Anlagen* (natural dispositions) in his words[6] – for these distinctive features under the influence of those climates. Rather, he supposed that all men possessed originally the dispositions for all of these different features. The role of the climate consisted in stirring the actual development of the best fitting features. With other words, Kant put forward a speculation on adaptation to changing environmental conditions that did not include a change in the stock of hereditary dispositions. He assumed, however, that the actual development of features under given climatic conditions leads to an irreversible fixation of this developmental choice, which is passed on to the progeny. – I will briefly come back to this sensible speculation when discussing certain assertions of Geoffroy as well as Lamarck.

1.3 Generation and Development

The breeding practice and the debates on human races stimulated from outside the life sciences to reflections on questions of heredity. However, in eighteenth and nineteenth century life sciences, issues of heredity were also raised from within, namely in different, although closely connected, fields of theoretical and experimental investigations. There was a broad spectrum of theoretical

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4 For the spectrum of interests supposed by historians as having driven Mendel, see Sapp (1990).

5 For Kant's notion of race and its distinction from that of strain (*Schlag*), variety (*Varietät*), and sport (*Spielart*), see the paper of Peter McLaughlin.

6 Kant ([1775] 1912), p. 434.

issues, which touched more or less explicitly questions of heredity. Just to remind of three famous debates in the seventeenth and eighteenth century life sciences:

- The debate about symmetric or asymmetric roles of the two sexes in generation, that is, the question of whether the germ is provided by both sexes or only by one of the two – either by the male whereas the egg serves only as a soil for its development or, alternatively, by the female whereas the semen plays only the role of a stirring principle;
- The debate whether or not plants engender their progeny sexually;
- The debate on development, that is, whether it is a process of growing, in the sense of blowing-up, of an already finally structured miniature organism (doctrine of preformation) or rather a modelling process by which an initially almost unstructured germ develops step by step the complex structure of the organism (doctrine of epigenesis).

It goes without saying, that each of these debated views had crucial consequences for the understanding of heredity regardless of whether or not their champions dealt explicitly with heredity issues. But it is also clear that basic preconditions of the very possibility of heredity were at stake in these debates, with the consequence that details like differential reproduction were almost eclipsed. It comes therefore without surprise that explicit discussions on heredity came only rarely down to details and did almost never go beyond the limits of ad-hoc arguments.

The debate between preformationists and epigenesists deserves particular attention in the context of this talk because both, the preformist and the epigenetic view,[7] when pushed to their extremes, could lead to the denial of the inheritability of individual traits or even of the very possibility of inheritance as such. According to the ontogenesis conception of the epigenesist Caspar Friedrich Wolff (1738-94), for instance, almost unstructured organic matter provided by the parental organism develops step by step into the organism's final structure by virtue of an innate *vis essentialis* (essential force). What the parents bequeath to their progeny is the initial organic matter with its essential force, which brings about the species-specific organism under suitable environmental conditions. The likeness between parents and offspring rests on the uniformity of this initial matter's development under comparable environmental conditions. Being equally the effect of equal causes rather than cause and effect of each other, the traits of individuals of subsequent generations are not linked by a relation of dependency.[8] On the side of the preformationists, the conception of hereditary traits was entirely erased if the preformist view of the germ was combined with the assumption of its pre-existence, that is, with the assumption that the germs of the entire progeny of a species were created in the beginning along with its primal couple, encased in each other like Russian dolls. In the framework of this understanding of generation and development, no place was reserved for the issue of heredity, not even for the inheritance of the species-specific characters. This issue simply did not exist. Apart from being designed by the same divine creator, there were no relations between the characters of subsequent generations. With other words, we come here across a biological debate that implied the possibility to question heredity as a meaningful concept and, thus, investigations of patterns of heredity as a reasonable enterprise.[9]

Ironically, the preformist view of generation and development stimulated interest in heredity

[7] Peter McLaughlin's paper for the 1st workshop on *A Cultural History of Heredity* discussed the bearing of the two views for the understanding of heredity.

[8] Bowler (1989), p. 40f.; Stubbe (1965), pp. 73ff.

[9] This seems noteworthy because, in my view, theories that negate explicitly or implicitly heredity deserve no less attention in a history of heredity concepts than theories that shape the meaning of such concepts.

issues just because of its negation of heredity – namely on the side of epigenesists who combined their view of the developmental process with pangenetic accounts of the formation of the germ. Actually or allegedly obvious facts of heredity were picked up as arguments against the extreme preformist view.[10] In particular, hybrids and descendents of parents of different races could be adduced as striking examples of mixed traits that seemed incompatible with the assumption of pre-existent preformed germs.[11] However, this critique resulted only in ad-hoc theories on heredity and not in detailed investigations. It is a telling fact in this respect that, in the course of the argument between adherents and opponents of the preformist doctrine, experiments for confirming or refuting certain claims about heredity patterns were proposed but obviously never carried out.[12] I will come back to these doctrines in connection with Lamarck.

2. Heredity in Lamarck's and Geoffroy Saint-Hilaire's Zoology

The arguments put forward so far pursued the purpose to mark a distinctive feature of scientific occupations with heredity issues before the end of the nineteenth century. This feature could be described negatively by stressing the lack of continuity of these studies, their ad-hoc character, or by pointing to the fact that heredity became no scientific subject in its own right. When heredity attracted the attention of life scientists in this age, it did so always as a concomitant of inquiries on issues of practical (e.g., breeding and allegedly hereditary diseases) or social-political concern (e.g., the question of human races) or of theoretical problems with implications for heredity (e.g., generation and development). These inquiries and their different backgrounds shaped of course the understanding of heredity as well as the selection of the aspects that were subjected to scrutiny. Being not a subject of scientific investigations in its own right, it depended entirely on certain constellations of practical, ideological, and theoretical views and interests whether or not heredity was dealt with at all, and, if dealt with, which of its aspects were investigated and by which means.

This feature is essential for my story. Lamarck's and Geoffroy's theories of adaptation to changing environmental conditions formed such a constellation that opened a window for the heredity question. These theories integrated results from different fields of research – biogeography, geology, palaeontology, teratology, and physiology – and constituted thus themselves constellations of theories. However, this case confirms not only once more that the understanding and treatment of heredity depended on such a constellation. It proves furthermore that the question of heredity could even be part and parcel of fiercely debated theoretical positions without getting investigated in more detail by any of the opposed parties.

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[10] On their part, preformationists tried to avoid the extreme consequences of their view and to allow for the inheritance of individual traits by assuming a transmission of characters through the nutrition of the germ – by the seminal fluid of the father as well as the mother's womb. Charles Bonnet (1720-93), for instance, developed ideas that resulted even in a combination of preformism and pangenesis. (Bowler, p. 30f.; Zirkle, p. 143) See also Peter McLaughlin's paper for the 1st workshop on *A Cultural History of Heredity*.

[11] Jacob (1971), p. 80f.

[12] Ibid., p. 91f.

2.1 Adaptedness and Adaptation

The adaptation of animals and plants to their habitats was of course no new discovery of Lamarck's and Geoffroy's days, although the awareness of such adaptations had certainly been sharpened by the increase of knowledge about "exotic" faunae and florae through European colonialism. The eighteenth century was almost obsessed with wondering about these indeed striking phenomena. The reasoning of this century's physico-theology dwelled on them excessively as an inexhaustible source of proofs of the divine creator's wisdom and providence.

With hindsight, it is obvious that these admirers of the creation dealt only with adaptedness and not with adaptation. They supposed that animals and plants fit so admirably well their environments because the divine creator designed them suitably. But if plants and animals were originally created as well adapted to their habitats, no process of adaptation needed to be assumed to account for their adaptedness. Living beings appear, thus, as being adapted to their habitats but not as adapting themselves to them. Adaptation as a natural process was not yet a needed concept. It became such a concept when naturalists were confronted with facts that indicated strongly to the possibility and even high probability that some, many or perhaps even all species of plants and animals had not always lived in their present habitats. With other words, with the emergence of doubts in stable relations between organic forms and habitats, the concept of adaptation to a new environment advanced as a possible natural account of adaptedness under changing environmental conditions.

The facts that induced doubts in unchanged environmental conditions were put forward firstly by the results of biogeographical investigations. The findings in this field of naturalistic explorations, which experienced a first flourish just in the second half of the eighteenth century, indicated strongly to the probability that closely related animals and plants from different regions of the world might be derivatives of one and same parental form which adapted themselves to different climates when spreading by migration. In Kant's anthropology, we encountered already such considerations about migration and adaptation, which also played a prominent role in the theories of the two most eminent figures of eighteenth century biology, namely Carl Linnaeus (1707-78) and George-Louis Leclerc, Comte de Buffon (1707-88).

Buffon, who has been celebrated as the founding father of modern biogeography, combined additionally the biogeographical view with that of a historic geology. In the middle of the eighteenth century, the question whether or not the Earth's surface underwent historical change was definitively given a positive answer by expert geologists, how much ever they dissented with respect to the extent and to the supposed causes of this secular change. Buffon went even so far as to put forward the bold particular hypothesis that Africa and South America formed formerly a united continent. Interestingly, this speculation drew less from geological evidences than from zoological ones, which indicated that different adaptations to unlike environmental conditions might account best for the differences between closely related species or genera of the two continents.[13]

The dramatic consequences of a historical view of the Earth for the biological understanding of adaptation unfolded finally just in the days of Lamarck and Geoffroy when modern palaeontology celebrated its first triumphs. The findings of George Cuvier (1769-1832) and William Smith (1769-1839) showed unmistakably that the different strata of the Earth contained

entirely different faunae and florae. This was really revolutionary and bewildering news. All naturalists, regardless to which extent they accepted these findings, agreed immediately upon one point, namely that these surprising facts must be subsumed under the adaptation concept: the strata contained different faunae and florae because they represented different life conditions in the Earth's past. The dissent came with the next question: must these different worlds of living beings be considered different creations which were completely wiped out by sudden changes of the Earth's surface or can they be taken to be different developmental stages of the same creation which, notwithstanding the extinction of a large amount of species, continued to exist although radically altered by its adaptations to drastic changes?

It goes without saying, with this alternative, really big questions were at stake and not just a detail of a theory – questions with far reaching consequences for religious and philosophical convictions and orientations which touched social and political interests. And for the life sciences, a cornerstone of their theoretical edifice was touched and endangered by this alternative, namely the concept of the constancy of species. It is therefore not surprising that the majority of naturalists preferred the first view and regarded the different faunae and florae as adapted to the conditions of their respective stratum but not as a result of a natural process of adaptation. The awkward consequence of a series of life erasing catastrophes and independent new creations seemed to them obviously less horrifying than the assumption that the species of living beings can transform themselves like a Proteus.

2.2 Lamarck and Geoffroy on Adaptation

However, as almost always in real life, *tertium datur*, that is, a middle position could be taken in this situation. Naturalists could defer judgment on the big questions raised with the palaeontologic discoveries – all the more as almost every conclusion from these discoveries could reasonably be questioned at that time – and confine themselves to the assumption that adaptation to changing environmental conditions engenders alterations of varieties, species, or even genera within certain limits. Even the radical Lamarck followed in a way this line. His theory of species transformation was not an attempt at keeping up with the history of life on this planet as suggested by palaeontology. He elaborated it independently of the palaeontologic discoveries of his days. These discoveries constituted a disturbance rather than a support for his theory of the historical development of organic forms, and he tended, therefore, to play down their significance and implications, and denied, for instance, the extinction of species apart from a few single cases.

Lamarck conceived of the transformation of species as a process that is primarily determined by inner-organismic laws and only secondarily and additionally by the environment. According to his theory, it is the interaction between the fluid and the solid parts of an organism what effects not only the ontogenetic development but also the gradual advancement of the adult structure of a species. His assumption that the species of the animal Kingdom, and the same holds for the

[13] See Roger (1997), pp. 331ff. – Speculations about adaptations of animals and plants to supposed changes of the Earth's surface had become wide-spread since the appearance of Benoit de Maillet's (1656-1738) *Telliamed* in 1748. In these speculations, adaptation was treated as a matter of fact that needs no explanation. An explication of the notion of adaptation to changing environmental conditions was seriously attempted first by Lamrack.

vegetal Kingdom, constitute different successive developmental stages of one and the same primal species[14] did not draw on any external factors. It was derived from supposed inner-organismic processes, and only this internal determination warranted the regularity and lawfulness of the species transformation. In the framework of this theory, external factors played the role of interferences from outside that disturb the natural way of development and alter its results. The unavoidability of such interferences rested, for Lamarck, on the spreading of the species throughout the different climates of the world rather than on historic alterations of the surface of the Earth.[15] And it is exactly at this point where the concept of adaptation surfaces in this picture. Adaptation to changing external conditions has the function to account for the deviations from the natural line of species transformation.

As is well known, Lamarck's and Geoffroy's concepts of adaptation differed considerably, but they did so on the basis of a shared presupposition that sounds strange today. Both men assumed that the alterations of an organism that effect its adaptation to new environmental conditions are induced, either directly or mediated, just by these new conditions. In order to mark the peculiarity of this presupposition, it may be convenient to remind briefly of the understanding of adaptation after Darwin's theory of evolution. According to this theory, a species' adaptation to changing conditions is effected by the natural selection of its individual variants that fit best the new conditions. However, this theory does in no way presuppose that fit individual variants are brought about by the changed environment, all the more not since the environment is viewed as being made up in the first place by other species and not by inorganic factors. Whether or not suitable and thus selectable variants come into being is an entirely open question in the framework of the theory of evolution, and thus the survival of the species under the new circumstances.

In contrast to this, the alterations with an adaptive value are induced just by the new environmental conditions in Lamarck's and Geoffroy's conceptions[16] – although in different ways. Geoffroy supposed a direct impact of changed external conditions upon the organism that causes its modification.[17] A background of this assumption was Geoffroy's studies on "monsters," as malformations were called then.[18] He pursued these teratologic studies not only as a comparative anatomist but combined morphologic investigations with embryologic experiments on how physical parameters like chemical composition of the air, temperature, etc. alter the development of a germ.[19] The results led him to the view that organisms are surprisingly flexible beings that are able to react, within certain limits, to changed physical conditions by developing modified organic structures in ontogenesis. And he considered this flexibility the basis of adaptations to changed environmental conditions.[20]

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14 More precisely, Lamarck assumed that all higher classes of the animal Kingdom arose from one of the four classes of the most primitive animal organisms, namely from the class of worms, whereas the three other primitive classes (infusorians, polyps, and radiarians) seem unrelated to the line of development that connects the worms with the mammals, and, thus, with man. See Lamarck (1809), 2: p. 457.

15 Lamarck (1809), 1: pp. 266f.

16 And just because of this, Lamarck needed not to be worried about the erasing effects of interbreeding – see Burckhard (1995), p. 181.

17 Russell (1916), p. 68; Appel (1987), pp. 132ff.

18 Ibid., pp. 75ff.

19 Ibid., pp. 128ff.

20 Cahn (1962), pp. 237ff.

Lamarck, on the other hand, denied such an immediate effect of changed conditions on the structure of organisms. He elaborated instead his famous theory according to which such conditions induce living beings to change their behaviour. Change of behaviour entails a different use of organs. New employments or refrain from former employments of organs lead to physical modifications of both the organs that are suitable for fulfilling the new tasks and the organs that come gradually out of use. Thus, the structure of an organism is modified by its active response to a new environment.[21] One has to admit that this concept of adaptation has the advantage to explain why just those alterations of the organism are induced by a new environment that are needed for the organism's coping with it.

2.3 Adaptation and Heredity

It goes without saying that Lamarck's theory of adaptation presupposed the inheritance of the modifications with an adaptive value obtained by one generation. The finally adapted shape of the organism's structure could only be achieved gradually through the accumulation of adaptive improvements of many generations. The famous or notorious inheritance of acquired characters was thus a necessity in Lamarck's theoretical framework.

It is not equally clear why Geoffroy followed the example of Lamarck what regards heredity. His theory does not necessarily imply an accumulation of alterations. Its distinctive feature consisted just in a supposed flexibility of organisms that enabled them to develop different structures under different conditions. This theory seems, thus, not in need of the assumption that advantageous characters acquired by one generation must be passed on to the progeny. Each generation seems able to develop itself the most advantageous structure. Being myself no expert what regards Geoffroy's zoology and having not been able to find information about this point in the secondary literature, I have to leave open this question.[22]

Anyway, Geoffroy followed Lamarck what regards the inheritance of acquired characters and referred explicitly to the two laws that the latter put forward in his *Philosophie zoologique*.[23] These laws explicate with desirable clarity how Lamarck viewed the connection between adaptation to changed environmental conditions and heredity and are, thus, worth to be quoted:

> First Law: In every animal which has not passed the limit of its development, a more frequent and continuous use of any organ gradually strengthens, develops and enlarges that organ, and gives it a power proportional to the length of time it has been so used; while the permanent disuse of any organ imperceptibly weakens and deteriorates it, and progressively diminishes its functional capacity, until it finally disappears.

[21] Lamarck (1809), vol. 1, chap. 7.

[22] However, I would like to indicate the conjecture that Geoffroy assumed the inheritance of altered structures among other things because of experiences gained by his embryologic experiments, namely that the flexible responses of organisms to altered conditions lack reversibility. This conjecture is suggested by an assumption of Kant mentioned in the first part of this paper, namely that man was initially endowed with the genetic dispositions for the features of all human races but could not go back to this initial universal state once specific features had become actualised under a certain climate. In both cases, an initially universal genetic disposition, which is open to different developments under different physical conditions, would loose its full plasticity after the realisation of one of the developmental possibilities. Subsequently, a limited plasticity is passed on to the progeny.

[23] Geoffroy (1826).

> Second Law: All the acquisitions or losses wrought by nature on individuals, through the influence of the environment in which their race has long been placed, and hence through the influence of the predominant use or permanent disuse of any organ; all these are preserved by reproduction to the new individuals which arise, provided that the acquired modifications are common to both sexes, or at least to the individuals which produce the young. [24]

The qualifications at the end of the second law are explicated in a short passage that reads as follows:

> […] in reproductive unions, the crossing of individuals who have different qualities or structures is necessarily opposed to the permanent propagation of these qualities and structures. Hence it is that in man, who is exposed to so great a diversity of environment, the accidental qualities or defects which he acquires are not preserved and propagated by reproduction. If, when certain peculiarities of shape or certain defects have been acquired, two individuals who are both affected were always to unite together, they would hand on the same peculiarities; and if successive generations were limited to such unions, a special and distinct race would then be formed. But perpetual crossings between individuals, who have not the same peculiarities of shape, cause the disappearance of all peculiarities acquired by special action of the environment. Hence, we may be sure that if men were not kept apart by the distances of their habitations, the crossing in reproduction would soon bring about the disappearance of the general characteristics distinguishing different nations.[25]

To my knowledge, this short passage is the most extended and elaborated one on heredity one can find in the *Philosophie zoologique*.[26] Out of the fifteen pages in which Lamarck expounds the two laws, this quarter page contains all he has to say about the inheritance of acquired characters. Almost all of his explanatory efforts are dedicated to the elucidation of his conception of the acquirement of new characters in response to new challenges of the environment. He sensed

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[24] Lamarck (1963), p. 113; Lamarck (1809), 1: p. 235: "Première Loi. Dans tout animal qui n'a point dépassé le terme de ses développemens, l'emploi plus fréquent et soutenu d'un organe quelconque, fortifie peu à peu cet organe, le développe, l'agrandit, et lui donne une puissance proportionnée à la durée de cet emploi ; tandis que le défaut constant d'usage de tel organe, l'affoiblit insensiblement, le détériore, diminue progressivement ses facultés, et finit par le faire disparoître.
Deuxième Loi. Tout ce que la nature a fait acquérir ou perdre aux individus par l'influence des circonstances où leur race se trouve depuis long-temps exposée, et, par conséquent, par l'influence de l'emploi prédominant de tel organe, ou par celle d'un défaut constant d'usage de telle partie ; elle le conserve par la génération aux nouveaux individus qui en proviennent, pourvu que les changemens acquis soient communs aux deux sexes, ou à ceux qui ont produit ces nouveaux individus."

[25] Lamarck (1963), p. 124; Lamarck (1809), 1: pp. 261f.: "Au reste, dans les réunions reproductives, les mélanges entre des individus qui ont des qualités ou des formes différentes, s'opposent nécessairement à la propagation constante de ces qualités et de ces formes. Voilà ce qui empêche que dans l' homme, qui est soumis à tant de circonstances diverses qui influent sur lui, les qualités ou les défectuosités accidentelles qu'il a été dans le cas d'acquérir se conservent et se propagent par la génération. Si, lorsque des particularités de forme ou des défectuosités quelconques se trouvent acquises, deux individus, dans ce cas, s'unissoient toujours ensemble, ils reproduiroient les mêmes particularités, et des générations successives se bornant dans de pareilles unions, une race particulière et distincte en seroit alors formée. Mais des mélanges perpétuels entre des individus qui n'ont pas les mêmes particularités de forme, font disparoître toutes les particularités acquises par des circonstances particulières. De là on peut assurer que si des distances d'habitation ne séparoient pas les hommes, les mélanges pour la génération feroient disparoître les caractères généraux qui distinguent les différentes nations."

[26] See also the short passage in Lamarck (1802), p. 61 and the thought experiment ibid., pp. 53f.

obviously no urgency to explicate equally elaborately the question of heredity.[27] The fact that he confined himself to the adduction of some speculations about human races is really a telling one.

Thus, one gets unavoidably the impression that Lamarck regarded the assumed inheritance of acquired characters the least risky part of his transformation theory. And this impression is strengthened by the literature on Lamarck, a large part of which takes this assumption as a commonly shared one at that time,[28] invoking, as a rule, the example of Erasmus Darwin (1731-1802).[29] I do not know whether contemporary laymen believed generally in such an inheritance, but would not be surprised if they did so notwithstanding the innumerable counter-instances, which could not hinder this belief since times immemorial. There are, however, good reasons not to presuppose a consensus on such questions in the community of life scientists.[30] Already the quoted passage on interbreeding of human races should caution us against rash judgements. Its assertions are put forward as if everybody was familiar and agreeing with them. But we noticed already that a well-informed writer like Kant adduced opposite assumptions what regards the possibility to wipe out certain distinct racial features by crossing. Obviously, questions like this were far from being answered definitively. And the fact that such contrary assumptions could be put forward like evident facts seems only to indicate that such assumptions were still not in the focus of biological conceptualisations.

What regards the assumption of the inheritance of acquired characters, however, there was an immediate connection to heatedly debated theories that occupied the attention of life scientists since almost half a century. For this assumption was only theoretically intelligible in the framework of an epigenetic conception of development that included a pangenetic understanding of the germ's generation – a conceptual framework that was not at all generally accepted among life scientists around 1800. Both, Geoffroy and Lamarck, were adherents of such an epigenetic understanding of generation and development. This conception formed the theoretical base for the teratological studies of the former[31] and constituted the very backbone of the transformation theory of the latter. Both men were familiar with the French tradition of epigenesis theories, which goes back to Maupertuis and Buffon.[32] It is Maupertuis who deserves particular attention in our context. For, in the frame of his theory of generation, the inheritance of acquired characters appeared not only natural but even inevitable.

In contrast with the preformist view, the doctrine of epigenesis had the advantage to be in good conformity with embryological results as well as with then known phenomena of regeneration. However, its disadvantage became obvious when it was about an explanation of how the particles of a developing organism manage to arrange themselves in such a way that they form exactly its complex organic structure. How can one account for this miracle if only the then known mechanical and chemical laws are admissible? As a way out, Buffon proposed *moules intérieures* in his *Histoire des Animaux* from 1749, that is, interior molds by means of which the particles are cast mechanically into the structure of the germ.[33] Four years earlier, Maupertuis had devised a

27 Burckhard (1995), pp. 179f.
28 Zirkle (1946), p. 91.
29 Ibid, p. 115.
30 Ibid., p. 117.
31 Appel (1987), pp. 127f.
32 For this tradition, see Roger (1998) part 3.

different explanation, namely a pangenesis hypothesis that reminds one very much of that of Charles Darwin.[34] He supposed that all organs of the parent organisms contribute to the formation of the germ through the production of specific genetic particles. Such specific genetic particles from a certain parental organ were thought to be responsible for the formation of just the same organ of the young. He even ascribed to the genetic particles a kind of memory. Anyway, the assumed transmission of properties of a parental organ to the corresponding one of the offspring via specific genetic particles is mechanically enough conceptualised as to make sure that individual and not generic properties are transmitted.[35] It is, furthermore, a transmission of individual traits of the parents that does not discriminate between innate and acquired ones. Inheritance of acquired characters, thus, is a natural consequence of this theory.

There were no much improvements of the epigenetic interpretation of generation and development after Maupertuis, and it is clear with hindsight that the followers of the doctrine of epigenesis had no chance to put forward better explanations on the base of the chemistry and physiology of this age, without our distinction between phenotype and genotype, and so on. It was, therefore, certainly not in the first place because of a strong belief in the preformationists' view when Cuvier, probably the most influential naturalist in the first two decades of the nineteenth century, rejected the doctrine of epigenesis.[36] In his view, this doctrine was a deterring instance of the wild speculations characteristic of the eighteenth century that science ought to overcome for the sake of its advancement. He sensed rightly that the epigenesists' view was part and parcel of broader speculations on how to bridge the gap between the inorganic and the organic world. And Lamarck's *Philosophie zoologique* could have served him as an example for the substantiation of this assessment. It contains, apart from other traits of an spirit *à la Buffon* or *à la Maupertuis*, a chapter on spontaneous generation,[37] in which Lamarck tries to demonstrate that spontaneous generation and generation by fertilisation are essentially processes of one and the same kind that differ only with respect to the stirring principles.

As is well known, Lamarck's theory of species transformation did not meet with much approval among the contemporary professional naturalists. It may be less known, that these naturalists correctly perceived it as part of his *Physique terrestre*, that is, a planned but only partly completed work, in which Lamarck intended to give a comprehensive theoretical account of the interrelated processes in the atmosphere, the lithosphere, and the biosphere.[38] The knowledge of this embedment of his zoological theory may lead to a better understanding of the contemporary

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33 Buffon (1749), chap. 2. Though throughout mechanical, the idea of such a interior mold was much more intricate than the metaphor of a mold might suggest – see the paper of Mary Terral for the 1st workshop on *A Cultural History of Heredity.*

34 Maupertuis (1768), Stubbe (1965), pp. 65ff. The idea of a pangenetic generation of the germ is as old as that of the inheritance of acquired characters, and variants of it can be traced back to classic antiquity and even farther backwards – see Zirkle (1946). For Darwin's pangenesis hypothesis, see Darwin (1894), vol. 2, chap. 17.

35 As Peter McLaughlin's has stressed in his paper for the 1st workshop on *A Cultural History of Heredity,* the distinction between the transmission of species-specific and individual traits is of great significance for an adequate historical understanding of eighteenth century heredity conceptions. These conceptions focus almost exclusively on the transmission of the former and neglect the latter nearly completely. However, in mechanical pangenesis hypothesis like that of Maupertuis, it is hard to discern this difference. Species-specificity is only present as a limit of individual deviations.

36 Appel (1987), pp. 49f.

37 Lamarck (1809), vol. 2, chap. 6.

naturalists' sceptic attitude towards Lamarck – not towards the expert for zoological classification, but towards the *philosophe*. Rejecting the entire enterprise of the *Physique terrestre*, they did not bother themselves with criticising its details, and at least such a comparative trifle like the assumption of the inheritance of acquired characters. The silence about this assumption must, therefore, not be mistaken as approval.

Heredity in Lamarck's and Geoffroy Saint-Hilaire's zoology, thus, proves to be only a further instance of the peripheral existence of heredity as a subject matter of scientific research before Mendel and the discovery of his discoveries. Also in this case, it surfaces only as a concomitant of other subjects of interest, this time as a complementary aspect of the question of adaptation to changing environmental conditions. It comes therefore without surprise that the question of heredity is treated casually in Lamarck's and Geoffroy's zoology and did not lead to investigations into its details, neither by these two scientists nor by their critics. My story about heredity in Lamarck's and Geoffroy Saint-Hilaire's zoology turns out to be the story of a missed opportunity.

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Erasmus Darwin on Hereditary Disease: Conceptualizing Heredity in Enlightenment English Medical Writings

Philip K. Wilson

Introduction

From ancient times, natural philosophers and physicians have questioned and offered explanations of the passage of hereditary traits including disease. The Hippocratic writers, for instance, attributed a hereditary character to epilepsy, claiming that it arose during the production of semen (a general reproductive fluid that the ancients claimed resided in both males and females) when "diseased parts of the parental body send off diseased seed."[1] This essay focuses on the period roughly a century before the rediscovery of Mendel – a time of considerable turbulence and discord in both societal and intellectual thought – the shifting era between the Enlightenment and the Romantic Period. My geographical focus – the seedbed of the European Industrial Revolution – lies in England's West Midland county of Staffordshire. There, I turn to an individual who offered considerable written insight into contemporary thoughts on heredity and disease. This individual, the physician, industrialist, educator of females – all around polymath – Erasmus Darwin. As our subject was better known to his contemporaries as "Dr. Darwin," I, too, will continue to use the sobriquet "Dr. Darwin," especially when distinguishing him from other family members. Despite his reputation – at least in some circles – during his own lifetime, he remains to us, at best, the 'other' Darwin.

Erasmus Darwin has long been a favored study in pedigree analysis, particularly in relation to the intellectual predisposition of his grandson, Charles Darwin. Historians typically cite Dr. Darwin's section, "On Generation", from his *Zoonomia, or, The Laws of Organic Life* (1794-96) to establish an intellectual background for his grandson's thoughts on adaptation, sexual selection, and evolution.[2] Such foreshadowing misses the opportunity to analyze Erasmus Darwin's thoughts on heredity within their own Enlightenment and early Romantic era contexts.[3] To begin filling this lacuna, this essay will examine several key influences upon Erasmus Darwin that are evident from his own writings on reproductive generation. In particular, I will focus upon Dr. Darwin's writings on human heredity, an area that even Erasmus Darwin enthusiasts have neglected in favor of his more voluminous and lusty botanical writings.[4] First, I'll concentrate upon two of his writings that look particularly at human heredity and disease. Then, I'll examine

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1 Temkin (1971), pp. 4, 31, 52.

2 Many authors have forged connections on evolution between the two Darwins including Glass, Temkin, and Straus, Jr. (1959); Darlington (1961), esp. pp. 7-13; King-Hele (1963), esp. pp. 63-96; and Harrison (1971). In one early notable exception, Bowler (1974) carefully contextualized eighteenth century views of evolutionary thought. Porter (1989) also addressed this point properly. Sheffield (2002) incorporated Dr. Darwin's evolutionary views into his historical science fiction.

3 For an overview of Erasmus Darwin and human reproductive generation, see Wilson (Forthcoming). Hassler (1973) convincingly portrays Dr. Darwin as a bridge between Enlightenment and Romantic literati.

4 Schiebinger (1993) has surveyed Erasmus Darwin's botanical writings in reference to gender.

briefly the views that several of his contemporaries held regarding hereditary disease in order to better contextualize Dr. Darwin's own expressed beliefs.

Disease was not, to the industrial-minded Dr. Darwin, an entity that invaded the body. Rather, sharing the convictions of his Edinburgh medical school professors, he viewed disease more in constitutional terms as the result of a "malfunction" of the healthy motions within the body.[5] In particular, disease expressed its mechanical defect as a "disturbance in one or more of the classes of fibrous activity." The physician's role, therefore, was "to apply remedies which would restore [... the body's] normal functioning," or even better, to prevent any malfunction in the first place.[6]

Building upon the Enlightenment projects of ordering and classifying information into new knowledge, Dr. Darwin envisioned his *Zoonomia* as a Linnaean classification for disease.[7] "There is need of a theory in the medical profession," Darwin argued, "a theory founded upon nature, that should bind together the scattered facts of medical knowledge and converge into one point of view the laws of organic life."[8] The passion to reclassify medicine had also been the long-term goal of Edinburgh Professor of Chemistry and Medicine, and later the Institutes (i.e., theory) of Medicine, William Cullen. Like many during this reign of neurophysiological nosologists, Cullen deemed "almost the whole of diseases of the human body might be called *Nervous*."[9] However, he distinguished his 1769 *Synopsis Nosologiae Methodicae* from the taxonomies proposed by François Boissier de Sauvages (1763), Carl von Linné (1763), and Rudolph August Vogel (1764) by labeling the "Neuroses" or Nervous Diseases a class of diseases by itself. Dr. Darwin's nosology, published a quarter of a century later, differed even further. For consistent with his view of society in general, he viewed diseases more in terms of their dynamic, evolving qualities rather than as the static entity more typical of Enlightenment taxonomies.[10]

Dr. Darwin, Heredity & Disease

Moreso than many of his contemporaries, Dr. Darwin readily acknowledged a hereditary predisposition to disease. In *Zoonomia* and in the *Temple of Nature: or, The Origin of Society* (1803), he argued that consumption (i.e., tuberculosis), scrofula (the "King's Evil"), gout, epilepsy, and insanity were hereditary. Ever prone to versify, Darwin stated his argument thusly:

> E'en where unmix'd the breed, in sexual tribes
> Parental taints the nascent babe imbibes;

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5 Motions within the fibrous part of the constitution were the key to Dr. Darwin's understanding of physiology and pathology. Many scholars have pigeonholed Erasmus Darwin as a mechanist without equivocation. His mechanistic inclinations should not surprise us given all of the machines he contrived for his fellow Lunar Society members. However, from a close scrutiny of *Zoonomia*, I discern his support of a deistic vitalism (or a vitalistic deism). In particular, I find that he proposed many vitalistic notions, albeit generally construed within a linguistic framework of mechanism. McNeil (1987) and King-Hele (1999) provide well contextualized overviews of Dr. Darwin's industrial-mindedness.

6 Crum (1931), p. 124.

7 Uglow (2002) depicted ordering and classifying as among the key projects of the Enlightenment, p. 266. For a highly readable overview of eighteenth century nosologies, including Dr. Darwin's, see King (1958), pp. 193-226.

8 E. Darwin (1809), 1: p. viii.

9 Bynum (1993), p. 152.

10 See, for example, Bowler (1974), pp. 166-179; and McNeil (1987), pp. 86-124.

> Eternal war the Gout and Mania wage
> With fierce unchecked hereditary rage;
> Sad Beauty's form foul Scrofula surrounds
> With bones distorted, and putrescent wounds;
> And, fell Consumption! Thy unerring dart
> Wets its broad wing in Youth's reluctant heart.[11]

Why did Darwin pay special attention to hereditary disease? In part, he had considerable experience with diseases that appeared in the same family – his own family. Throughout his life, Dr. Darwin suffered from stammering (i.e., stuttering). This "defect" was so pronounced that some said it to be "painful" to hear. Others, however, claimed that Darwin "repaid his auditors [i.e., attentive listeners] so well for making them wait for his wit or knowledge, that he seldom found them impatient."[12] When one young man questioned him as to whether he found this "deficit" to be inconvenient, Dr. Darwin replied, with typical wit, "No, sir, it gives me time for reflection, and saves me from asking impertinent questions."[13] Darwin's eldest son, Charles, was also afflicted with stammering. Darwin sent this son, when 18, to France, in hopes that "if he was not allowed to speak English for a time, he would be cured of [… stammering]. Charles returned a year later, spoke French fluently for the rest of his life, but continued to stammer in English."[14] For Dr. Darwin, this served as evidence that at least some hereditary diseases could be modified in their expression. His further investigation into this familial linkage was stopped when Charles, as a prize-winning medical student at Edinburgh, died from blood poisoning following a finger cut at the dissecting table.

Dr. Darwin also suffered from gout, a disease thought by many to be as inherited as titles among the upper class. William Darwin, Erasmus's great-great-grandfather, had died in 1644, it was claimed, "from gout." It was "therefore probable," claimed Erasmus's grandson, the gouty naturalist Charles Darwin, that Dr. Darwin, as well as many other members of the family, "inherited from this William, or some of his predecessors, their strong tendency to gout."[15] Dr. Darwin also gathered considerable case study evidence from his wide-ranging practice, predominantly though not exclusively among the middle and upper ranks of society, that he interpreted as further proof of a hereditary transmission of gout.[16]

It was also an "early attack of gout" that turned Dr. Darwin into a "vehement advocate of temperance" for the rest of his life.[17] Darwin viewed intemperance (i.e., alcoholism) as the foundational hereditary disease. In the words of his grandson, "No man ever inculcated more persistently and strongly the evil effects of intemperance than did Dr. Darwin […]."[18] Dr. Darwin

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11 E. Darwin (1804), *Reproduction of Life,* Canto II.
12 Pearson (1930), p. 42.
13 Krause (1879), p. 40. For an historical overview of stammering, see Compton (1993).
14 Pearson (1930), pp. 9-10.
15 C.Darwin (1879), p. 1.
16 Although based in Lichfield and later Derby, Dr. Darwin's practice was based over a large geographical area. He traveled extensively, either in his carriage or on horseback, to see patients. In 1766 alone, he calculated having traveled over ten thousand miles.
17 C. Darwin (1879), p. 1.
18 C. Darwin (1879), p. 56. As Pearson (1930) noted (p. 27), the novelist Maria Edgeworth, daughter of Lunar Man Richard Edgeworth, also testified that Dr. Darwin "believed that almost all the distempers of the higher classes of people arise from drinking […] too much vinous spirit."

himself argued that all the "hereditary diseases of [Britain]" originated as "the consequence of drinking much fermented or spiritous liquor."[19] Consequently, he argued that overcoming the hereditary tendency to intemperance was "perhaps […] the most practical line of attack" against all "ill-health."[20]

Turning again to his own family lineage, Darwin shared thoughts about intemperance as a hereditary disease. In a letter to his son Robert Waring Darwin, Erasmus discussed his own father-in-law, Charles Howard. Howard, he claimed, was "a drunkard both in public and private – and when he went to London he became connected with a woman and lived a deba[u]ched life in respect to drink, hence he always had the Gout of which he died."[21] These effects carried forth into the life of Mary Howard, Dr. Darwin's first wife. Mary Darwin began to drink excessively early in their married life – though attempting to conceal this from her husband – in order to overcome episodes of "temporary delirium, or […] insanity."[22]

Enlightenment medical authorities including William Heberden, William Hunter, and William Cullen – all with whom Dr. Darwin had studied – as well as the physician Thomas Beddoes, founder of the Pneumatic Institute in Bristol, and the Birmingham physician and fellow Lunar Society man, William Withering, also viewed what were called "the drunken diseases" [including gout, epilepsy, and insanity] as "hereditary in some degree."[23] The Scot-born gouty physician and literati, Tobias Smollett, also featured the hereditary passage of disease in his popular late eighteenth century novels, *The Adventures of Peregrine Pickle* (1751) and *The Adventures of Humphrey Clinker* (1771). Consistent with these authorities, Dr. Darwin claimed that it was the tendency, the diathesis, the predisposition to disease rather than the particular disease itself that was hereditary.[24] Contemporaries described "hereditary predisposition" as an "original conformation of the body, transmitted from the parent to the offspring" that, "when particular exciting causes are applied, a similar train of morbid phenomena takes place" in the child as was experienced by the parent.[25] Predisposition, the precise factor that was inherited, was deemed as "the medium between health and disease."[26] Thus the susceptibility to be afflicted with a hereditary disorder like gout, epilepsy, insanity, or consumption could be enhanced when an individual was exposed to certain triggering environments. Or, using the terminology of Dr. Darwin's day, the remote cause of disease (its inheritance) could be triggered by the proximate or "exciting" cause (cold, heat, some spasm or other debilitating disturbance in one's environment).[27]

> The clime unkind, or noxious food instills
> To embryon nerves hereditary ills;

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19 E. Darwin (1804), p. 178.
20 C. Darwin (1879), p. 56.
21 E. Darwin ([1792] 1958), p. 224.
22 Colp (1977), p. 119.
23 E. Darwin ([1792] 1958), p. 224. For complementary accounts of the Lunar society, see Schofield (1963) and Uglow (2002).
24 For an overview on diathesis, see Ackerknecht (1982); and for an elaboration on the importance of "constitution" in regard to hereditary disease, see Olby (1993).
25 Trotter (1808), p. 169.
26 Ibid., p. 204.
27 Bynum (1994), p. 19.

> The feeble births acquired diseases chase,
> Till Death extinguish the degenerate race.[28]

Like the claims of many natural philosophers both before and after this time, Dr. Darwin viewed disease itself, even when labeled as a hereditary disease, as the result of both nature and nurture.[29] Specifying the particular cause of disease was, to a nosologist like Darwin, of utmost importance for the precision of his diagnoses. Identifying the causal factors, however, seemed less significant in determining the actual treatments he proffered. Rather, by implicating the degree to which nature –versus– nurture was viewed as the chief "cause" of a particular disorder helped Dr. Darwin target how to best prevent the further occurrence of this disease within a particular family. If a patient's past pedigree suggested that he was the likely carrier of a hereditary propensity to disease, then it was the physician's role to prevent the patient from being exposed to the precipitating factors that would most likely induce the onset of disease. Neglecting to treat the symptoms of a reputed hereditary disease could also present a problem. For if "improperly treated," a hereditary disorder like the gout may be "diverted from its proper course" such that "the miserable patient has a chance to be ever after tormented with head-achs, coughs, pains of the stomach and intestines."[30]

Dr. Darwin on Consumption and Gout

Darwin's thoughts on hereditary disease, especially consumption and gout, were influential to several contemporaries including the physician, Thomas Trotter, of Newcastle on Tyne. Trotter, whose mind was fixed on the nervous temperament as the exciting, proximate cause to all disease, also incorporated the predisposition to hereditary disease in his diagnoses. Indeed, Trotter argued that the inherited predisposition itself may become visibly apparent long before the patient complained of specific symptoms. Such was the case, he argued, of those "phthisically disposed," i.e., those marked with the predisposition to phthisis (i.e., consumption or tuberculosis). Markings of phthisis – the pallid, gaunt face, and the sunken chest – may frequently appear in the first stages of infancy, late in infancy, or even later in development in patients afflicted with a latent form of disease. The onset of puberty, for example, was a particular time in later life where "changes […] in the constitution, conjoined to the quick growth of the body" proved to be "a most critical period" for the onset of symptoms of phthisis as well as other hereditary diseases.[31] According to Dr. Darwin, hereditary pulmonary consumption was known to "attack" patients "so infallibly a few years after puberty, that it does not appear to depend much on external circumstances."[32] Thus, at times, nature appeared to have heavily outweighed nurture in precipitating the onset of hereditary disease.

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28 E. Darwin (1804), *Reproduction of Life,* Canto II.

29 López-Beltrán (1994) has described that a malleable admixture of nature and nurture existed in the "soft hereditarianism" beliefs of the early nineteenth century in contrast to the more objective qualifications of a nature-based, "hard hereditarianism" later in the century.

30 Buchan (1828), p. 277.

31 T. Trotter (1808), p. 172. For descriptions of later views of hereditary tuberculosis, see Wilson (Forthcoming).

32 E. Darwin (1809), 2: p. 255.

Coupled with the evidence for hereditary disease garnered from his own family lineage, Dr. Darwin gathered additional evidence from many of the families for whom he offered medical care. "I have seen epilepsy," one of the "drunken diseases," "produced […] very often" in the same family. As a treatment, he noted from his own success that "one sober generation" can cure epilepsy. Insanity, another "drunken disease," could be stopped in a similar manner.[33] Indeed, Dr. Darwin claimed to have treated many people "who had insanity [… on] one side" of their family, yet whose "children now old people have no sign of it." His practice demonstrated that diseases, like gout and intemperance, though inheritable, were not inevitable. Consistent with the views of later historians of the Enlightenment, hereditary diseases could, at times, be disinherited.[34] In particular, hereditary predispositions "cease," Darwin claims to have observed, "if one or two sober generations succeed; otherwise the family becomes extinct."[35] If the "drunken diseases" were not curable by imposing one sober generation upon the family, then, Darwin exclaimed, "*there would not be a family in the kingdom without epileptic, gouty, or insane people in it.*"[36]

Not everyone shared Dr. Darwin's belief in the transmission of hereditary predispositions, or even in hereditary diseases themselves. The irascible Edinburgh physician, John Brown, whom Darwin admired for quantifying "excitation" and "stimulation" in his explanation of the actions of human physiology, disease, and medications, disapproved of applying the concept of "hereditary" to any disease. Brown's theory – known widely, especially throughout continental Europe as Brunonian medicine – was based upon the belief that every individual's temperament or constitution was the same. Drawing upon Isaac Newton's revolutionary claim that "one single principle" governed all motion in "the whole planetary systems of the universe," Brown conjectured that the human form was similarly organized around one single human constitution.[37] Disease, according to Brown, an ex-pupil and extramural rival of William Cullen, resulted from either an excess or deficiency of "excitability" (i.e., the capacity to react to external stimuli).[38] To claim that "a taint, transmitted from parents to their offspring" should be "celebrated under the appellation of hereditary" was, Brown argued, "a mere tale." For true Brunonians, "there is nothing to the fundamental part of [… the] doctrine of hereditary disease."[39] As evidence, he speculated that the "sons of the rich," who "succeed to their father's estate, succeed also to [… their] gout. Those [sons] who are excluded from the estate, escape the disease also, unless they bring it on by their own conduct." It is interesting that despite his adamant disbelief in the concept of hereditary disease, his recommendations for preventing such disorders were not that dissimilar from those of Dr. Darwin. In one of his rationalized case examples, Brown argued that although "Peter's father may have been affected with the gout, it does not follow that Peter must be affected; because, by a proper way of life, that is by adapting his excitement to his stamina, he may have learned to evade his father's disease." "If the same person," he continued, "who from his own fault and improper management, has fallen into the disease;

[33] E. Darwin ([1792] 1958), p. 224.
[34] Porter and Rousseau (1998), p. 117.
[35] E. Darwin (1809), 1: p. 414.
[36] E. Darwin ([1792] 1958), p. 225.
[37] Brown (1803), pp. 242-243.
[38] Bynum (1994), p. 17. Yet, as Lawrence (1988) has insightfully pointed out, identifying the essential characteristic(s) of Brunonian medicine has been a difficult task for over two hundred years.
[39] Brown (1803), p. 396.

afterwards, by a contrary management, and by taking good care of himself, prevents and removes the disease, […]. What then [… has] become of [the] hereditary taint?" Alas, there is nothing whatsoever hereditary about this or any other disease. "Whatever produces gout in one [individual], will produce it in another. And whatever cures it in any one [individual], cures it also in every other."[40]

Another contemporary, William Cadogan, physician to the Foundling Hospital in London, an institution formed upon Enlightenment ideals, also questioned the claim that diseases were hereditary. Like Brown, he argued that if a disease was truly hereditary, it would "necessarily be transmitted from father to son, and no man whose father had it could possibly be free from it." His own extensive practice and readings had provided him "many instances to the contrary." Cadogen explained further, "Our parents undoubtedly give us constitutions similar to their own, and, if we live in the same manner they did, we shall very probably be troubled with the same diseases; but this by no means proved them to be hereditary: it is what we do to ourselves that will either bring [… the diseases] on, or keep us free."[41]

Cadogan argued his case specifically in reference to gout.[42] This select paragraph exemplifies his numerical-based (i.e., statistical) critique.

> Those, who insist that the gout is hereditary, because they think they see it so sometimes, must argue very inconclusively; for if we compute the number of children who have it not, and women who have it not, together with all those active and temperate men who are free from it, though born of gouty parents; the proportion will be found at least a hundred to one against that opinion. And surely I have a greater right from all these instances to say that it is not hereditary, than they have from a few to contend that it is. What is all this, but to pronounce a disease hereditary, and prove it by saying that it is sometimes so, but oftenernot so? Can there be a greater absurdity."[43]

Although many, including Darwin, concurred with Cadogan on temperance, they opposed his view regarding gout and heredity. William Falconer of Bristol rebuked Cadogan in a 1772 treatise as did Aberdeen practitioner William Grant in an essay seven years later. Grant firmed up a general view between constitution and hereditary disease by arguing that just as "constitutional diseases are often hereditary, […] the hereditary diseases are always constitutional."[44] The Lichfield luminary, Samuel Johnson, praised Cadogan's work as "a good book in general" but criticized it as a "foolish one in particulars. […] 'Tis foolish, as it says, the gout is not hereditary."[45]

Consistent with his deistic beliefs that development on the earth followed no fixed plan, Dr. Darwin argued that disease, too, was not predestined. Following the dissenter's practice of working to improve one's lot during his earthly existence, one could also work to overcome or prevent disease, including diseases to which one might be hereditarily predisposed. To achieve these aims, Darwin argued, one must learn how best to exert power over nature. Such objectives

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40 Ibid., p. 243.
41 Cadogan (1771), p. 70.
42 Porter and Rousseau (1998), p. 104, call Cadogan's view on gout and heredity as the "paradigm-shift framing his entire theory."
43 Cadogan (1771), p. 70.
44 Porter and Rousseau (1998), p. 115.
45 Ibid., p. 81.

also represented Dr. Darwin's critique on Britain's traditional social fabric that enforced aristocratic, class-based structures of inheritance.

Darwin & Buchan: Progressive-minded Reforms of Inheritance

Darwin's views were most consistent with the progressive-mindedness of his fellow Edinburgh-educated physician, William Buchan (1729-1805). Indeed, Buchan and Darwin were likeminded in many ways. They both supported the revolutionary action in the American colonies and in France; they both promoted the diffusion of useful knowledge; they were both avidly pro-temperance decades before any formal organization was to be found in Britain. In short, they were both liberal, progressive-minded reformers who exemplified that doctors, like politicians, could also be crusaders for social improvement.

Buchan, however, distinguished himself from Darwin through the aim of his medical writings. Unlike Darwin, whose chief medical writing, *Zoonomia*, was addressed to his fellow practitioners, Buchan, in the true spirit of Enlightenment's view of the democratic power of nature, sought to put medical wisdom in the hands of the public. His principle work, *Domestic Medicine*, first appeared in 1769 and was reprinted throughout the nineteenth century. Like John Wesley's *Primitive Physic* (1747), and the anonymously written midwifery manual, *Aristotle's Masterpiece*, *Domestic Medicine* served many needs of the lay public. Some claim that Buchan's book partnered with the Bible in its popularity.[46] As a means of appreciating what much of the public in Darwin's Britain understood regarding hereditary disease, Buchan's *Domestic Medicine* continues its usefulness in serving us as a valuable guide as well.

Based upon his own extensive practice and reading, Buchan claimed to have uncovered "manifold and decisive proofs" of the heritable transmission of disease. In particular, he noted that during "certain periods of life," children "become liable to the diseases of their parents, and consumption, gout, or dropsy makes its appearance, the germs of which must have lain in the system from the earliest periods of existence, although they did not disclose themselves till their due season."[47] But once a disease is "contracted and riveted in the habit," it became "entailed on posterity."[48]

Expanding beyond Darwin, Buchan suggested how to anticipate the future occurrence of hereditary disease. He informed readers that children were "particularly prone" to the diseases of the parent "to whom they bear the greatest personal similarity." Such direct linkage was not the sole key, however, for he warned that just as "we occasionally perceive the resemblance of some more remote ancestor break forth" in the personality and characteristics of a child, "so we shall [also] find the constitution and diseases of that child […] in the nature of the progenitor whom it most resembles."[49]

Further noting that this "point of similarity between parents and children" regarding the hereditary disease had "not hitherto been sufficiently attended to," Buchan focussed considerable attention to this familial connection in discussing diseases including consumption, gout, scrofula,

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46 Porter (1992), p. 217.
47 Buchan (1828), p. 162.
48 Ibid., pp. 441-442.
49 Ibid., p. 162.

scurvy, and dropsy – all disorders that he identified as having a hereditary predisposition.[50] These disorders must, he continued, "be the result of a certain combination of habits, continued, perhaps, from one generation to another, combined with the peculiar circumstances in which the individual is placed. It is reasonable to suppose that, by altering the former, and counteracting the latter, the general constitution might be changed"[51] But just what did Buchan mean by "altering the former" – that is nature's contribution – regarding the cure of hereditary disease?

Recalling Jean-Jacques Rousseau's analogies that were popular in England at this time, Buchan reminded readers of the farmers' inability to reap "a rich crop from a barren soil." Delicate women and men who pursue "irregular" habits may, he acknowledged, be able to bring forth children, but such children are "hardly […] fit to live." The "first blast of disease" tends to "nip the tender [child] in the bud." Although some of these children may be able to "struggle through a few years' existence," their "feeble frame[s], shaken with convulsions from every trivial cause," leave them "unable to perform the common functions of life." In short, they "prove a burden to society."[52] This burden, Buchan was quick to note, was not perpetuated only amongst the lower classes. "How happy had it been," he charged, "for the heir of many a great estate had he been born a beggar, rather than to inherit his father's fortunes at the expense of inheriting disease."[53] Indeed, the lower classes might actually hold some predilection against the onset of the hereditary diseases that were precipitated by the Epicurean living of England's upper class.

Beyond the diagnostic significance of identifying hereditary predisposition, Buchan, perhaps more than any other contemporary, challenged readers to accept the responsibility they held, individually and collectively, in improving future generations. Most pointedly, Buchan proclaimed, it was in the name of progress that any "person laboring under any incurable [hereditary] malady ought not to marry." Doing so, he continued, not only "shortens his own life, but [also] transfers its misery to others." When "both parties are deeply tainted" with hereditary diseases, their offspring, he prognosticated, "must be very miserable indeed."[54]

Working to improve one's circumstances beyond what nature provided was consistent with industrial, progressive-minded, Enlightenment ideals. And by placing further responsibility for the future in the hands of the public, Buchan believed himself to be enhancing the progressive cause. "Want of attention to these things" in the past, he proclaimed, had "rooted out more families than plague, famine, or the sword." And unless individuals became more informed and active in suppressing the propagation of the diseased, the "evil" associated with such disorders was bound to continue.[55] Thus for Buchan, as for Dr. Darwin, the social reality of hereditary disease had significantly prohibited human progress. To enhance a more positive evolution of humanity, he argued that people must assist and encourage nature to work in a progressive manner.

Believing that particular diseases were introduced via marriage lines, Darwin, too, suggested that more attention should be directed to one's choice of marriage partner. The "art to improve the sexual progeny" in humans would, he argued, follow the choice of "the most perfect of both

[50] Ibid., p. 162.
[51] Ibid., p. 163.
[52] Ibid., p. 441.
[53] Ibid.
[54] Ibid., p. 442.
[55] Ibid.

sexes." Fertility itself, Dr. Darwin claimed, was hereditary and subject to selection.[56] Noting that some families had "become gradually extinct by hereditary diseases," he offered the cautionary note that "it is often hazardous to marry an heiress, as she is not infrequently the last of a diseased family."[57] Offspring would also be less liable to hereditary disease, Dr. Darwin argued, it they married into different families. Such views contrasted traditional aristocratic family structure in which "like" tended to marry "like." They convey Dr. Darwin's social progressive-mindedness, and they were consistent with what Lawrence Stone (1977) and others have characterized as contemporary attempts to break from the traditional notions of fixed patterns of inheritance. These views, proposed in Dr. Darwin's last work, *The Temple of Nature*, were also foundational to what, a century later, became incorporated into programs of both positive eugenics (i.e., promoting the marriage and proliferation of "good stock") and negative eugenics (i.e., the prohibition of marriage and breeding between "defective stock").

Few physicians in Britain expanded more upon the particulars of what might be termed the "eugenics" of this era than did William Buchan. Buchan noted that responsible actions were required of both women and men towards shaping the future in a progressive-minded manner. If women would "reflect on their own importance and lay it to heart, they would embrace every opportunity of informing themselves of the duties which they owe to their infant offspring." It was "their province," Buchan argued, "not only to form the body, but to give the mind its most early bias." Women "have it very much in their power" to make their children "healthy or valetudinary, useful in life or the pests of society."[58] "Were the time that is generally spent by females in the acquisition of trifling accomplishments employed in learning how to bring up their children […] so as best to promote their growth and strength […], mankind would derive the greatest advantage from it." But until the education of females expands beyond "what relates to dress and public show, we have nothing to expect from them but ignorance" in important concerns such as their role in preventing the propagation of hereditary disease.[59] It should be noted that Darwin, too, devoted considerable attention to improving the education of women. His chief work, *A Plan for the Conduct of Female Education in Boarding Schools*, written, ironically, for his two illegitimate daughters, the "Misses Parkers," was aimed at improving the minds and bodies of girls attending the boarding school that he had established at Ashbourne in Derbyshire. Progress in the body, as in society, was, in part, achievable through improving nurture.[60]

Buchan argued that men, too, must become more attentive to their role in improving their offspring. Why is it that men are "not ashamed to give directions concerning the [… breeding of] dogs and horses, yet would blush were he [… to perform] the same office for that being who derived its existence from himself, who is the heir of his fortunes, and the future hope of his country!" [61] Darwin similarly noted that "those who breed animals for sale" had long known that "the sexual progenies of animals" were "less liable to hereditary diseases, if the breeding took place between families rather than within the same family."[62] For when both parents suffer from the

[56] Darlington (1961), p. 11.
[57] E. Darwin (1804), p. 179.
[58] Buchan (1828), p. 440.
[59] Ibid.
[60] For further discussion of Erasmus Darwin's model of female education, see Schiebinger (1993).
[61] Buchan (1828), p. 440.

same hereditary disease, he argued that the disease was more likely to descend to their posterity. Thus, another way to achieve progress among humanity resulted from improvements upon nature. Both Darwin and Buchan popularized the proscription of marriage when hereditary disease was a family concern.

Buchan also charged physicians as being negligent in showing attention to hereditary disease. This inattentiveness, he argued, was due largely to their unwillingness to attend to the sickness, management, and "preservation" of children. How striking the "labour and expense [that] are daily bestowed to prop up an old tottering carcase for a few years, while thousands of those who might be useful in life perish without being regarded! Mankind [is] too apt to value things according to their present, not their future usefulness."[63] Such characterization symbolizes a difficulty that had long plagued preventative thinking in medicine. Focussing on the here and now in medical practice had been (and continues to be) the norm, thereby leaving little energy (and funding) to expend on improving the lot of humanity for the future.[64]

Darwin, Buchan and many of their contemporaries based their medical practices, in part, on altering one's physical constitution in order to enhance resistance to disease. Habits, characteristics – indeed – physical constitutions were thought to be subject to alteration. Subsequently, the altered or acquired forms of a constitution were heritable. Such a "transformation of descent"[65] exemplified what has been labeled "trans-generational progress."[66] In the minds of some, the altered constitutional makeup was thought to be passed along intact to the next generation. Thus Darwin anticipated what Gottfried Reinhold Treviranus and, more notably, Jean-Baptiste Lamarck would later argue about the passage of acquired characteristics. In his *Philosophie Zoologique* (1806), Lamarck provided considerably more evidence drawn from nature than did Dr. Darwin. Moreover, he argued for a directional development that Darwin had not done. Still, in the context of industrial revolutionaries, Darwin's arguments set forth in *Zoonomia* "biologised the concept of progress."[67] The progressive developments in organic life were carried forth into the embryonic development of the next generation, or in other words, inherited. It might be said, contrary to the usual phrasing, that Lamarck was actually Darwinian in his thinking.[68]

Nineteenth century Heredity & Disease after Dr. Darwin

Darwin routinely had the ear of fellow Lunar Society men like Josiah Wedgewood, Matthew Boulton, and James Watt, industrialists whose success depended upon unprecedented demands upon the work force. More than some, Wedgewood appreciated that his maximal financial gain depended in large part upon maximizing the health of his workers. In part, through Dr. Darwin's

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62 E. Darwin (1804), p. 178.
63 Buchan (1828), p. 441.
64 Rosen (1977), pp. 69-77.
65 Darlington (1961), p. 10.
66 McNeil (1987), p. 112.
67 Ibid., p. 123.
68 Krause (1879), p. 133, made a similar comparison, rightly noting that it is "more proper" to view Jean Lamarck as a Darwinian of the "older school" than to characterize Dr. Darwin as a Lamarckian. Drachman (1930), p. 88, also addressed this point.

efforts, public health and hygiene became critical concerns within the industrial Midlands. In the generation immediately following these Lunar luminaries, public health concerns became increasingly addressed in these heavily populated towns-turned-cities. The divide between the "haves" and the "have nots" intensified. From an environmental perspective, the financially dependent were crowded into unsanitary areas that soon became known for their high morbidity and mortality. From a hereditary perspective, these rates were thought to increase even further for these environments could easily excite those with predispositions to particular diseases into full blown manifestations of their disorders.

It could be argued – though with sweeping generalizations – that concern about hereditary disease became relatively inconsequential in England during the decades immediately following Dr. Darwin. With the rise of industry, inheritance was no longer the only way to achieve substantial financial gain. The growth of industry also diminished the significance of inheritance within the minds of many medical reformers. Individuals including William Wilberforce, Lord Shaftsbury, Jeremy Bentham, and Edwin Chadwick focused much of their reform efforts on improving the environmental factors related to disease and public health. Although some claimed Dr. Darwin to be a pioneer of temperance reform, later temperance campaigns operated from the premise that drinking was more of a societal ill than an inherited one.[69]

The rise of bacteriology later in the nineteenth century further diverted the medical gaze, focusing more upon the germ than the germ cell. With efforts aimed at cleansing society from germs, the concept of hereditary disease might appear to have lain dormant within British medical and popular writings throughout much of the later half of the nineteenth century. According to standard historical accounts, heredity was only excited into action in after another British polymath, Francis Galton, a grandson of Erasmus Darwin, drew attention to what he called the "study of agencies, under social control, that may improve or impair the social qualities of future generations either mentally or physically."[70] Encouraging a shift away from the primary focus on bacteriology, Galton proposed that massive efforts should be undertaken to improve the human reproductive stock of society by giving "the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable."[71]

Although some truth lies within such explanations, we are only beginning to see more clearly through works of Carlos López-Beltrán (1994), John C. Waller (2002) and others that support for hereditary explanations of disease remained strong throughout nineteenth century Britain. Charles Darwin's son, Leonard Darwin – a key spokesperson for British eugenics in the early twentieth century – claimed that this interest in heredity, both as related to disease and to societal well-being, was itself a commonly noted trait passed along through family pedigrees. For his family, this may well have been true. However, our continually refined focus upon the passage of ideas, or influence, of one generation of medical writers upon succeeding generations will further illuminate areas of continuity and areas of change regarding more general thoughts about the possible connections between heredity, environment, and disease in the nineteenth century.

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69 Pearson (1930), p. 27.
70 Galton ([1909] 1984), p. 81.
71 Galton (1883), p. 24.

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Pathological Heredity as a Bid for Greater Recognition of Medical Authority in France, 1800-1830

Laure Cartron

Introduction

To understand the widespread popularity of the notion 'pathological heredity', we must first identify the ways in which physicians acted in specific conditions to pursue their interests and ideals and to spread their convictions.

By the end of the 18th century, heredity was a topic of debate not just among philosophers but among plant and animal hybridists as well. Philosophers speculated about the continuity and progress of mankind. Most of their theories were dominated by fantastical representations of generation. Historically, breeders had fundamental concerns focused on the generation and transmission of peculiarities. Using empirical methods, they sought to isolate and preserve acquired features among animals and plants. Meanwhile, influential physicians saw the question of heredity as a physiological problem rather than a pathological one. They considered the conundrum of heredity as being "beyond [their] immediate grasp."

In 1815, when young physicians were discharged from Napoleon's Armies, they faced a problem of overcrowding in the medical profession. Like other middle-class professions in Western Europe between 1815 and 1848, medicine was suffering from the discrepancy between demand for services and supply (i.e. medical school graduates). Paris certainly was saturated, with only 3 percent of the national population but 13 percent of all doctors. The result was bitter competition for patients and for salaried hospital positions. In 1819, the *Dictionnaire des Sciences Médicales* had an entry for "Médecine politique", described in normative terms as "the series of relations that doctors ought to have with governments in the interest of the governed." It was noted that most of these 'relations' were not highly developed – a situation that was soon to change.

After Fodéré had published his *Traité de Médecine légale et d'Hygiène publique*, in 1813, no well-informed physician spoke about hereditary diseases in the same way as his predecessosrs had done some 20 or 30 years before. Then the same disease with the same symptoms had been thought to appear in children at the same age and in the same circumstances as it had appeared in their affected parent. Now, they would use the key terms, "hereditary predisposition", "hereditary taint" and "predisposing factors" to talk about hereditary disease. Heredity transmitted an organic disposition not only to one particular disease but also to a special condition that could produce a variety of illnesses or disabilities. As this new model of thinking developed and spread through the medical corps, an unprecedented notion took root: chronic diseases would appear in those with an inherited constitutional weakness. This constitutional weakness was inherited at the time of the conception, birth or during weaning. At this stage, hypotheses diverged but the physicians' basic argument was simple: Given that the transmission of external physical characteristics seemed to be constant, there could be no doubt that the same transmission process was at work in determining man's internal constitution. So, when the same chronic disease affected several

members of the same family, transmission by heredity was involved. It was convenient in medical language to mix up the use of the terms "inherited diseases" and "family diseases". When referring to contagious illnesses, observers, not being able to explain why contagion did not affect every individual in a group to the same extend, began to write passionately on this question of transmission by heredity.

The question I want to address is the following: at a time when progress was the driving force of history and science, was there a group of influential physicians who were willing to adopt a new attitude on such essential issues as the status of medical theories and the role of the medical corps in the new political context, the insuperable obstacles to real knowledge of the causes of illnesses – a new attitude, then, which replaced the vagueness of theory with the positive and sure light provided by statistical data, held as a fundamental value?

1. Medicine is a science

Now, only science could guarantee progress in knowledge. Physicians had been able to observe that great improvements were being made in sciences like chemistry, physics and astronomy but progress in medical science was almost nil. So, anxious to ensure the scientific stature of medicine, they expected that medicine could be modeled on the physical sciences and could achieve the same kind of certainty. The new medicine would indeed then be a science, rather than a conjectural art as it had been considered in the past. Physicians, like many other scientists and publicists, were intellectually influenced by Pierre-Simon Laplace, then Europe's most famous figure in mathematical probability theory.[1] After having claimed that the regularity of phenomena, established with rigor, permitted investigation of causes, Laplace also asserted that his theory could be extended to the human and moral sciences. From 1800 on, numbers had begun to play a prominent role in all social activities where control and prediction were sought. The range of phenomena and activities under methodical observation was widened to encompass anything and everything, and particularly, aspects of society such as conscription, demography, suicide and criminality. Overall, the two main features in this endeavor were the great importance given to studying the poor, and the focus on seeking causes (in general terms). In public opinion, physicians were having a lot of trouble solving medical problems. They needed a strategy which

- would create a stir in the medical field,
- boost their claim to specialized knowledge,
- and, in this way, enhance the social authority of their profession.

Physicians began to place an emphasis on statistics.[2] They thought that this approach to seeking constant causes could eliminate uncertainty in sicknesses. They also felt that a tabular form of representation lent them an appearance of scientific objectivity. Hence, their use served their pretensions to scientificity well. Physicians had to find a cause. Calling on a material and physical explanation of illnesses like phthisis, madness or syphilis which afflicted many and had

[1] Laplace's *Essai philosophique sur les probabilities* was published in 1814 but this work was well-known long before. The work had gone through five editions before the author's death in 1827.

[2] In the 18th century, German intellectuals coined the noun *Statistik* but the thing had existed under the name of "political arithmetic" in England in the 17th century. By the 19th century, the label from the Germans was adopted.

no cure, could enable them to convince the French government and public opinion that physicians alone could diagnose and cure diseases. The refusal to consider contagion as a cause of illness led to the search for etiological explanations: heredity was the prime candidate. But it remained to be proven.

The development of medical statistics could not have occurred without hospital medicine.[3] Physicians were to take the hospital as their experimental site *par excellence*. The notion of pathological hereditary predisposition emerges at the point where clinical teaching converged with the use of medical statistics. Clinical observation of numerous cases – the basis of scientific medical knowledge – could lead to certainty only if it was completed by statistics from which doctors could extract a sufficient mass of probabilities. Administered by the State since the Revolution, the hospitals kept careful registers of patient admission and check out. Some practitioners, who had begun to specialize in treating madness, decided to make more use of the registers than just for calculating the cost of inmates. As Baillarger would say: "Asylums have hundreds and hundreds of the insane all in one place. Thus in La Salpêtrière and Bicêtre, there are more than two thousand of the mentally ill. Nothing is easier than to collect numerous observations in a few years." The moral physicians, as they called themselves, were well placed to collect rich data. And Baillarger added: "Indeed, consumptive, scrofulous and gout-afflicted persons are scattered here and there and a single observer would have much difficulty and spend much time collecting enough data."[4] For the French State, mental illness was *the* disease of the 19th century. Of the many medical topographies, newspapers and chronicles, the majority of texts that evoke physiological heredity were by physicians who had responsibilities in hospital asylums. These physicians were in the front line in opposing the religious orders who had been in charge of the hospitals and hence the insane before the Revolution. The religious orders were now recovering their former prerogatives, thanks to the monarchy's return. Here, we will examine only works written by the most influential doctors of the time. Physicians knew little about what caused madness, what its ultimate nature was, or how to cure it, but they still insisted that diagnosis and cure had to be made by members of organized medicine.

2. Hereditarianism and professional legitimacy

Within the framework of his project of "scientising" his moral treatment of the insane, Philippe Pinel (1745-1836) set out to use quantitative thinking. On the basis of his research, he concluded in the first edition of his *Traité medico-philosophique de l'aliénation mentale* (1801), that the "calculus of probabilities" could be used to determine the effectiveness of various therapies by counting the number of times a treatment had a positive effect. Although Pinel alluded to the mid-18th century work of the mathematician Daniel Bernoulli, there is little evidence that he meant anything more by the term "calculus of probabilities" than accurate record keeping. It is from

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3 "La clinique" in the M. Foucault's words.

4 (En effet tandis que) "les phtisiques, les scrofuleux, les goutteux sont disséminés çà et là (et) un seul observateur ne pourrait qu'avec beaucoup de peine et de temps arriver à rassembler un nombre suffisant d'observations. Les aliénés au contraire sont réunis par centaines dans les hospices, ainsi à la Salpêtrière et à Bicêtre il y a plus de 2000 aliénés et rien de plus facile que de recueillir en quelques années des observations très nombreuses" (Baillarger 1844).

1807 onward that we can consider Pinel a real user of statistics. Speaking at the Institut de France, he advocated that the use of the "calculus of probabilities will always be an easy and simple application when a distinct knowledge of the number of events, favorable and contrary, has been acquired".[5]

In the second edition of this *Traité* in 1809, he included a section entitled "Résultats d'observations et construction de tables pour servir à déterminer le degré de probabilité de la guérison des aliénés."[6] This section, more than two hundred pages in the new edition, was devoted to commenting on figures characterizing his patients in Bicêtre and La Salpêtrière and the circumstances of their illness. Pinel showed the importance of the patient's family background and his relationships to other patients. In the study of causes of madness, he defined two kinds: predispositional (or latent) and chance.

By starting his discussion of causes with heredity, he drew attention to this as a major predispositional cause, although his figures did not explicitly show it: "It would be difficult not to admit the hereditary transmission of mania when we see everywhere that in certain families, some members are affected by the disease, over several successive generations." It is interesting to note that, at the same time as Pinel was asserting that medical therapy could attain the character of a true science only "by the application of the calculus of probability", he abandoned all reference to the "concierges" method of curing.[7]

In the field of pathological heredity, the most influential voice was Esquirol (1772-1840). He was the first practitioner to specialize in the cure of madness only (Pinel was also a teacher at the *École de Médecine*). We know that his calculus had served as the premises for the 1838 law on the insane. His role as a statistician was not just an administrative one. Between 1810 and 1820 he made three research trips at his own expense to collect data. Esquirol argued that observation in medicine could be improved only by statistics. And when the *Académie de Médicine* was created anew in 1820, Esquirol was named a member of its Statistics Commission. It is in the framework of this institution that Esquirol played a part in the debate on numerical method. He spoke up on behalf of his colleague, Pierre Louis,[8] saying:

> What is experience if not observation of facts, often repeated and stored in memory? But sometimes, memory is unreliable. Statistics record and don't forget. Before a physician puts forward a prognosis, he has done a mental calculus of probability and solved a statistical problem. Notice that he has observed the same symptoms, ten, thirty, a hundred times in the same circumstances and from this, he draws his conclusion. If medicine had paid attention to this tool of progress, it would have acquired a greater number of positive truths. It would not be taxed with being a vague and conjectural science lacking strong principles.[9]

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5 Pinel (1807), p. 199.
6 Pinel (1809), pp. 402-403.
7 In the introduction to the first edition, Pinel had explained that his "moral treatment" was drawn from healers' practice. "Men who are strangers to medical principles and are guided solely by sound judgment or humble folk tradition have dedicated themselves to curing the insane and have brought about the recovery of a great many."
8 Pierre Louis had found that in a sample of 28 phtisics, 18 had at least one parent who was or had been ill with the same disease.
9 Esquirol (1835), pp. 5.

For Esquirol, this was why statistics had to lead to an evaluation of the relative importance of the various causes of madness. And the statistical procedures he used would be a demonstration of the "investigation of causes". An essential premise of Esquirol's reasoning was the validity of comparative studies of the insane made according to rigorous observations over time, and in which the variables of social context, climate, and same conditions of observation were similar or identical. From such studies, he suggested: "[…] what invaluable results could be had for understanding madness and its causes!" As well, Esquirol warned against using statistics to justify *a priori* knowledge but he was himself a prisoner of his own convictions.

On the basis of a 3-year survey (1811 to 1814) in La Salpêtrière, Esquirol found heredity to be the cause of mental illness in 105 out of 466 cases. This impressive proportion, almost 23 %, did not satisfy him and he made assertions that his figures did not, in fact, support: "I am sure that heredity predisposes to mental illnesses more frequently than my figures show here." Comparing the figures from La Salpêtrière to those from his private clinic, he concluded that hereditary mental disease was more frequent in rich people than in poor people. His ratios were 1 to 2 for the rich and 1 to 4 for the poor. Esquirol did allow that the proportion for the poor would probably be greater. At La Salpêtrière, poor female patients "often did not even know their parents' name," but in the private clinic where the rich were situated, doctors had more background information on the patients' families.

From 1820 on, Esquirol's figures were repeated in many works. Etienne Georget, used them, for example, in his famous treatise *De la folie.* Moreover, on several occasions, Esquirol had laid great stress on the large proportion of the "idle rich" (3 out of 4), as he had concluded that mental illness was also caused by *ennui.* The fact that only rich people were in a position to pay for medical treatment explains why there was such a focus on the number of rich who were mentally ill. It is also why physicians found it important to impress upon them the major risk of hereditary predisposition.

The medical profession in Paris, towards the end of the Restoration (1815-1830) had a pyramid shaped organization. At the very top, we find a notorious and inescapable personality, Antoine Portal (1742-1832):

- Before the Revolution, he was Professor of Natural History to the Dauphin. Afterwards, he was to hold eminent positions under all the different political systems that France would devise.
- In 1818, he was First Physician to the King, Louis XVIII, and in 1824, he held the same position under Charles X.
- And in the 1820's, he was also the President of *Académie de Médecine*, a member of the *Institut de France*, and Professor of Medicine at the *Collège de France.*

This incredible career was due to his work as an anatomo-pathologist and his publications. He wrote more than 40 volumes on a wide variety of medical subjects, including surgery. As he had performed many autopsies without catching any chronic disease, he concluded that such diseases were a matter of heredity rather than of contagion. He thus advocated the heredity of diseases in most of his works, especially in *Considérations sur la nature et le traitement des maladies héréditaires ou maladies de familles* (1808).

In less powerful intellectual spheres, there were other circles where social connections counted heavily in selecting candidates. Esquirol was a strong patron. His circle was very close to and

became solidly anchored in the state system. On his visits to provincial asylums, he was able to strike up relations with the physicians in charge. They were to reserve positions for Esquirol's disciples from the 1830s on. Jan Goldstein has compiled a list of nineteen doctors who were members of Esquirol's circle. In time, writing in the *Annales de Médecine Legale et d'Hygiene Publique*, founded by Esquirol in 1829, they would become advocates of Parisian moral medicine and work to spread the statistical methodology and conclusion on pathological heredity.

As Félix Voisin (1794-1872) was to say: "From every disease afflicting mankind, there is none which is transmitted more easily by heredity than madness. So, starting from this mathematical truth […]."[10]

Conclusion

When Portal died in 1832, a group of physicians, indebted to their patron for their hospital position and convinced that the inheritance of mental illness had been proved by statistics, could take over in defending the theory of inheritance of diseases.

The notion of latent hereditary predisposition allowed physicians to judge someone as potentially unwell even if he appeared completely healthy. This induced three significant developments:

1. with their claim to understand the causes of illness, physicians showed the French State that they had an important part to play in setting up the public health administration.
2. In the judicial system, alienists used the notion of pathological heredity to compete with judges in the courtroom, providing another understanding of criminal and destructive behaviors. Their expert knowledge could lead to the exculpation of criminal behavior or more humane methods of handling deviants who were deemed a danger to society.
3. The conviction that illness and vice could "run through generations of marriage" obviously had had implications for ideas about the role of physicians in the management of populations. Thus, doctors stressed their role as counselors to the upper classes on the advisability of particular marriages. They extended their role to the keeping of marriage registers, in the same way as lawyers kept records of property transactions.

The growth in heredity studies corresponded to a time of increasing fragility in the relationship between social controls and individual rights. The delicate balance was to be severely affected. The medical profession succeeded in slanting power in favor of social identity over that of the individual. It is thus no surprise that during the July Monarchy (1830-1848) we see physicians entering government "en masse".[11]

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[10] Voisin (1826), p. 287.

[11] Bajard, Dupuytren, Hahneman, P. Ricord, G.L Bayle, Beclard, Gall, Raspail, Villermé, Trousseau. In contrast, during the Restoration, the elected Chambre des Pairs had only 3 physicians who moreover did not practice medicine; Berthollet and Chaptal were chemists and Porcher-Dupleix, ennobled by Napoleon was practically the 'lord and master' in La Chatre (Indre).

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Poor Old Ancestors: The Popularity of Medical Hereditarianism, 1770-1870

John C. Waller

In 1769 the popular British medical writer William Buchan issued a stern warning to his many thousands of lay readers. "When a disease is contracted and riveted in the habit it is entailed on posterity. What a dreadful inheritance is the gout, scurvy, or the king's evil, to transmit to our offspring."[1] A few years later he continued on the same theme, "How happy had it been for the heir of many a great estate had he been born a beggar, rather than to inherit his father's fortunes at the expense of inheriting his diseases!"[2] From these short excerpts we can distil three of the primary characteristics of medical hereditarianism in the period stretching, very roughly, from 1770 to 1870.

First, hereditary maladies were typically assumed to have their origins in acquired conditions. Second, once a predisposition to a disease became 'rooted' in the constitution it was considered to be difficult to remove. Third, so resistant to therapeutics were heritable diseases deemed to be that sexual prophylaxis was regarded as the only reliable means of obviating their spread. Accordingly, those who had children despite haling from scrofulous families were routinely accused of having a callous indifference to the laws of life. When it is remembered that the conditions eighteenth and nineteenth century physicians labelled 'hereditary' (in particular, gout, scrofula, consumption and insanity) were prevalent and devastating, one can begin to understand why Buchan and hundreds of others recommended sexual forbearance with such pious conviction.

But there is something curious about the conceptualisation of hereditary malady I have just outlined: if new hereditary characteristics could be acquired, as most doctors agreed they could, then why were inherited maladies associated with such dismal prognoses? If the constitution was labile and susceptible to alteration, why would remedies be of no avail? Or, to put it another way, why was the origin of inherited disease judged to be compatible with *soft* hereditarianism, whilst hereditary maladies, once contracted, were typically described in all-but *hard* hereditarian terms. In trying to resolve this tension, one thing is immediately apparent. Ideas of hereditary disease drew upon but were seldom derived from empirical data. The pedigree evidence was slight and, as several doctors noted, highly ambiguous.[3] Nor can we attribute the genesis of the concept of hereditary disease to the weight of medical tradition; for, as has been stressed on several occasions, the idea of the specific disease diathesis was in part a creation of eighteenth century medical discourse.[4] In fact, as I aim to show, medical hereditarianism comprised an assemblage of largely unconscious and unexamined assumptions, sutured together by loose associations and certainly not by a process of logical deduction.

Exploring these associations will, I hope, provide the key to understanding the origins of the concept of hereditary disease and explaining why medical hereditarianism achieved such

1 Buchan (1791), p. 9.
2 William Buchan (1809), p. 15.
3 See, for example, White (1784), p.10; and Henning (1815), p. 19.
4 See Carlos López-Beltrán (1992) and López-Beltrán's contribution to this volume.

paradigmatic importance in eighteenth and nineteenth century medical discourse. I will begin this analysis by substantiating the claim that heredity and relative fixity were virtual synonyms in medical parlance. Then I will go on to show how this non-obvious association arose, and why it proved so congenial to the medical profession.

To Palliate or to Cure?

The association between heredity and incurability was a touchstone for both sides of the eighteenth century debate as to the proper treatment of gout. In 1772 the Bristol-born physician William Cadogan irritated many of his peers by stating that given simple changes in lifestyle no-one need suffer the agonising paroxysms of gout. Yet in pressing home this view, Cadogan felt it imperative to refute the idea that gout is heritable; for, he explained, heritability automatically implied that any remedy would be to no avail. Cadogan argued with Puritanical zeal that the condition is caused by improper living, or "the mistaken habits of life." Talk of diatheses was dangerous, believed Cadogan, because having received a diagnosis of *inherited* gout the afflicted promptly abandoned any hope of cure and continued to live dangerously indulgent lives. The possibility that gout was both hereditary *and* curable apparently never occurred to him. "Diseases really hereditary," he wrote, "I fear are never cured by any art or method whatsoever."[5]

In accusing medical hereditarians of fatalism, Cadogan hardly exaggerated. As early as 1734 the English physician Thomas Bennet was explicitly linking heritability with the inefficacy of medicine. "The Acquir'd Gout may be cur'd," Bennet wrote, "the Hereditary reliev'd." Or, as he went on to say, "Hereditary Gout […] may be at least palliated, the Intervals lengthened out, or the Paroxysm render'd less VIOLENT; and the Acquir'd, if taken in Time may be always with Safety, and generally with Certainty, cur'd."[6] This binary opposition between heredity and curability persisted throughout the eighteenth century, and beyond. Sir James Jay, for example, did not deny that "palliation" was possible, but he was adamant that "gout must be looked upon as a hereditary disease," in consequence of which, "a radical cure is not to be expected." Few medical hereditarians had much more to recommend to their seriously gouty readers than the virtues of a stoical frame of mind. Only charlatans and quacks, they agreed, would claim that gout can be any more than palliated by the available *materia medica*.[7]

To an equal if not greater level, fatalism permeated discussions of the scrofulous maladies. The scrofulous diathesis was considered by most doctors to be the underlying cause of not only scrofula, but also consumption and, in some cases, secondary and syphilis too. Accordingly, all called forth gloomy prognoses. London's George Henning made the cognitive ties between inheritance and incurability most explicit. "I am now to advert," Henning wrote in a treatise of 1815, "to an opinion concerning the nature of scrofula, which has long been entertained, and which, if it was well founded, would supersede all reasoning, and render the practice of medicine in it of no avail; namely, that it originates, and wholly depends on a something, which is transmitted through parents to their progeny."[8] The London surgeon Thomas White reckoned

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5 Cadogan (1772), p. 18-19. Having cited evidence for the curability of gout, Cadogan also noted, "this is another strong argument that proves it not hereditary" (p. 7). See also Stevenson (1779), pp. 6-7.

6 Bennet (1734), p. 30.

7 Jay (1772), pp. 43-4; Berdoe (1772), p. 9.

that medical hereditarians had cost "many thousands of lives" because their pessimism had forced desperate patients into the hands of charlatans dispensing heroic remedies.[9] White demurred from conventional wisdom believing that scrofulous diseases could be controlled through changes in lifestyle and the taking of specifics. As with Cadogan, his therapeutic optimism impelled him to inveigh against the doctrine of hereditary disease.[10] Crucially, neither he nor Cadogan ever doubted that heritability implies difficulty of cure.

The same assumptions pervade Sir James Clark's 1835 *Treatise on Consumption*. Clark explained that standard therapies usually fail to arrest this terrible malady because they are directed at superficial symptoms rather than at the diathetical cause of all scrofulous maladies. For Clark, as for the majority of his fellow physicians, the alleged fact that consumption was "a hereditary disease" readily explained the difficulty they had in treating it. Condemning the panaceas of quack medicine, Clark asserted that the hereditary taint is so difficult to eradicate that, even in ideal conditions and with the most appropriate regimen, it still takes at least a "few generations" to effect a full cure.[11]

But there were many different forms and degrees of scrofulous disease, some of which carried rosier prognoses than others. It is therefore even more significant that it was only the incurable forms of the malady that tended to be placed within the hereditary category. William Stokes, another influential British writer on consumption, instructed doctors to attempt a cure only in "the absence of the strumous diathesis, or hereditary predisposition." Where there is evidence of a diathesis, Stokes continued, stick to "palliatives."[12] Richard Payne Cotton, physician to Brompton's Hospital for Consumption, also noted that "cases arising from hereditary taint [are] more intractable, of shorter duration, and less amenable to remedial agents, than those in which the tuberculous diathesis has, from any cause, been acquired."[13] James Whitehead, author of a treatise on hereditary diseases, emphatically agreed. "When a disease," Whitehead wrote, "the elements of which were inherited, has once been developed into palpable form, all efforts at what is termed a radical cure, will probably be unsuccessful."[14]

The terms of this debate were recapitulated among early nineteenth century alienists. Despite his firm anti-hereditarian stance on gout, William Cadogan had described "mania" as unquestionably heritable because of its apparent incurability.[15] Similarly, those psychiatrists who made a distinction between the heritable and environmental causes of madness were mostly convinced that the more intractable forms of madness involved hereditary taint. Briton's George Man Burrows stated baldly: "Hereditary insanity protracts." And, although alleviation is sometimes possible, Burrows added that "relapses and recurrences are more often to be expected."[16] Not all alienists, however, agreed. James Cowles Prichard, for instance, deemed

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8 Henning (1815), p. 49.
9 White (1784), p. 12.
10 Cadogan (1772), p. 14. Cadogan also considered the scrofulous maladies so hard to treat that they had to be heritable (Ibid., p. 17).
11 Clark (1834), p. 63.
12 Stokes (1844), pp. 417-9.
13 Cotton (1858), p. 86.
14 Whitehead (1851), p. 66.
15 Cadogan (1772), p. 19.
16 Burrows (1828), p. 568.

hereditary madness to be "not less curable than a disease having symptoms of the same description." But Prichard recognised that he was at fault with general psychiatric opinion.[17]

In America, most early Victorian doctors shared Cadogan's and Burrows' attitude of qualified pessimism towards cases of allegedly heritable insanity. Presenting an overview of psychiatric thought in 1847, George B. Wood noted, "Inherited insanity is less easily and permanently cured than that arising without such predisposition."[18] William H. Stokes, a Maryland psychiatrist, predicted that "ninety-nine in a hundred can be radically restored" from madness, but he lodged an important caveat: such improvements could not be expected in individuals with "a strong constitutional [i.e. hereditary] tendency to mental disease."[19] These confessions of impotence in the face of hereditary insanity are all the more significant because they coincided with a period of intense optimism in psychiatry. But the conceptual link between heredity and incurability was so deeply entrenched in the logic of medical practice that in the case of inherited madness optimism was often conspicuous by its absence.

During the second half of the nineteenth century, there are indications that psychiatric theory became generally more fatalistic. As asylums became overcrowded and filled up with the incurably insane and large numbers of socially marginalized immigrants, it is said that psychiatrists were no longer able to sustain the soaring optimism of the days of Phillipe Pinel and Daniel Tuke. An indicator of this, several historians have argued, was an increase in the invocation of heredity as a causal factor in mental illness.[20] Of course, heritability had been identified as a chief predisposing factor in madness since the late eighteenth century and had always been associated with ineradicability. But it does indeed seem that the 1860s witnessed a growing fascination with essentialistic psychology. Dozens of examples, from Britain and America, indicate that Henry Maudsley's extreme mental hereditarianism of the 1860s and 1870s was far from exceptional. Even Maudsley's well known eugenic proposals were adumbrated by several prominent medical and psychiatric writers during and after the late 1700s.[21]

This fatalism is no less perceptible in non-professional discourses. The heritability and persistence of gout was so firmly established that by the late 1700s the gouty diathesis had become a primary cultural motif for notions of tradition and pedigree.[22] And the fear of marrying into hereditarily tainted families was well entrenched by the late eighteenth century.[23] There is much evidence to suggest that parents often sedulously examined the relatives of their children's suitors for evidence of chronic disease; and after titles, cash and connections, the family's record of health was often the next most serious criterion used when deciding whom their progeny should marry. It was rumoured, for instance, that the poet William Cowper's hopes of marrying his cousin were vetoed on the grounds that hereditary insanity existed in both lineages.[24] And the theme of 'prudent' reproduction is explored in several eighteenth and nineteenth century novels.

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17 Prichard (1837), p. 122.
18 Wood (1847), p. 759.
19 Cited in Earle (1887), p. 40.
20 See, for example, Dain (1964), especially chapter 4 and Jacyna (1982).
21 See Waller (2001).
22 See Porter and Rousseau (1998) and Macaulay (1834), p. 285.
23 See Percy ([1609] 1930), p. 12 and Gregory (1774), p. 9.
24 King (1986), p. 24.

In his last work, *Sir Charles Grandison* (1759), Samuel Richardson explicitly linked heredity and untreatable insanity. Referring to the marital aspirations of two of the principal characters, he narrated: "The Count found an opportunity to let me know his unabated passion for Clementia and that he had lately made overtures to marry her, notwithstanding her malady, having been advised, he said, by proper persons, that as it was not an hereditary, but an accidental disorder, it might be, in time, curable."[25] Unsurprisingly given medical orthodoxy of the time, many children born to insane parents lived in considerable fear of what one novelist described as "the evil destiny" of hereditary madness. So much so, in fact, that Charles Dickens classed inherited insanity as a taboo subject unsuitable for mention in the journal he edited, *Household Words*. Thus when in 1847 his friend, the crime novelist Wilkie Collins, asked him to publish a short story on the subject of hereditary insanity, he was peremptorily turned away.[26]

Claims that insanity is heritable clearly troubled Charles Dickens. A decade before fobbing off Collins, he had written *The Pickwick Papers* in which he referred to the "well-known medical theory" that "hereditary madness" exists in certain families. Dickens lodged his disapproval of the idea by explaining how one particular madman fell into "morbid insanity" and eventually "raving madness" because he became obsessed with the "strange delusion" that he had inherited the seeds of mania.[27] As Dickens saw, the adjective 'hereditary' struck terror into those whose madness was so labelled because it suggested that all hope of cure was vain. Dickens, however, was probably being over-protective of his readers, as during the following decades a spate of novels were published, all presenting the same gloomy conception of hereditary insanity. Geraldine Endsor Jewsbury's 1855 *Constance Herbert* was based entirely around the theme of hereditary insanity and the moral duties of the afflicted. In this novel, the feckless and irresponsible father of Constance, Charles Herbert, is redeemed only by recognising the folly that led him to reproduce. Bemoaning the fate of his daughter, he sobs: "To know that she is doomed to live under the shadow of madness, and that it is I, her father, who have entailed it upon her; - it is this, this that is the bitter sting in my grief."[28]

Most famous of all nineteenth century treatments of hereditary insanity was Mary Elizabeth Braddon's 1862 crime thriller *Lady Audley's Secret*. Lady Audley had many secrets, not least her bigamy, her abandoned child, and the attempted murder of her first husband and his best friend. But there was one secret that first propelled her into the career of lying and deception that resulted in her eventual incarceration in a Belgian asylum: the fact that her mother had "died mad" in a "mad-house" and that, therefore, she too probably carried what the novel's alienist referred to as the "taint of hereditary insanity."[29] *Lady Audley's Secret,* one of the most popular books of the Victorian age, turned on the assumption that heredity implies incurability. To its readers, the description of Lady Audley's pedigree at the denouement of the book gave them the final piece of information they required in order to understand the reasons for Lady Audley's career of reckless and murderous deceit.

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25 Richardson (1753-4), vol. 4, letter 40.
26 See House and Storey (1965), p. 45.
27 Dickens (1839), p.146.
28 Jewsbury (1855), 2: p. 23.
29 Braddon (1862), 3: p. 231.

Nor were these the only treatments of hereditary insanity in Victorian fiction. Jane Margaret Winnard's 1854 *Lady of Darkness,* Holme Lee's 1862 *Gilbert Massenger* and Wilkie Collins' 1859 *Mad Monckton* all focused on the theme of inherited mania and all characterised it as an irrepressible and uncontrollable morbid taint.[30] These authors were equally undivided in declaring the marriage of the hereditarily mad to be morally repugnant. Clearly, to the popular novelist and to the professional psychiatrist, sexual prophylaxis was one of the few guaranteed means of obviating the risk of future lineages being condemned to madness. And this observation brings us back to the seeming paradox highlighted at the beginning of this paper. If it was generally assumed that the heritable material was susceptible to alteration, why did the term 'hereditary' so frequently carry connotations of destiny and incurability? In short, how and why did this cluster of associations arise?

Of essence and experience

The biological concept of heredity originated from the desire to label, if not explain, the phenomenon of offspring more closely resembling their parents than more distant relations or, for that matter, different species. It was an essentialistic concept invoked to describe the stability and/ or fixity over the course of generations of certain species, racial or familial attributes. Yet a recognition that the extraordinary variety of heritable traits could not have been present in the progenitors of each species pushed natural philosophers into accepting various forms of soft hereditarianism. The hereditary material became plastic, and acquired features and traits heritable. This, however, had significant repercussions for the concept of heredity: its meaning was detached from its anchorage among the Platonic essences and allowed to drift towards the opposite pole. In other words, the belief in the inheritance of acquired characteristics blurred the distinction between what one is born with and what one acquires during a lifetime of experiences. It followed logically from this shift that nothing inscribed in the hereditary fabric had to be considered indelible.

Nevertheless, the association between heredity and relative fixity persisted. Indeed, so strong did it become that for centuries, possibly for millennia, the direction of inference ran in *both* directions: fixity began to imply heredity almost as much as *vice versa.* The very fact that an attribute seemed resistant to change over an individual's lifetime time indicated that it was also very likely to be heritable. This confusion, or conflation, of meanings underpins much of the tradition of hereditarian thought and, I believe, helps explain why heredity was so routinely applied to mental characteristics and disease states even when there was no evidence that an individual's parents were similarly endowed. A representative example is provided in Alexander Walker's book *Intermarriage.* This London doctor wrote in 1839 of an anonymous Frenchman who learned to speak English with breathtaking fluency in less than two years. Such a pronounced aptitude seemed inexplicable in terms of learning and environment: something deep-rooted and (therefore) hereditary had to be at work. Sure enough, upon investigation it transpired that Walker's linguist had an English-speaking grandmother. The Frenchman had never met his

[30] Winnard (1855); Collins (1859).

grandmother but he had inherited a voice box adapted to speaking her native tongue. How else, Walker noted, would he have been able to pronounce 'Thistlethwaite'?[31]

In the same way, when centuries of writers spoke of the "nature" or "disposition" of their characters, referring to the stable elements of personalities that might be refined or modified but not erased, it required only a small cognitive step to make them hereditary as well. One did not need direct evidence of hereditary transmission in such cases, the intractability of the quality in question was usually evidence enough. Conversely, heredity has often been invoked by writers to imply a lack of personal control over deep-seated thoughts, feelings and actions, and especially the inability to suppress sexual desire. The contradiction arising between the Christian morality of self-denial and the more primitive, animalistic instincts that people observed in themselves convinced many that mankind was beyond redemption, and theories of hereditary taint rationalised people's sense of their desires and drives being beyond their conscious governance. Similarly, poets and playwrights implied that original sin is somehow part of man's physical fabric, a hereditary entailment against which he is utterly defenceless.

It was as a means of emphasising the fixity of traits that Victorian writers so frequently introduced the idea of heritability. George Eliot used the motif of heredity in her 1868 *The Spanish Gypsy* to signify the irresistibility of her heroine's tragic fate. Fedalma had been "chosen", she wrote, "not by any momentary arbitrariness, but as a result of foregoing hereditary conditions."[32] Novelists, including George Eliot, found the idea of heredity just as useful; for it instantly symbolised to the reader that the traits in question defined the individual and set the boundaries of their potential thoughts and actions. Indeed, it was because of her fascination with the insufficiency of the individual will that Eliot made such extensive use of essentialistic concepts. In *Middlemarch*, for example, Dorothea's irrepressible humanitarian zeal was attributed to a "strain" of Puritanical energy that ran through her family and "glowed alike through [all her] faults and virtues."[33] So deeply inlaid in her nature was this zeal that she could in no way resist her urge to improve the conditions of her fellow creatures. Such a basal quality, it seemed to Eliot, had to be traceable to Dorothea's ancestry.

Likewise, when Dickens wished to emphasise Martin Chuzzlewit's propensity for getting into violent scrapes, he imputed a long tradition of Chuzzlewit pugnacity extending back to "their Great Ancestor beneath the vaults of the Parliament House at Westminster." In this novel Dickens came close to identifying the underlying rationale of imputing heredity. Seeking to account for the murderous tendencies of Jonas Chuzzlewit, he remarked, "the more extended the ancestry, the greater the amount of violence."[34] True bellicosity, it seemed, had to have a pedigree. Likewise, it was in order to explain the intractably immoral character of Becky Sharp that William Thackeray raised the possibility of hereditary taint in *Vanity Fair*. Miss Pinkerton, her school mistress, comments on her ward's pedigree: "My dread is, lest the principles of the mother – who was represented to me as a French Countess, forced to emigrate in the late revolutionary horrors; but who, as I have since found, was a person of the very lowest order and morals – should at any time prove to be hereditary in the unhappy young woman whom I took as an outcast."[35] The

[31] Walker (1839), p.108.
[32] Eliot (1868), 3: p. 22.
[33] Eliot, (1872), p. 13.
[34] Dickens (1844), p. 12.

misdemeanours that Becky Sharp would go on to commit were so wicked that they required a hereditarian rationale.

Of course, heredity has never been applied solely to malign qualities: any marked characteristic has tended to earn the adjective 'hereditary'. The parents of geniuses, for instance, have been expected to be prodigiously able themselves. And Francis Bacon's remark "genius continueth not" arose from his surprise that so many sons were actually disappointments to their fathers (though Bacon could hardly have felt let down by Nicholas). Indeed, the failure of some of the greatest minds, from Shakespeare to Cromwell and Pope, to produce talented offspring caused considerable puzzlement. In writing his biography of the famously low-born Michael Faraday, John Tyndall struggled to explain his lack of eminent forbears. How could so pronounced a quality as Faraday's intellect, he asked, have arisen *de novo*? "I once used the privilege of my intimacy with Mr. Faraday," Tyndall wrote, "to ask him whether his parents showed any signs of unusual ability. […] He could remember none. His father, I believe, was a great sufferer during the latter years of his life, and this might have masked whatever intellectual power he possessed."[36] Because it was hard to imagine anything as distinctive as Faraday's intellect being other than heritable, nature was emphasised over nurture despite all the evidence pointing in the opposite direction. In 1857 G. H. Lewes chided those who, like Tyndall, ignored counter-examples.[37] But only three years later even Lewes affirmed the heritability of high intellect by listing about a dozen notable cases, such as the Bachs and Tassos, in which talented fathers sired famous sons.[38]

Those historians who claim that concepts of heredity pre-Weismann were non-deterministic typically refer to the hereditarianism of Victorian optimists such as Spencer, Robert Chambers and an array of professional and amateur phrenologists. And, to be sure, these figures did stress the capacity for the individual's heredity to be improved from generation to generation. Nevertheless, one must ask why these prophets of progress seized upon hereditarian concepts with such alacrity. The answer is I think straightforward: If intellectual and moral improvements could be rooted in the hereditary makeup this implied that any gains would be much more permanent than if they rested on emulation and education alone. Hereditarianism appealed to the social reformers precisely because it suggested that progress was an additive process and that achievements were hard to reverse. This is also precisely what the large readership of phrenological works wanted to be told. Their own attainments, they were delighted to find out, would lead to the birth of more intelligent and moral children whose capacity for edification would exceed their own. There would be no risk of affirming the old maxim 'rags to rags in three generations', for backsliding was barely even a possibility.

Explaining failure

The conceptual suture we have been exploring between fixed traits and heritability provides the key to understanding why certain conditions were labelled heritable. History's doctors were confronted with a wide range of persistent maladies, like gout, scrofula and consumption that

35 Thackeray (1847-8), p. 90.
36 Tyndall (1868), p. 15.
37 Lewes (1857), p. 384.
38 Lewes (1859).

failed to respond to anything within the available pharmacopoeia. In attempting to explain the tenacity of chronic diseases, the concept of heredity was an obvious recourse. The Greeks might have said little about the inheritance of specific maladies, but the conceptual framework in which chronic ailments came to be associated with heritability was of extremely ancient provenance.

So, just as with Alexander Walker's anglophone Frenchman, pedigree itself was not in the first instance important. The mere fact that chronic maladies refused to respond to medical care was enough to suggest a corrupted inheritance. But once invoked it was easy to make the label 'hereditary' stick. For gout, scrofula and consumption were so common that they could be expected to appear every two or three generations in most families. Even where the pedigree evidence was very weak indeed, the doctor could declare that the family carried a latent taint, or predisposition, that had remained dormant for many generations. In fact, of course, the pedigree evidence was open to multiple interpretations. But the strong tendency to conflate heritability with destiny became a critical factor in sustaining the concept of hereditary disease.

There was also another way in which the conflation of heredity with fixity helped forge the concept of hereditary disease. It is vital to realise that physicians almost universally agreed that the locus for chronic diseases like scrofula, consumption, gout and, in some cases, madness, was the inborn constitution. The idea of the individual constitution, or temperament, derived from a Hippocratic-Galenic tradition that remained vibrant during the 1700s and 1800s despite the rise of localism. The concept itself was predicated on the idea that some individual aspects of character, health and appearance are highly resistant to change over time. A person, it was believed, was born and died with the same temperament, whether lymphatic, bilious, sanguineous, phlegmatic or, in some typologies, nervous and athletic. This constitutional arrangement linked together general bodily condition, upon which the individual's health depended, with such apparently fixed properties as physiognomy, hair and skin colour, the general shape of the body, mental acuity, and the individual's type and degrees of intellect and emotionality. Seen as core elements of individuality, these traits lent coherence and continuity to an individual's existence in the midst of a daily life of seemingly bewildering flux and unpredictability. Clearly, that the constitution itself could be significantly altered, for good or for ill, was in large part antithetical to the very idea of a physiological constant. As such, those born with constitutional imbalances, doctors claimed, could only remain healthy through the constant efforts of their doctors to maintain equilibrium. Enduring changes would take many years to accomplish.

Considering that the constitution was deemed this hard to alter, it should come as no surprise to learn that it was also generally assumed to be heritable. "That a peculiar temperament distinguishes a nation, no one who will consult history, or look through the world, at the Turks, the Dutch, the Spaniards, can deny," explained George Bancroft in a lengthy 1829 essay entitled the *Doctrine of Temperaments.*[39] Likewise, the American doctor John B. Lewis noted that the "peculiar condition of organism we denominate temperament, is remarkably subject to continuation in the offspring."[40] Adhering to Ancient medical tradition, most doctors accepted that the constitution was no less heritable than hair colour, eye colour and physical form. Indeed,

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[39] Bancroft (1829), p. 142.
[40] Lewis (1866), pp. 87-105, p. 96. See also Anonymous (1833), p. 122.

those inheriting "fair hair, light blue or light grey eyes, and a fair, soft skin" were for long believed especially likely to be carriers of the scrofulous taint.[41]

This provides the final key to explaining how the concept of hereditary malady thrived despite the paucity and ambiguities of the available pedigree data. As we have seen, in the shape of gout, consumption, scrofula and insanity doctors confronted on a regular basis a range of serious and apparently incurable conditions. In explaining their resistance to medical therapeutics, one option was to invoke environmental causes alone, such as unhealthy lifestyles capable of producing stubborn build-ups of morbid poisons. But this explanation must have seemed implausible to many doctors because modulating the sufferer's habits and environment, or subjecting them to courses of bleeding and purging, rarely seemed to have a beneficial effect. This being the case, a rather more persuasive rationalisation was that chronic diseases were caused by forms of constitutional disturbance. Since the constitution was deemed to be largely unchanging, it shared with chronic, hard-to-treat maladies a fundamental property: altering environmental conditions seldom produced lasting change. Diseases like insanity, scrofula and gout, on the one hand, and the individual constitution, on the other, were both characterised by relative permanency. Grafting irremediable illnesses onto the pre-existing notion of the inborn constitution was a means of explaining the hitherto inexplicable.

This, however, reinforced the association between chronic illness and inheritance. For making incurable maladies constitutional implied that they were also, at least some of the time, hereditary. It was a view neatly expressed by the New York doctor Daniel Haynes in 1838. Having argued, that "hereditary diseases are never cured," Haynes justified his belief on the grounds that some illnesses are so firmly fixed within the body's organisation that they are bequeathed alongside its essential corporeal structures. "I believe it will be generally admitted," he wrote, "that a disease contracted, not inherited, by what we call a healthy man, may become so confirmed and fixed in his system, as to be by him transmitted to his offspring, and become a hereditary disease."[42] The primary suture here was between the ideas of incurability and the individual constitution. The connection between heredity and incurable disease was to some extent a consequence of this linkage. Once again, of course, this was an association of ideas underpinned by the conflation of fixity with heritability in Western biological thought.

But the concept of the disease diathesis not only had the power to rationalise incurability. Perhaps just as importantly it was also capable of legitimating it. Encountering, over a lifetime's practice, hundreds of desperate patients with persistent, chronic maladies, few doctors could have relished explaining to them that for reasons they could not fathom, medical science could treat some cases of chronic malady but not others. One means of upholding the dignity of the profession was to insist that diseases like gout, scrofula and phthisis were the result of faulty constitutions over which doctors could hardly be expected to exercise any curative authority. The relative fixity of the individual constitution was an accepted principle of both professional and popular medical thought, so locating chronic disease within the constitution promised to assuage any doubts the public might have had in the competence of the medical profession. Once more, a

41 See Phillips (1846), p. 10.
42 Haynes (1838), p. 198.

bi-product of forming this conceptual linkage was that gout, scrofula, phthisis and insanity inadvertently became hereditary maladies.

This explanation was also suggested by a handful of eighteenth and nineteenth century medical writers. Thomas White rhetorically asked why doctors assumed that scrofula was hereditary. "To deem it hereditary," he explained, "was the best apology that ingenuity could devise" for the "great difficulty of curing those afflicted with it."[43] The poet John Byrom versified the same suspicion:

> When our distempers did their names receive,
> (One instance more, good doctors, by your leave),
> Some chronic matters, such as gout and stone,
> That would the fare of no arcana own,
> To save their Credit, these, the learned dons,
> Cried out, were fix'd hereditary ones:
> If a man's father, grand- or great-grand sire;
> Had the same, 'twas needless to enquire;
> Plain was the case, and safe the doctor's fame;
> The poor old ancestors bore all the blame.[44]

George Henning put the case with the greatest tenacity. "It is a fact, on every account worthy of observation" he wrote in 1815:

> […] that gout and mania, scrofula and phthisis, together with epilepsy are the only diseases […] which are acknowledged to be incurable by the means of medicine, and are the only ones that have acquired the character of being inheritable. A fact that begets some suspicion that the medical world has taken sanctuary under this term hereditary, to shelter themselves from the opprobrium of not having devised remedies for these obstinate maladies. For surely, if it can be rendered plausible, that these infirmities are so intimately blended, by nature, so interwoven, as it were, with our fabric, as to be inextricable form it by any art, we vindicate our profession from censure, although we add nothing to the reputation of it.[45]

Revealingly, in the literature of the 1700s and 1800s there is barely a single case of an author claiming a chronic malady to be non-hereditary as well as incurable. This is not surprising. For, to have held this unhappy position, would have been to acknowledge the limitations of ones professional competence whilst depriving oneself of any face-saving rationalisation for failure. Cadogan, White and Henning were happy to repudiate the concept of hereditary disease, but *only* because they shared the conviction that the profession was selling itself short and that chronic diseases frequently "give way to medicament and skilful regimen."[46]

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[43] White (1784), pp. 15-16.
[44] Byrom (1899), p. 70.
[45] Henning (1815), p. 58.
[46] Cadogan (1772), p. 34.

"Fix'd hereditary ones"

"Fix'd hereditary ones" – this cluster of words from Byrom's poem crisply conveys the associative relationship that underpinned the idea of hereditary disease. By the late 1700s, heredity had come to be invoked, as little short of a cognitive reflex action, whenever a characteristic seemed unusually stable over long periods. In the case of inherited malady, this false syllogism had a double bind. Within this theoretical framework, because certain maladies were resistant to medical intervention, they could automatically be considered heritable. At the same time, the failure of therapeutics to cure many chronic diseases called forth another essentialistic category, constitutional disease, which because of its association with fixity, in turn also came to imply heritability. Small wonder that it proved extremely hard to dislodge the notion that conditions such as consumption were heritable, even after Robert Koch's famous bacteriological investigations. Likewise, we can now see why, when psychiatrists assembled clear evidence to show that insane individuals with insane relations were no less treatable than those without,[47] the association between heredity and incurability remained unbroken.

Broader inferences may also be drawn from this analysis. An over-emphasis on how doctors, naturalists, physicians and breeders imagined new hereditary variants to arise has, in my opinion, obscured the implicit fatalism of much hereditarian thought prior to the 1880s. Soft hereditarian assumptions may have been routinely invoked to explain the differences among species, races, tribes and families, but inherited mental traits and disease conditions were assumed to be extremely stubborn once engendered. Indeed, according to many physicians, only a distinct physical principle, usually dubbed the 'law of atavism' or 'variation', could explain why hereditary diseases often seemed to disappear and why mankind was not freighted with a far heavier load of inherited flaws. Finally, once we appreciate this powerful current of fatalism I think it becomes easier to account for both the hard hereditarianism of Charles Darwin and the recurrence of eugenic ideologies at irregular intervals throughout modern European history.

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[47] See, in particular, Stewart (1864).

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Comments on the papers given by Phillip Wilson, John C. Waller, and Laure Cartron

Gianna Pomata

Since this workshop is part of an ongoing series of conferences, I will include in my comments the essay by Carlos López-Beltrán "Natural Things and Non-natural things. The Boundaries of the Hereditary in the 18th Century", that was presented at the preceding conference,[1] and that in my view gives important background information for a better understanding and discussion of the essays by Wilson, Waller, and Cartron.

1. López-Beltrán has pointed out a decisive shift in the conceptualisation of heredity in the early 19th century. He argues that after the 1830s, first in French and then in other European languages, one can notice a transition from a typically adjectival use of the term (the hereditary) to a nominal use (*hérédité*, heredity). According to López-Beltrán, this reification, or "hardening", of a concept that had been formerly used in a loose metaphorical sense, implied the creation of consensus over the "facts of heredity" as a commonly recognised set of observed regularities, a growing attribution of causal value to genealogical links and the progressive transformation of heredity into a central aspect of physiology and pathology.[2]

López-Beltrán contrasts this new strength and salience of the concept of "heredity" with the marginality of the "hereditary" in early modern medicine.[3] Before the early 19th century, he argues, the hereditary was not a stable domain, an object of debate rather than general consensus, nor was it a key-element of physiological and pathological theories. A set of phenomena called hereditary (resemblance to parents, origin and transmission of monstrosity, etc.) was discussed in the 17th and 18th centuries in relation to the theory of generation. But the transmission of form from generation to generation was seen as due to a constant invariable cause that gave the species its fixity and stability, and had nothing to do with the contingencies of genealogy. For either preformationists or epigenetists, there was a basic common structure for each species (due to a pre-existent germ or to some epigenetic principle) over which the singular, accidental characters of the ancestors had no permanent influence. It was considered impossible that variations due to external influences (such as climate, nutrition, etc.) would be integrated into the lineage and eventually adopted in non-accidental manner. In consequence, López-Beltrán argues, the hereditary was seen as belonging to the domain of the accidental. To use his own words, "there was a deep conceptual hiatus between the explanation of organization (taxonomic similarities) and of accidental individual peculiarities (variations)."

According to López-Beltrán, this conceptualisation of the hereditary as accidental explains why from Antiquity to the Renaissance and well into the early modern age, Western medicine paid little attention to the heritability of disease. In the 18th century, innovators such as the "solidists" (who believed that disease was caused by physical or mechanical lesions of the solid body parts – fibers, tissues, organs) did not believe in hereditary diseases, since they did not believe that

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1 López-Beltrán (2002).
2 López-Beltrán (1994).
3 But see the entry "morbi hereditarii" in Lipen (1679), s.v.

external factors could affect the body irreversibly. In contrast the humoralists, building on the ancient Galenic notion of individual temperament, or constitution, thought it possible that the embryo could be altered by peculiarities of the parental seed (paternal or maternal) due to external influences, and that such alterations could be transmitted through the lineage. How were these alterations produced? López-Beltrán explains at length how the notion of the six "non-naturals", deeply rooted in humoralism, was used to explain the link between body and environment. The Galenic distinction between the seven "natural things" (elements, temperaments, parts, humours, spirits, faculties, actions) and the six "non-naturals" (air, food and drink, work and rest, sleep and vigil, retentions and excretions, the passions of the soul) allowed the conceptualisation of the boundary and interplay between internal and external determination of bodily features. "Non-natural" factors (such as diet, exercise, mental and emotional states, etc.) could affect the internal balance of the humours that was the main determinant of individual temperament. The disease (conceptualised in Galenic terms as "praeternatural", that is a deviation from nature's customary ways) appeared when something went wrong in the interaction between naturals and non-naturals. According to López-Beltrán, the concept of heritability of disease was developed in connection with a stronger emphasis on the heritability of temperament. If temperament could be modified by the "non-naturals", that is by behavioural and environmental factors, this modification could be transmitted across generations as a particular susceptibility to disease. López-Beltrán stresses, however, that this was at best a very soft form of hereditarianism. Within humoralism, what was inherited from the parents was only a small portion of the complex web of influences that acted over each body, and it could in any case be further modified by non-natural factors. The hereditary was the consequence of non-natural factors, and it was not irreversible because they could again affect it. In this framework, hereditarianism was strongly subordinated to environmentalism. More importantly, the hereditary was conceptualised as unstable: there was always the possibility that hereditary traits could be discontinued or even reversed by behavioural and environmental changes in the non-naturals. At the end of the 18th century there was considerable variety of opinions on this issue. Kant, for instance, believed that variations due to inheritance of traits derived from external influences could disappear in changed circumstances. For Blumenbach instead hereditary variation, including hereditary disposition to disease could become a stable part of temperament, an irreversible "second nature".

So López-Beltrán stresses that within a humoralist framework, the notion of hereditary transmission of disease did not go beyond a "soft hereditarianism", which went hand in hand with a strong emphasis on behavioural and environmental factors as the crucial determinants of temperament. The notion of hereditary transmission of physical and moral characters did not preclude the possibility of improvement through hygienic measures – a view that French vitalists preserved throughout the 19th century. According to López-Beltrán, a breakthrough occurred only in the first half of the 19th century, when solidists accepted the evidence of hereditary transmission of diseases. At this point a distinction was developed between properly hereditary transmission and congenital influences derived from external factors. Only at this point could "hard hereditarianism" develop.

2. The papers by Wilson, Waller and Cartron provide further evidence of the transition from "soft" to "hard" hereditarianism in English and French medical thought over the 18th and 19th

centuries. Wilson describes in detail Erasmus Darwin's notion of hereditary diseases, which seems to have been typical of the "soft hereditarianism" of 18th century doctors. Like many of his contemporaries, Dr Darwin adopted the view that diseases such as gout, consumption, scrofula, epilepsy, insanity were hereditary. What was inherited however was a "tendency" – the diathesis, a predisposition to disease – that could be effectively stopped by behavioural changes (the non-naturals). Not only disease in general but even hereditary disease was amenable to treatment through changes in the "non-naturals". That behaviour was considered crucial in explaining and treating these "hereditary diseases" is shown by the fact that they were also called the "drunken diseases". Gout, in particular, was explicitly seen as the consequence of "intemperance in drinking much spirituous liquor," to use Dr Darwin's own words. In fact Dr Darwin's views on hereditary diseases provide a very clear example of the primacy of environmental factors over strictly hereditary ones that is typical of 18th century "soft hereditarianism". The chief, original cause of disease was environmental, as stated in the couplet from Dr Darwin's *Temple of Nature*: "The clime unkind, or noxious food instills / To embryon nerves hereditary ills."

This soft, environmental hereditarianism was inherently optimistic. Precisely because the original cause of hereditary disease was environmental, its transmission could be stopped by behavioural and environmental changes brought about by preventive medical measures. Hereditary diseases could be "disinherited" thanks to behaviour properly regulated by medical advice.

Waller's paper describes the development, over the period 1770-1870, of a harder, more pessimistic form of medical hereditarianism. In contrast with the 18th century optimistic view of hereditary diseases as amenable to cure or prevention, he stresses how 19th century English and American doctors established a self-evident link between the heritability and incurability of the very same diseases (gout, epilepsy, scrofula, consumption, insanity) that their 18th century predecessors had considered hereditary *and* curable. For instance, in marked contrast with Dr Darwin, William Cadogan, already in the 1770s, stressed that the gout should not be considered hereditary, because it was curable by change in behaviour. This implied that, by definition, hereditary diseases could not be cured. Waller provides various examples of this link between heredity and incurability of disease, especially from early and mid-19th century sources. It seems to me, however, that he tends to over-stress this link, which often seems less strong, on the evidence of his own sources, than he takes it to be. He quotes for instance, as evidence of the presumption of incurability for hereditary diseases, Sir James Clark's argument, in his *Treatise on Consumption* (1835), that a full cure of hereditary consumption can be effected over "a few generations". This seems more an instance of soft hereditarianism: the idea seems to be that the transmission of disease can be interrupted thanks to medical intervention and changes of behaviour. Going over the medical texts quoted by Waller, what strikes me is that the sources that stress more clearly the link of heredity and incurability date typically from the mid 19th century. This seems to confirm López-Beltrán's thesis that a "hardening" of the notion of heredity occurred after the 1830s. Waller himself, however, seems to have a different view. He argues that the link of heredity and incurability was firmly in place already by the mid 18th century, and that "implicit fatalism" characterized European hereditarian thought well before the 19th century. He argues that "hard hereditarianism" and eugenic ideologies as they developed at the end of the 19th

century were no novelties, but represented in fact the resurfacing of a trend that recurred "at irregular intervals throughout modern European history." Indeed, he argues that "the conceptual framework in which chronic ailments came to be associated with heritability was extremely ancient." This conceptual framework, he says, was provided by the Hippocratic-Galenic idea of temperament: since temperament was thought to be inheritable, incurable diseases, which were thought to be constitutional, were also seen as hereditary. In other words, Waller seems to think that "hard", pessimistic hereditarianism is not a 19th century development but a deeply seated feature of Western medical tradition.

I find this thesis unconvincing, especially in view of the arguments and evidence presented by López-Beltrán and Wilson. It seems to me that the humoralist notion of temperament provided at most the mental *outillage* for a soft kind of hereditarianism. It also seems to me that Waller at times misinterprets his sources by reading more hereditarianism into them than they actually contain. For instance, he quotes George Bancroft's belief that different people are distinguished by a peculiar national temperament. This seems to him clear evidence that temperament was thought to be inheritable. But did this view necessarily imply strong hereditarianism? Commonality of national temperament was just as easily attributable to shared environmental conditions, especially within a humoralist framework. The notion of national temperament and national diseases is not a 19th century development: we find it already in early modern medicine, the most obvious example being the 17th, 18th century medical literature on *morbi iudeaorum*, the diseases of the Jews. What is stressed in this literature, however, is that such diseases are rooted not so much in hereditary transmission as in the "non-natural" factors of temperament shared by a population, namely work and living conditions, diet etc.[4] It seems to me that Waller underestimates the extent to which the humoralist notion of temperament was environmental rather than hereditary, or rather was based on a very blurred distinction between environmental and hereditary factors.

Though Waller, in my view, fails to recognize some important differences between 18th century and 19th century versions of medical hereditarianism, his paper provides much persuasive evidence of the popularity of medical hereditarianism in the 19th century. What explains the popularity of medical hereditarianism in this period? Waller suggests that this popularity had to do with the medical practitioners' anxiety about their performance. By arguing that diseases like gout, scrofula and consumption were hereditary, doctors could justify their failure at curing them. As the poet John Byrom shrewdly pointed out, by blaming the "ancestors" doctors managed "to save their credit."

This argument is developed in Cartron's paper. Like López-Beltrán and Wilson, and differently from Waller, Cartron sees medical hereditarianism as a new 19th century development. In 18th century France heredity had been a physiological rather than a pathological problem, an object of interest to philosophers and naturalists rather than to physicians. But in the first decades

[4] See for instance the chapter on the "diseases of the Jews" in Ramazzini (1700), chap. 32. It was argued for instance that the Jews were particularly subject to haemorrhoids as a hereditary condition, but several early modern medical authors questioned this view, arguing instead that the disease derived from external factors such as diet (see for instance Frommann (1677), pp. 147-49, who argues that not the Jews but the English are disproportionately afflicted by this disorder because of the excessive amount of sugar in their diet).

of the 19th century there is a new emphasis on "hereditary taint, or predisposition to disease", exemplified by Fodéré's *Traité de Médecine légale* (1813). What explains the rise of this new medical hereditarianism? Cartron suggests that the emphasis on heredity supplied a theoretical alternative to the notion of contagion that was considered outdated (and hard to reconcile, as Edwin Ackerknecht has shown, with the policies of economic liberalism). Another element, according to Cartron, was the development of medical statistics that seemed to provide hard evidence of the hereditary nature of some diseases, in particular insanity. It must be noted, however, that the kind of statistical argument used by Esquirol – as quoted by Cartron – to prove that insanity was hereditary, seems hardly an instance of the primacy of numbers. Finding that 105 out of 466 cases of insanity at La Salpêtrière were hereditary, Esquirol proceeded to argue that in fact "heredity predisposes to mental illness much more frequently than my figures show here." For Esquirol, a theoretical presumption that insanity was hereditary clearly overrode the force of statistical evidence.

Cartron argues that another factor of the diffusion of medical hereditarianism in early 19th century France was the corporate spirit of a medical profession that had emerged newly organized from the crisis of the old regime. The emphasis on heredity helped to legitimize a new and more influential social and political role for the medical men. Since physicians could not cure some diseases, they could justify their failure by arguing that such diseases were hereditary. On the other hand, thanks to their soft hereditanianism, they could claim that the hereditary transmission of disease was preventable thanks to a newly-medicalized social hygiene, including for instance, as Fodéré insisted, pre-nuptial medical advice. Since what was inherited was a predisposition to disease rather than the disease itself, medical preventive treatment could interrupt the hereditary chain. By diagnosing a latent hereditary disposition to disease in some families or sectors of the population, physicians could thus contribute decisively to public health. The medical men's claim to this new public role was furthered by their intensive participation in liberal politics: Cartron points out that physicians entered the government *en masse* during the years of the July Monarchy (1830-48).

3. All these papers (with the exception of Waller) present further evidence and arguments supporting the chronology suggested by López-Beltrán. Roughly, the chronology is the following. From Antiquity to the early modern period hereditarianism had a very limited role in European medicine. In the 18th century, in contrast, there are very clear signs that a "soft" but widespread hereditarianism developed in medical circles – a version of hereditarianism based on the humoralist notion of temperament and characterised by a very blurred distinction between environmental, behavioural and hereditary factors. In the mid 19th century there is another fundamental shift, with the development of a "hard", or at least harder form of hereditarianism. It would be interesting to compare in detail the soft, 18th century version of hereditarianism with the hard 19th century version. This could be done, for instance, by comparing Erasmus Darwin's medical hereditarianism with Francis Galton's eugenics. My impression is that much changed between the two, and that such a comparison would be highly instructive.

If this chronology is correct (and it is of course only a rough sketch) some interesting questions emerge. First of all: why was hereditarianism so unimportant in European medical tradition before the 18th century? And why did it become significant in the 18th century? I think that, in

looking for an answer to these questions, we need to go beyond the intellectual reasons explored in these papers. There is a social element that is very obvious in the sources, though neither Wilson, nor Waller nor Cartron make much of it. A recurrent feature of the medical discourse on heredity in the 18th and early 19th century is *the critique of the aristocratic family*. Some very significant examples of the link between the emphasis on the heritability of disease and the rejection of aristocratic culture are given by Wilson. Not by chance they concern especially gout, the "patrician malady" *par excellence*. Wilson quotes William Buchan's view that it would be better "for the heir of many a great estate" to be "born a beggar, rather than to inherit his father's fortunes at the expense of inheriting disease." Erasmus Darwin stressed that "it is often hazardous to marry an heiress, as she is not infrequently the last of a diseased family." Buchan noted that "once a disease is contracted and riveted into habit," it became "entailed on posterity." *Entail* of course is a word coming directly from the language of legal inheritance, and by the late 18th century it had acquired a strongly negative connotation as a symbol of the inequities of property devolution within the aristocratic family (such negative connotations are obvious for example in John Galt's novel, *The Entail,* 1823). "Entailing" disease on posterity was presented by 18th century and early 19th century doctors as a reprehensible aspect of aristocratic behaviour. The association between the aristocratic family model and hereditary disease was so strong that even John Brown used it to prove that gout was *not* hereditary, by pointing out that eldest sons succeeded not only to their fathers' estates and titles but also to their gout, while cadets escaped the disease (which went to show, of course, that gout was caused by behavioural and not by hereditary factors.)

This suggests that when we try to understand the origins of medical hereditarianism in the 18th century we should probably connect it with the crisis of the aristocratic family model – a crisis that was a prominent aspect of European culture in the Enlightenment and Romantic period. In this perspective, we can also understand why medical hereditarianism developed only at this point, though the intellectual framework on which it was based (the Galenic notion of temperament) was extremely ancient. In the late Renaissance and in the 17th century the aristocratic "culture of lineage" was at the peak of its influence over the family structures and strategies of the European elites, as shown by the diffusion of primogeniture. Within the "culture of lineage", marital choices were firmly dictated by a rigid policy of class endogamy and wealth acquisition, that gave strategic prominence to the marriage of eldest sons and often required the enforced celibacy of cadets and daughters. There was not much space, in this perspective, for health or even fertility considerations in the choice of a marriage partner. Also, what travelled along the generational chain, in this view of the family, was exclusively charged with positive value: ancestors were the fountainhead of family honour, patrimony, glory – it was hardly conceivable to think of them as the source of disease. Even admitting this possibility probably required the crisis and even the breakdown of the aristocratic family model, and more in general the collapse of the cultural hegemony of the aristocracy. By asserting the heritability of disease, physicians expressed a new vision of the family based on bourgeois rather than aristocratic strategies and values.

But what about the transition from soft to hard hereditarianism? Cartron's paper suggests that a class element was involved also in this shift. It is significant that most of the 19th century doctors' interest in hereditary diseases shifted from gout, the patrician malady, to insanity – a disease considered to be endemic at the other end of the social ladder, among the "dangerous" classes, the

urban poor. These classes, rather than the aristocracy, were perceived as a threat to the social order at this point. Furthermore, this new threat was perceived as a much more serious menace to the social fabric. When dealing with aristocratic diseases, physicians had taken an optimistic view of hereditary stock as improvable over the generations, but in dealing with the disease of the urban poor, in contrast, they adopted a much more negative attitude, one that emphasized the social need to prevent the reproduction of people from tainted stock. Erasmus Darwin's insistence on the need to include health considerations in the choice of marriage partner is a far cry from 19th century medicalized social hygiene and especially 19th century eugenics.

This does not mean that the transition from soft to hard hereditarianism can be wholly explained by social factors. There is one intellectual development that seems to have been obviously related to it. The "hardening" of medical hereditarianism should be understood in connection with the changing notions of nature in this period. Medical thought in the 18th century was still deeply inspired by a benevolent view of nature and a collaborative model between nature and medical art. Within this view, there was as yet no clear-cut distinction of the natural, on one side, from the conventional, the artificial, the social on the other. As rightly stressed by López-Beltrán, the natural/non-natural distinction in humoralist medicine was very different from our nature/nurture distinction. In late 18th century medicine, nature and nurture, though increasingly distinct, were not yet seen as mutually exclusive. The boundary between them remained elusive because nature was still understood first of all as a prescriptive, not a descriptive concept. Nature still meant a *telos*, an intention never fully realized in actuality. Such teleological view of nature was at the core of the co-operative model of nature and art (including medical art): art could improve on nature by seconding and furthering nature's own goal. Nature therefore did not imply destiny: it was understood as a pliable set of potentialities (like the humoralist notion of temperament), rather than a reality inexorably, unalterably fixed. Like nature, so heredity: both were conceived as malleable, susceptible to improvement or deterioration brought about by behaviour. Medical hereditarianism assumed much stronger form in the 19th century, when nature turned from a benevolent, purposeful entity to assume the harsh face of physical necessity. The "hardening" of heredity seems to have been part and parcel of the process that led to the hardening of the face of nature.

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Heredity, Milieu and Sin: the works of Bénédict Augustin Morel (1809-1873)

Jean-Christophe Coffin

Morel's works can be viewed as an attempt to unify, within the emerging mental medicine, notions and issues belonging to natural sciences, medicine and philosophy. Two fundamental questions are at the center of his work. His first concern is to explore the reasons why an increasing number of individuals suffer from mental disorders and why these disorders remain permanently with these individuals.[1] The second concern deals with the impact of mental diseases on social life and its future. These questions are directly linked to his philosophical belief that we live in a world threatened by a series of morbid forces.[2] This paper seeks to present Morel's answers to these questions compiled in two books, which have been among the most influential works of 19th century French psychiatry. They were written at the time of the French Second Empire, which spans from 1852 to 1870.

Born in Vienna in 1809, Morel is placed in a seminary located in the west of France where he spends some ten years.[3] Influenced by Félicité de Lammenais's (1782-1854)[4] reformist catholic views, he is destined to become a priest. Instead, he chooses to study medicine and settles in Paris. He arrives there just after the Revolution of 1830, which paved the way to a new constitutional monarchy. These liberal trends spread among university students from all political convictions who supported the new king, Louis-Philippe.[5] Morel meets several doctors and intellectuals close to the Catholic reformist movement promoted by Philippe Buchez (1796-1865) who is to become Morel's great friend. Beside his medical practice, Buchez is considerably active as a journalist and as a free writer. Hostile to the former royal power, he then becomes more and more critical of the new regime, accusing it of promoting exclusively material instincts and the supremacy of money. Morel never got as much involved into philosophical reflections as his friend Buchez did during this period of the July Monarchy but Morel was very much under his influence.[6] Morel gets his medical degree in 1839 at a time when the battle between the physiologists and the psychologists,

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1 "A mesure que j'avançai dans la carrière […] je ne tardai pas à m'apercevoir que la curabilité des affections mentales était un problème de plus en plus difficile à résoudre" (Morel 1857, p. 341).

2 Morel (1857), p. 8.

3 For a more complete biographical information, see Lasègue (1873); Motet ([1874] 1894); Constant (1970).

4 As a priest Lammenais promoted religious freedom, Christianity involved in social matters but he was denied by the pope Grégoire XVI in 1832. He was deputy in 1848 and 1849 after the birth of the Second Republic. Let me precise that there is a 'conservative' Lamennais mostly before the 30s – very much for instance in favor of an increasing power for the Pope and in favor of a kind of theocracy and then a liberal after he became very deluded with the Restauration regime in France.

5 The historian Jean-Claude Caron considered that the University took a large part in the Revolution of 1830 (Caron 1991, pp. 295-317).

6 First of all a *carbonaro*, then close to the Saint-Simonian movement, Buchez attempted to unify the message of the Gospels and the ideas of the French Revolution. After the 1830s, he returned to a more classical catholic faith. Buchez has developed throughout his books a true phisophy of history of great influence on Morel. Buchez's books used for instance by Morel in his own works later on are: *Introduction à la science de l'histoire, ou science du développement de l'humanité* (Paris, 1833); *Essai d'un traité complet de philosophie au point de vue du catholicisme et du progrés*, 3 vol. (Paris, 1840). There is some literature on Buchez; on his specific ties with medical thinking see Isambert (1967).

which started in the 1820s, was coming to a close. Morel clearly supports the psychologists at the time.[7]

Morel sets up a practice but fails to attract patients. In these difficult times he has the opportunity to meet the psychiatrist[8] Jean-Pierre Falret (1794-1870) who is introduced to him by his friend and former Claude Bernard. Falret is the leading alienist of the 40s in France after the death of Esquirol, the spiritual son of Philippe Pinel's himself the emblematic figure of French psychiatry, who died in 1840. Morel becomes Falret's secretary and translator of German texts. Upon Falret's suggestion, Morel travels throughout Europe visiting asylums. In the first years of the new decade, he visits Italy, the Netherlands, Germany, and Switzerland. From theses places he sends articles and detailed accounts of his tour which are published in the newly founded *Annales médico-psychologiques.*[9] In these writings, he reports upon the state of psychiatry in these countries and offers a thorough knowledge about theorists and practitioners there. He returns to France still without a permanent job, before the Revolution starts in February 1848. Although he does not get involved into politics, he takes advantage of the revolutionary climate to call for the establishment of a social medicine truly orientated to the poors in several articles.[10] In May 1848 his friend Buchez becomes elected president of the National Assembly. Thanks to Buchez' patronage Morel is granted a job as chief doctor at Mareville asylum (close to Nancy) in 1848 and thus integrates the public national asylum system. He then moves to Rouen (Normandy) in 1856 where he dies in 1873.

In Nancy he becomes a local public figure but suffers from jealousy and criticism from the asylum director, who thinks that he is too iconoclast and lacks the constitutive characteristics of a good civil servant.[11] Apparently, Rouen asylum atmosphere is more in line with his personal frame of mind. He rapidly becomes a member of the selective local Academy of Sciences and Humanities/Letters and integrates the local bourgeoisie circles. At this point we may note that his rebellious attitude and 'revolutionary' calls for reform are somewhat attenuated, all the more so, that the Imperial Regime has honored him with the Legion d'honneur in 1864.

The Treatise on Degeneracy

If Rouen is a better place for him, others do not share this bliss. Fast-growing industrialization, terrible working conditions in the predominant garment industry, in that part of Normandy, extended poverty of the lower classes is what he finds in the Rouen vicinity. Like Alexandre Parent-Duchâtelet (1790-1836)[12], Louis-René Villermé (1782-1863)[13] and others from the movement for social observation,[14] Morel is concerned with the effects of social pathologies on workers' physical

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7 Morel (1842). For an exponent of the psychologist trend see Jouffroy (1839), vol. 2. For a good analysis of the clear-cut intellectual atmosphere of the time see Braunstein (1986). For this study, I use the words "materialism", "spiritualism", "dualism" with the meanings given by the actors of that time. Though, we have to keep in mind that these words are also categories which need historical and critical investigations and as such have not necessarily to be taken for granted. For my part, I consider Morel as a spiritualist doctor which means for me his refusal to reduce the activity of the mind to mere physiological processes.

8 The expression mainly used at the time was 'alienist' rather than 'psychiatrist'.

9 *Annales médico-psychologiques*, (1844), vol. 3 and (1846), vol. 6.

10 For instance: *Revue nationale* (1848), 2 (2).

11 According to Motet (1894), p. 17.

12 Parent-Duchâtelet wrote on public hygiene and on prostitution. See Parent-Duchâtelet ([1831] 1981).

and moral health. At the beginning of his book entitled *Treatise on the Physical, Intellectual, and Moral Degeneracy of the Human Race*, Morel writes:

> Le nombre toujours croissant des suicides, des délits, des crimes contre les propriétés, sinon contre les personnes, la précocité monstrueuse des jeunes criminels, l'abâtardissement de la race, qui dans beaucoup de localités, ne peut plus remplir les anciennes conditions exigées pour le service militaire, sont des faits irréfragables.[15]

Further down in the introduction Morel reminds that poverty is always linked to moral flaws. Disciplines such as natural sciences, ethnography, geography, anatomy, physiology and history are present in this book. So are the leading scientists from the 18th and the first quarter of the 19th that he quotes at length to the point that the book looks like a catalogue of portraits. Most data contained in the book go back a while and are secondary sources; for instance, Buffon holds a predominant place but he is mentioned through Flourens' (1794-1867) comments who is an academic, member of the Collège de France, and professor of physiology.[16] But Morel's book also contains more immediate knowledge, for instance through the influence of Henri Ducrotay de Blainville (1777-1850) whose courses he attended at the Museum of Natural History.[17]

If Morel plans to raise the issue on the relations between the physical and the moral aspects of man, his understanding of Cabanis – author of a book precisely on that question[18] – is through the Italian doctor Cerise (1807-1869), another friend of Buchez who considers Cabanis's treatment of the question much too materialistic.[19] Morel, like his friends from the spiritualist movement, is a dualist. A state that is illustrated by his point that "the brain is the organ of the soul".[20] Morel shows some interest in the Austrian Franz Joseph Gall (1758-1828), but not for his invention: phrenology, but for his book on the relationships between harmony and disease that Gall wrote at the end of the 18th century.[21] Last but not least, Morel refers several times to Claude Bernard's experimental physiology. More particularly, Morel uses Bernard's work to analyze the influence of toxic substance on the degeneration process. Nonetheless, Morel's text is by no means

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13 Villermé is the author of *Tableau de l'état physique et moral des ouvriers dans les fabriques de coton, de laine et de soie,* (1840). He is also known for his books on prisons and on the physical constitution of workers.

14 Coleman (1982).

15 Morel (1857), p. ix.

16 Morel uses Flourens's book *Histoire des travaux et des idées de Buffon.* He mentions 1850 as the date of publication. This is actually the book's second edition. (Paris: Hachette). The first edition was printed in 1844.

17 Morel himself acknowledges this influence in his introduction, but he never mentions any particular de Blainville's publication in the rest of his treaty. It is thus not easy to evaluate this influence. De Blainville's interest for the milieu might have had some 'resonance' on Morel's own interpretation on that topic.

18 The first edition was published in 1802. Cabanis (1757-1808) has been a professor at the Paris medical school and has been deputy during the revolutionary period and a senator of the Council of the Five Hundreds after the *coup d'état* of the 18th Brumaire (1799). His book was written in a materialist tone and Cabanis was considered then as a fervent materialist. Nonetheless, he moderated his own views and he became a member of the Ideologue group. During the 1820s and on, his book was still regarded as one of the terrible example of materialist ideas. He had a large influence on the 'physiological medicine' throughout the 19th century. See Génil-Perrin (1910). See also the classical work by Staum (1980).

19 L. Cerise (also written Cerisi) wrote a preface to the re-edition of Cabanis famous book newly published in 1843. Moreover he wrote: *Essai sur les principes et les limites de la science des rapports du physique et du moral*, (Paris, 1855). See Bourdin (1872).

20 Morel (1857), p. 56.

a "Bernardian" manifesto. We can note that the majority of scientists present in Morel's book constitute a homogeneous group representing a science, which is sharply put into question in the mid 19th century.

Teratology, Pathology and Milieu

The purpose of the book is to present a theory entitled the theory of degeneracy.[22] The length of the volume is not due to the complexity of the theory; it is the result of the many examples of degeneration chosen by Morel from numerous locations in the world and from every kind of population. Degeneration is, according to Morel, a disease. Thus, the book is build up around the study of the causes of the disease, the description of its symptoms, its evolution and finally the therapy/the cure. His definition of degeneracy is briefly explained in the first pages of the book: degeneracy is a "morbid deviation from the primitive human type".[23] These deviations are produced by a range of causes and Morel is particularly eclectic since he writes: "[…] the contribution of external circumstances, social institutions, and any other occasional influence […]."[24] The deviation process bears some characteristics. It is hereditary and it contributes to the gradual weakening of the reproductive functions of the individual every time it is passed on. These deviations result in the physical and moral modifications on the individuals. The modification becomes apparent through physical stigmata on the body and curious abnormal behaviors. For instance, he writes:

> […] la petitesse ou la mauvaise conformation de la tête, la prédominance d'un tempérament maladif, des difformités spéciales, des anomalies dans la structure des organes, l'impossibilité de se reproduire; mais aussi à des aberrations les plus étranges dans l'exercice des facultés intellectuelles et des sentiments moraux. [25]

The signs of degeneration are mainly physical but not always external. Cerebral lesions could also be interpreted as signs of the degeneration process at work. But Morel seeks to get away from the sole anatomical-pathological model to explain madness. He applies a new definition to the word

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21 F. J. Gall, *Recherches médico-philosophiques sur la nature et sur l'art dans l'état de santé et de maladie chez l'homme*, a book also mentioned by Claude Bernard in his *Introduction to the study of experimental medicine*. The original title is: *Philosophisch-medicinische Untersuchungen über Natur und Kunst im kranken und gesunden Zustande des Menschen.* Gall came to Paris in 1807 and acquired the French citizenship in 1819. He gave lectures on phrenology and he became quickly successful. But his reputation vanished rapidly; nonetheless phrenology was not completely forgotten after his death. To know more on the French episode of this European movement see Renneville (2000). And on Gall: Lantéri-Laura (1965).

22 There is a growing literature on the subject, not always from an historical approach, though. The oldest analysis – to my knowledge – in French medical literature is Georges Génil-Perrin's clever and well-documented thesis, *Histoire des origines et de l'évolution de l'idée de dégénérescence en médecine mentale*, (Génil-Perrin 1912-13); He also wrote a more specific study entitled "L'idée de dégénérescence dans l'œuvre de Morel", (Génil-Perrin 1911). On secondary sources, see Friedlander (1973); Dupeu (1976), a text which still deserves to be cautiously read. Martin (1983); Peset (1986); Carlson (1985); Nicasi (1986); Hoochman (1992). And for the cultural dimension of degeneration theory, Daniel Pick's book remains an excellent and brilliant synthesis (Pick 1989).

23 Morel (1857), p. 5.

24 Ibid.

25 Morel (1857), p. 62.

'lesion': degeneration causes functional anomalies within the body. Thus it is not surprising if a doctor doesn't find cerebral lesions (in the anatomical sense of the word) among hereditary madmen. Lesions are functional and result from the slow process of the toxic influence of the natural environment and/or individual living conditions. These deviations gradually produce morbid varieties within the species. Pathology has a proximity with teratology in Morel's treatise. Morel acknowledges the view of biologists that monstrous characteristics occur through the stoppage of physical and mental growth in the individual. But I think that Morel did not completely give up the former conception of teratology. In a certain extent, Morel remains 'fascinated' by the monstrous. In that sense it could be argued that he perpetuates the ancient teratology influenced by the demonology.[26]

Morel's theory is made up of creationist philosophy and the monogenist conception of the human race. In Morel's beliefs, the origin of man is God, hence the question why does the human race degenerate? He rejects Rousseau and Condillac's views and in particular their critics concerning the role of the institutions in the decadence and prefers pointing out "the original degradation of the human nature".[27] But this process is rarely possible without any other cause. And if, for instance, the role of the original sin is fundamental, it is not considered by Morel as unique.[28] It needs to be associated with other causes coming from the pathogenic natural and social environment to carry on influence.

As I wrote previously, the notion of milieu is important within his treatise, which can be regarded as representative of the environmental medicine trend.[29] Neo-hippocratism is largely explicit in Morel's works.[30] As a matter of fact, his books rely on medico-topographical investigations. And one of the origins of his theory comes from the personal investigations he conducted on cretinism some years earlier.[31] On the basis of this work, he then moves on to demonstrate that cretinism as a degeneration is caused by the natural environment, more particularly by the mineralogical constitution of the soil. Following the same line of thinking, he attributes a great role to climate[32] and in a lesser extent to the quality of air. All these factors together cause what he labels "toxic degeneration".

I would argue that he represents milieu as a fluid. This shows how much he is influenced by the mechanical conception stemming from Newtonian physics.[33] On the other hand, Morel never makes clear if the living has any impact on the milieu. Therefore it is difficult to measure what influence dynamic conception may have had on his interpretation. But the influence of Buffon on his work is clear as Buffon's interpretation relied likewise on the mechanistic and geographical

26 Canguilhem (1975), especially pp. 176-80, has written interesting observations on that point.

27 Morel (1857), p. 3. This is of course Morel who gives that interpretation of Rousseau and Condillac's thinking.

28 A link between original sin and French legitimists of the Restauration government is suggested by Locke (1974), p. 141. Here, there is no evidence of a link between the cultural atmosphere of the Restauration and Morel. He remains closer to the social catholicism of his youth and gives apparently any approval to the catholic traditionalism, predominant at that time.

29 In the tradition initiated by the *Société royale de médecine* at the end of the 18th century. See for instance Peter (1967). For a general analysis see Jordanova and Porter (1979), especially pp. 119-46.

30 Many medical texts were influenced by former hippocratism. Emile Littré (1801-1881), doctor, former activist of the Revolution of 1830 before becoming a positivist, had previously published Hippocrat's works. The first volume was issue in 1839. See also Jouanna (1992), especially, p. 512.

31 Morel wrote: "Le crétinisme avait été la première variété dégénérée sur laquelle s'étaient fixées mes recherches"(Morel 1857, p. 357).

dimension. Former and classical interpretations of the milieu are predominant in Morel's treaty. He never mentions Auguste Comte's conception and there is absolutely no evidence that he may rely on ideas developed in the *Cours de philosophie positive*, for instance.[34] Although the milieu is very important, heredity is the focal point of Morel's interpretation of degeneracy.

Morel and Heredity

Morel's work on the topic of heredity is witness to an increasing interest in the issue of the role of heredity in the development of madness. While alienists are arguing on the question whether the nature of insanity is either a disease of the soul or a cerebral disease, Morel prefers to work on the causes of insanity rather than on its precise nature.

Until the 1840s, alienists are convinced that hereditary pathological predispositions are frequent. The psychiatrist Jules Baillarger, one of the directors of the *Annales médico-psychologiques* declares at the Academy of Medicine in 1844: "[…] c'est d'ailleurs une opinion populaire et très ancienne que celle de l'hérédité de l'aliénation mentale et les relevés statistiques publiés depuis vingt ans ne font que le confirmer."[35]

The tone of certainty that he adopts here should not mislead us. Heredity was and remains still very mysterious. As one of his colleagues, the catholic alienist Alexandre Brierre de Boismont, asserted that heredity raises difficulties and problems, rarely solutions.[36] Thus, the 1850s witnessed the emergence of heredity as a focal point of interestand psychiatrists put hereditary mechanisms on their agenda.[37] A growing number of psychiatrists were ready to consider heredity as the cause of the cause of insanity. The psychiatrist and republican Prosper Lucas (1808-1885) published a book in two volumes between 1847 and 1850 entitled *Philosophical and Physiological Treatise on Natural Heredity*. More philosophical than physiological, his book is praised by the Academy of Sciences[38] and becomes rapidly a reference among psychiatrists.[39]

Morel's *Treatise of degeneracy* raises directly the question of heredity in the second part of his book although he only dedicates a few pages to the subject.[40] Nonetheless, he introduces a new

[32] Morel (1857), p. 31; his sources come mainly from the English doctor James C. Prichard (1786-1848) who studied at length human races. Morel mentions two of his books in his own treaty: his *Natural history of man* and his *Researches as to the Physical History of Man*. Prichard is also know to have coined the expression 'moral insanity' which Morel as well as Prichard will then use and consider as a distinct disease. In Morel's view, people suffering from that type of insanity belong to the large class of degenerates. In his own treaty, Morel also did a review of Prichard's *On the different forms of insanity, in relation to jurisprudence, designed for the use of persons concerned in legal questions regarding unsoundness of mind*. See *Annales médico-psychologiques* (1843), 1: pp. 329-37.

[33] On this influence on the notion of milieu, see the masterpiece written by Canguilhem (1952).

[34] Auguste Comte discusses about the notion of milieu in the 41st, 42nd and especially 43rd lesson entitled "Considérations philosophiques sur l'étude générale de la vie végétative ou organique" and written according to Comte in 1837. On some influence of Comte's notion of milieu, see Braustein (1997), pp. 557-71.

[35] Baillarger (1844), p. 158.

[36] "L'étude de cet important sujet soulève une foule de problèmes dont la solution a présenté jusqu'alors des difficultés insurmontables." (Boismont 1849, p. 221).

[37] See Laure Cartron's paper and Carlos López-Beltrán's contributions to the first and to the second workshop, and especially López-Beltrán (1994) and Bénichou (1989). On the specific context of psychiatry Dowbiggin (1991).

[38] *Comptes-rendus hebdomadaires de l'Académie des sciences*, 35, 1853.

[39] Bernard Balan (1989), pp. 49-71. His judgment on Lucas is nonetheless too severe according to me.

interpretation. It is time, he declares, "to give the word heredity a greater meaning than assigned to it ordinarily."[41] Psychiatrists usually consider heredity as a mechanism of transmission of similar characteristics. Morel on the contrary, conceives morbid heredity as the transmission of a predisposition to disease, rather than the transmission of a specific disease entity.[42] Consequently, this conception leads to the creation of a morbid variety which encapsulates very different individuals, though all of them are linked by the hereditary predisposition and /or diseases.

The second main characteristic of the hereditary mechanism is its progressiveness. Each new generation received a heavier and more destructive dose of morbidity. This process is nonetheless not infinite throughout history. Sterility indeed intervenes at the fourth generation, subsequently stopping the process of degeneracy. Thus, Nature returns back to its natural order. Harmony is, at the end, stronger than inevitability and I think that this notion of harmony is predominant within the entire works of Morel.[43]

The hereditary predisposition needs to be connected to a vicious or a pathogenic milieu. This is what he labels the "law of the double fertilization".[44] The best illustration is alcoholism. Individuals drink because of their moral misery and drinking has negative physiological impacts on the body.[45] Then, children from this heritage are particularly exposed to degeneration. Organic predisposition and heritage of a vicious milieu will indeed favor the disease.

What can be done against this hereditary process?

In 1857, Morel declares himself very concerned with the question of the therapeutic program and announces a treaty of regeneration on the subject. But there is no trace of the project. Nonetheless, he dedicates some pages on the issue in his *Treatise of degeneracy*. The therapeutics he elaborates are made of three major measures: crossbreeding, moral treatment and prophylaxis.

He is particularly concerned with crossbreeding and as such fights racial determinism.[46] His belief stems from his monogenist conception.[47] Then, he asserts that "the most active means of the regeneration of the species is crossbreeding."[48] But crossbreeding will have a positive impact only if other recommendations are followed.[49] For instance, after crossbreeding, moral treatment should be particularly developed to reach a perfect regeneration of the former insane individual. For the rest, he remains fairly vague. In 1860 he declares that hereditary madness is curable[50] upon

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40 While he has put a lot of footnotes throughout his book, he mentions very few writers on the topic of heredity. For instance there is no reference to medical texts except Lucas's treaty.

41 Morel (1857), p. 565.

42 "Nous n'entendons pas exclusivement par hérédité la maladie même des parents transmise à l'enfant. […] Nous comprenons sous le mot hérédité la transmission des dispositions organiques des parents aux enfants" (Morel 1857, p. 565).

43 We know that the idea of '*une marche de la nature*' is spread over the life sciences throughout the 19th century. See for instance Conry (1980).

44 Morel (1857), p. 567.

45 The link between alcoholism and degeneration is promised to a long life throughout centuries. See Jacques Borel, *Du concept de dégénérescence à la notion d'alcoolisme dans la médecine contemporaine*, (Montpellier, 1968). Also: W.F. Bynum, "Alcoholism and Degeneration in 19th Century European Medicine and Psychiatry", *British Journal of Addiction*, 79, 1984.

46 For instance, he rejects Gobineau's ideas on race. (*Précis analytique des travaux de l'Académie des sciences, belles-lettres et arts de Rouen*, 60, 1857-58, p. 152). Man of letters and diplomat, Arthur de Gobineau (1816-1882) became famous after his essay entitled *Essai sur l'inégalité des races*, published between 1853 and 1855. He asserted that the decay of the western civilization was caused by the lack of purity of the white race. Crossbreeding was then regarded as the most irrelevant thing to do.

the expressed conditions that prophylaxis and good hygiene are respected. What seems clear in his mind is not expressed from a practical point of view. Moral life may be what is lying under this rhetoric.

The Treatise on Mental Disorders

After the publication of the treatise on degeneracy Morel carries on explaining why degeneration should be important to psychiatrists.[51] In the treatise he writes: "insanity is predominantly a degeneration"[52], and this is what he will seek to demonstrate in a new book entitled *Treatise on Mental Disorders* in 1860. The book is a manual for psychiatrists but also for general practitioners. He introduces among other novelties a new nosology. Within his classification based on the aetiological dimension of the disease, he labels a new medical entity: *folie héréditaire*, hereditary madness. Individuals which belong to this entity are divided in four groups. This division is based on the graveness (seriousness) of the disease, that is to say, in Morel's view, on the degree of hereditary intensity. Indeed, theses groups are organized along the same structure previously used by Morel. Consequently, the first group gathers individuals with nervous temperament. In the second one, we find alcoholics, individuals suffering from aberration of the moral sense, and moral insanity. In the third group, we find the same individuals but with a more pronounced taint; as well as eccentric, disorderly and dangerous individuals because of their total lack of sense of Good and Bad. In the last group are gathered cretins and idiots. We can note that, in a way, hereditary madness is close to degeneration. There seems to be the idea of a vital force in this morbid heredity. The level of intensity of heredity determines the intensity of mental disorders.

How are these ideas received? Following the publication of Morel's last treatise, the *Société médico-psychologique*[53] *(SMP)* opens the debate on the classification of mental diseases and discusses the treatise. Buchez has already introduced Morel's books to their colleagues of the *SMP* when the debate on classification begins. In his introduction, Buchez is as enthusiastic as he had been when he explained the *Treatise of degeneracy* to his fellows some three years ago, (always in the *SMP*). Nevertheless, Buchez's colleagues are not entirely convinced by Morel's book and Buchez's argumentation.[54] A majority of the members praises his ambition to suggest another

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47 Morel (1857), p. 349: "L'homme est un, l'espèce est une. Il ne peut y avoir, pas plus entre les races humaines qu'entre les variétés maladives de ces races, de distances infranchissables telles qu'il en existe entre les espèces et les règnes que renferme la nature." At that time, Armand de Quatrefages, professor of anthropology at the Museum of Natural History and member of the Academy of Sciences strongly supported the unity of the human species. ("Du croisement des races humaines", *Revue des Deux-Mondes*, 1-3-1857.) For more information on the scientific and intellectual debate on monogenism and polygenism in France, see Blanckaert (1996), 2: pp. 3021-37.

48 Morel (1857), p. 524.

49 He previously reported negative examples of mixed races in others pages of his book. See Morel (1857), p. 413. Thus crossbreeding could provide opposite results: breeding in (what he labels "remonter vers le type supérieur" – Morel 1857, p. 517) or breeding out.

50 Morel (1860), p. 646.

51 Morel (1860), p. iii.

52 Morel (1857), p. 345.

53 This association has been founded in 1852 and was opened to non-practitioners. It was at the time the only structure which gathered the profession of *médecins-aliénistes*.

54 The first paper read during the days dedicated to the debate was by Louis Delasiauve – a colleague appreciated by Morel – who summarized most of the critics pronounced later on.

methodology for classification. Still, they think that an aetiological classification is unrealistic given the state of their knowledge. The sharpest criticism concerns the entity of the hereditary madness. Psychiatrists do not understand how Morel can assert an entity strictly based on heredity since heredity concerns different types of mental disorders. What could be the criteria to define such a category? Morel argues that this new category gathers specific individuals who suffer special forms of delirium, a mix of calm and of furor etc.[55] Since the nature of the pathological process is specific, madness of that origin is specific as well. Morel is unsuccessful in convincing the majority of his colleagues. The difficulty to trace a borderline between hereditary madness and other insanities where heredity plays a role is seen as too subtle. Besides, some members of the *SMP* have the feeling that this interpretation may lead to the assimilation of heredity and pathology. As a conclusion, we can say that the members of the *SMP* in 1860 do not endorse this new medical entity.[56]

In the years following the debate, Morel keeps on publishing on the subject of heredity. As a tribute to Flourens, he publishes a book on different case studies on toxic degeneration.[57] He also publishes a series of new articles on hereditary mechanisms and the process of degeneration. In these, he does not change his views but tries to be more specific and to attenuate some of their stronger aspects. For instance he points out again that the transmission of dissimilar characters is the rule in the mechanisms of the heredity of mental pathologies, but that the rule is not exclusive.[58] Nevertheless, he remains adamant on the specificity of heredity of mental disorders and never gives up the notion of hereditary madness. He just tends to moderate the fatalistic trend that some of his colleagues see in his general framework.[59]

Conclusion

Milieu and the original sin cause abnormality; heredity maintains and accelerates the abnormality and there is no cure because this is the tragedy of the human race. That is what Morel tells us. This is not to be discarded as merely simplistic. Morel is indeed of great importance in the development of mental medicine within the more general domain of medical and biological sciences. To a certain extent, his own intellectual evolution from spiritualist psychology to physiological pathology could be seen as an illustration of the evolution of psychiatry itself.[60]

It may be said that he provides a wonderful model to explain a bizarre process. In a way, he gives a solution to the question of insanity and therefore opens up a new path for the development of mental medicine. His *Treatise of degeneracy* reveals a large influence from vitalism and from teleology. But in his attempt to put forward a solution, he does not restrain himself to these philosophies and mixes diverse intellectual influences on the nature of insanity. In doing so, he

55 Morel (1860), p. 252.
56 When he wrote his review of Morel's book, Buchez himself hesitated between his friendship and his doubt about Morel's attempts. Buchez (1860).
57 Morel (1864a).
58 Morel (1867). This aspect remains very successful among psychiatrists after Morel; it is of great importance, according to me, to understand the intellectual orientations of French psychiatry. See Dupeu (1976). And also Gilman (1985).
59 Morel (1864a), p. 17.
60 As one of his colleagues declared: "[…] quoique spiritualiste, je n'ai pas peur de la matière;" (*Société médico-psychologique* 1860, p. 325).

puts forward an interpretation, which can satisfy those who defend the model of brain lesions and those belonging to the psychologist trend (which was kept alive mainly because of the weakness of the opposite interpretation).

But his role has not only been to unify the different interpretations of insanity of his time. Also, he has suggested that mental pathology is governed by its own specific rules. And the hereditary mechanism as viewed by Morel contributed to a new interpretation of the pathological. Far from being determined by a link of degree with the normal, the pathological becomes determined by a difference of nature. Therefore there is no possibility to go back to normality and this is why hereditary madness cannot be curable.

Although hereditary madness is central to Morel's view, it cannot be argued that Morel is a mere exponent of biological psychiatry. Heredity and milieu are not opposed in Morel's framework. On the contrary they can be considered as very much intertwined, linked into solidarity. In a way, Morel prolongs and extends the role of Milieu as a cause menacing the harmony of the body.

Because for the Fin de siècle psychiatrists, hereditary madness means organic causality, Morel's interpretation of heredity has been traditionally included in the positive age of psychiatry[61] and praised by a new generation of psychiatrists convinced that insanity is a pure organic disease. Also, they have seen in Morel a precursor of organic psychiatry and evolutionism. But the interpretation of hereditary mechanisms as shaped by Morel and praised by French psychiatrists after his death, may indeed have not favored the coming together of psychiatry and positive biology. It can be argued on the contrary that it has reinforced the specificity of psychiatry, or at least the particularity of the exponents of the notion of hereditary madness. They primarily defined a pathology of heredity rather than explaining in what sense insanity could be considered a hereditary disease. The exponents of the physiological orientation of mental medicine support an interpretation of hereditary mechanisms, which is not particularly influenced by Claude Bernard's experimental medicine principles. This is a kind of paradox. But after all, degeneration has been largely praised during the 19th century, which is also the century of evolutionary ideas and progress.

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61 Génil-Perrin (1912-13), p. 12.

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George Combe's law of hereditary descent

John van Wyhe

In this paper I would like to make two main points. The first is historical and the second theoretical or methodological. The historical point is that the phrenologist and philosopher George Combe played a disproportionately major role in popularizing some forms of heredity and proto-eugenic concerns in the mid-nineteenth century. The second or methodological point I would like to make is that the heredity of the ideas of inheritance themselves is as important as their context in determining their specific characteristics.

George Combe was a young Edinburgh lawyer when the German phrenologist Dr Johann Gaspar Spurzheim came to Edinburgh to face down an acrimonious critic in 1816. Through skilful dissections and naturalistic rhetoric Spurzheim was widely seen to have defeated his opponent and Spurzheim's reputation, for some, quickly swung from that of an outrageous foreign quack to a serious man of science to be respected. Combe was among those Spurzheim converted to the new science of phrenology during a seven month stay in Edinburgh.

Spurzheim was at that time the only advocate in Britain of the system founded by Dr Franz Joseph Gall formerly of Vienna and later residing in Paris. Gall called his system *Die Schädellehre* and later in Britain it was named phrenology. Gall recognized that the brain was the organ of mind and furthermore he argued that the mind must be composed of multiple distinct innate faculties. Therefore, each faculty must have a distinct seat or 'organ' in the brain. The size of an organ, other things being equal, must be a measure of its power. Hence, as the skull follows the shape of the underlying brain, the exterior of the head serves as an indicator of the shape of the brain underneath and reveals an accurate index of psychological aptitudes and tendencies.[1]

George Combe began by purchasing some plaster busts to study the science and these soon attracted friends and visitors who looked to Combe to explain the details. This was Combe's first real taste of speaking authoritatively on a scientific subject and he was soon addicted. Over the next few years Combe and his fellow Spurzheim acolytes created the British hybrid doctrine we now recognize as phrenology with its white plaster busts with black markings and the lists of 35 or so renamed cerebral organs with their corresponding mental faculties arranged into orders and genera. Combined with these was a version of the traditional doctrine of the four humours or temperaments – as the phrenologists termed them the lymphatic, bilious, sanguine and the nervous temperament. Combing estimations of temperament and the shape of the skull, phrenologists diagnosed character, aptitudes and mental powers and inclinations. The authority to classify and define the powers and abilities of all humans was a uniquely authoritative role for a phrenologist and it does not seem coincidental that all of the major phrenologists were ambitious, egotistical and often quite arrogant men.

George Combe was perhaps the most ambitious of them all. He first set his sights on becoming a man of science. This he to some measure achieved by co-founding the Phrenological Society in 1820, by writing scientific publications on the subject – his first publications – and by giving public

[1] van Wyhe (2002).

lectures. For Combe the direction in which phrenology was to be taken next was to continue to emphasise and develop the already marked naturalistic themes, which had become part of phrenology.

For example, phrenologists used an appeal to Nature (usually with a capital N) to defend themselves from all matter of criticism of their science. Phrenology must be true, phrenologists argued, because Nature showed it to be true. This sort of tactic, reiterated and relied on throughout the 1820s as it was, became a constant accompaniment and eventually a typical aspect of phrenology. In the face of critics who quipped: "Fool and Phrenologist are terms nearly synonymous," phrenologists replied that: "phrenological […] is another word for natural," or "whatever is natural is just to the same extent and in the same degree phrenological."[2]

Combe was deeply impressed by the natural philosophical and phrenological works of his mentor, including Spurzheim's *A view of the philosophical principles of phrenology* (1825) and his *Philosophical catechism of the natural laws of man* (c1824). Combe wrote to Spurzheim: "[Your book the *Philosophical principles of phrenology*] has afforded me more delight than I ever received from any book on any subject whatever."[3] Spurzheim, then living in Paris, was deeply influenced by Enlightenment writers like Baron d'Holbach, Constantin François de Volney and Pierre-Jean-Georges Cabanis. Spurzheim reiterated many of their Enlightenment themes such as the progress of knowledge through naturalism, the supreme reign of natural laws, anti-clericalism and also a better morality – which for Spurzheim was not incompatible with Christianity. Spurzheim also wrote about the inheritance of healthy or sickly constitutions and mental characteristics. Perhaps the details of Spurzheim's hereditarian comments owe as much to earlier writers as do his phrenological and philosophical ideas. It is difficult to trace Spurzheim's sources with no papers and few letters known.

Reading Spurzheim along with Combe, however, there can be no doubt about the formers' influence on the latter. Combe borrowed a radically naturalistic, progressive and normative philosophy full of scientistic elements such as hierarchical classifications, nested realms of natural laws and the unanswerable force of causal necessity. From these materials Combe eventually formulated what he called, after Spurzheim, the 'doctrine of the natural laws'. This doctrine was expressed in many of Combe's works but its primary showplace was Combe's masterpiece *The constitution of man* (1828). This book went on to become one of the most widely read books of the nineteenth century. It sold more than 350,000 copies by the end of the century and was continuously in print from 1828 until 1899 with more than one hundred publishers in half a dozen languages.

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2 See "Anti-Phrenologia" in *Blackwoods Edinburgh Magazine* 13 (1823), pp. 100-8, 199-206, p. 100; *The Phrenological Journal*, 1, 1823/4, pp. xxi, 94.

3 Combe to Spurzheim, 18 February 1826.

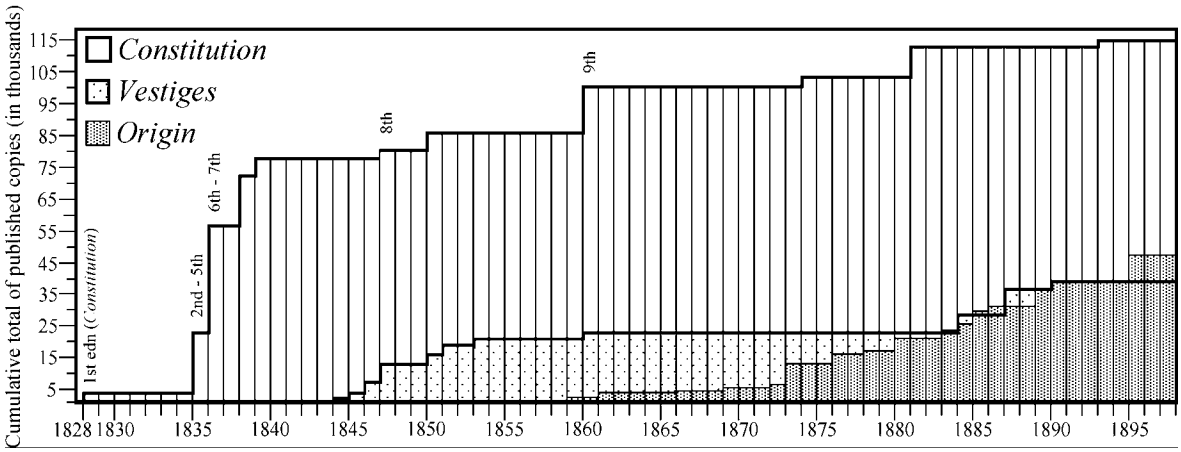

Fig. 1: Sales of George Combe, *The Constitution of Man*, Robert Chalmers, *Vestiges of the natural history of creation*, and Charles Darwin, *The origin of species*.

If we compare the English-language sales of *Constitution* with those of the better-remembered *Vestiges of the natural history of creation* (1844) or *The origin of species* (1859), we get a sense of how much more common *The constitution of man* was in the nineteenth century than its reputation today would lead us to believe (see fig. 1). As I have argued elsewhere *Constitution* did not just sell more copies but probably created more controversy and inspired more subsequent writers to imitate it than *Vestiges* and the *Origin* combined during the nineteenth century.[4]

The doctrine of the natural laws

So what was Combe's doctrine of the natural laws? The doctrine was a systematic, though somewhat vague and amateurish, bid to provide an alternative for traditional Christian systems as guides to conduct and especially as an alternative to beliefs of the fallen state of Nature and Man, the sufficiency and necessity of the Bible as a guide to daily living and as a moral, philosophical, and epistemological authority. Briefly stated, the doctrine went thus: if Man were to devote himself to understanding and following the natural laws, all would live in a happier, healthier world and experience the greatest possible joys and satisfactions as civilization, and individuals, progressed ever farther towards perfection. All the evils in the world follow from disobedience to the natural laws and all pleasure and progress follows from knowledge of and obedience to them. As 'the true science of mind', phrenology could be the key to unlocking this doctrine, but Combe was explicit in referring to phrenology and the doctrine of natural laws as distinct enterprises. Little in Combe's account was very new but he did arrange his pieces into a convincing and provocative order which countless thousands of nineteenth century readers found profoundly moving.

According to Combe, Nature was designed benevolently by a deistic creator according to a progressionist principle. It was not ruled by divine intervention but by a complex set of natural laws. The main categories of natural laws were physical, organic and intellectual or moral (the

4 van Wyhe (forthcoming 2003).

wording varied). The three realms were reflected in Man's constitution and corresponded to the "three classes of [phrenological] organs, the animal, moral, and intellectual."[5]

The laws were the regularities of matter and mind which the creator had willed at the beginning. Combe never tired of reiterating that the realms of natural laws which he preached acted independently of each other; although this too he borrowed from Spurzheim.[6]

The physical laws included traditional notions of natural laws such as chemical properties, gravity, and other consistencies of Newtonian physics. The organic laws were a realm devoted to the unique properties of living organisms and Combe used them to espouse the importance of cleanliness, hygiene, adequate ventilation, guarding against rapid bodily temperature changes, bodily exercise, moderation in exertion, and sufficient rest.

Obeying the moral and intellectual laws would lead to the enjoyment of "a fountain of *moral and intellectual happiness*".[7] New and higher pleasures awaited those who could bring their faculties into harmony with Nature. Therefore, apart from promoting good health, Combe valued intellectual more than physical pursuits. Modes of behaviour proscribed by the moral and intellectual laws included greed and corruption, employing people to do things for which they were not naturally suited, and capital punishment (then a common sight in Edinburgh).[8] Most of all respect for Combe's style of secular natural philosophy was enjoined as progressive and just.

The law of hereditary descent

One law within the realm of the Organic laws was what Combe called the 'law of hereditary descent', referring to the fact that offspring acquire characteristics from their parents – both of what would today be called heritable traits and Lamarckian inheritance.

Combe's law of hereditary descent was essentially his description of the fact that heredity occurred and that a good or bad constitution was inherited by offspring. According to Combe, the qualities of children were determined jointly by the constitution of the parents (though often to a varying degree) and by the faculties, which predominated in power and activity in the parents at the time of conception. Combe divided heredity into two basic kinds:

1. the inheritance of inborn mental and physical characteristics
2. the transmission of acquired and even momentary mental and bodily qualities and conditions.

Like Darwin's *Variation of Animals and Plants under Domestication* of 1868, Combe provided many cases of heredity of various kinds. For example, Combe wrote that mothers have a strong hereditary impact on offspring, particularly if the mother is marked by strong mental or physical qualities. A mother's state of mind, especially any strong impressions like fear or horror at the sight of a cripple could specifically imprint themselves on the offspring. (Incidentally, for this fact Combe cited the authority of Dr Darwin.) In general both parents contributed characteristics to offspring and it seemed likely to Combe that fathers contributed more to sons and mothers more to daughters. If a clever man married a dull woman then their children, because mixed, would be

5 Combe (1828), p. 181.
6 Spurzheim (1825).
7 Combe (1828), pp. 19, 37.
8 Gatrell (1996).

less clever than the father. Close relations should not marry. In addition the too young and too old should not reproduce because their imperfect condition would be passed on to their children. The prime of health and vigour was heritable for Combe.

The same inheritance of mental qualities was attributed to different human races – hence "each Hindoo, Esquimaux, Peruvian, and Carib, obviously inherits from his parents a certain general type of head; and so does each European." In intermarriage between Europeans and Hindoos or native Americans similar effects would occur as when a clever man and dull woman reproduce – pureness of virtue would be diluted and lost – but the offspring would still be superior to those of pure native ancestry.

According to Combe, mankind was arranged in a hierarchical scale of superiority and inferiority. The scale began with non-European races, especially those with dark skins "whose brains are inferior" at the bottom, and western Europeans, like Combe himself, at the top.[9] European interbreeding in India, for example, would lead to a mixed-race that would eventually rule the native inhabitants. Combe's belief in distinct human 'races' and in a scale of their superiority were wholly unoriginal points. Despite the low value attributed to other 'races', Combe was vehemently opposed to chattel slavery and was an early critic of colonialism. For Combe non-European races were emphatically human, as phrenology proved, by possessing the same cerebral organs. Nevertheless in all things there were degrees of power or virtue. A phrenological brain organ could be well or poorly developed – but it was still the same organ. In the same sense all humans were ranked according to their natural gifts – some were intelligent, others stupid, some healthy, others sickly. Human races were essentially the same for Combe, though some were *better* than others.

Combe asserted that vital and long-term conclusions were to be drawn from the law of hereditary descent. He thought that heredity alone enabled the progress of Man to occur in the long run, as each individual could increase his or her physical and mental powers through proper use and exercise and as the actual heightened state of physical and mental virtue could be passed on to offspring. Combe theorized that each generation could be given a head start by beginning at the heightened state of perfection reached by its parents. European society could gradually increase its concentration of intelligent and moral beings and lower races could gradually improve their stock and thus climb the scale of civilization.

In order to best progress societies must practice improvement breeding almost like that done for domesticated animals. Only the fittest people in the prime of their lives, who were in perfect health and could afford to support a family should be allowed to breed. In support of the view that careful improvement breeding should be applied to humans Combe cited, among others, Horace, John Gregory[10], Voltaire[11], Dr James Gregory,[12] John Mason Good[13], Albrecht von Haller, and an unnamed medical friend.

Interestingly in the marginalia to the 6th edition of *Constitution* held at the Whipple library in Cambridge an unnamed evangelical reader left traces of his reactions to Combe's work. Among

[9] Ibid., p. 194.
[10] John Gregory (1766).
[11] Voltaire (1766), s.v. "Cato."
[12] James Gregory [c. 1780].
[13] Good (1825), vol. 5.

these are some scribbled responses to Combe's hereditarian pronouncements. The evangelical reader objected to Combe's proposal to improve mankind because of "[the] original depravity Adam *fell*!" The human species could not be improved because "the germ of all is bad.[…] hence Sin has descended to us all!"[14]

Combe's lengthy focus on heredity, which totalled about 10,000 words in *The Constitution of Man*, more than was devoted to phrenology, brought to a vast reading audience many of the themes for which Darwin is now better known. *Constitution* brought these subjects from specialist contexts into the home as Jim Secord has shown that *Vestiges* brought evolution into the home.[15] Darwin's comment that *Vestiges* helped prepare readers for his *Origin of species* could have included *Constitution* which for thirty years had taught countless thousands of readers to think in terms of selective breeding and the cumulative effects of the early death of the sick or infirm:

> When we reflect on the transmission of hereditary qualities to children, we perceive benevolence to the race, in the institution which cuts short the life of an individual in whose person disease of essential organs has exceeded the limits of the remedial process: it prevents the extension of the injurious consequences of his errors over an innumerable posterity […] the race is guaranteed against the future transmission of his disease by hereditary descent.[16]

However a focus on Combe's great influence should not lead us to think of him as the source of these ideas. Very similar passages can be found in Spurzheim's earlier and less widely-read books. For example, Spurzheim wrote: "Since beggars, and those with hereditary dispositions to diseases, only propagate to the detriment of society and to entail misery on their progeny, were it not better to prevent them from marriage altogether?" The future of society is dependent on only "the stoutest and best made men" propagating and not those with "bodily weakness and disease".[17] In his turn Spurzheim had been influenced to the same extent by Gall and the physician Pierre-Jean-Georges Cabanis as Victor Hilts has shown.[18]

These remarks by Spurzheim and Combe sound remarkably like Darwin's view in *The descent of man* (1871):

> Yet [one] might by selection do something not only for the bodily constitution and frame of his offspring, but for their intellectual and moral qualities. Both sexes ought to refrain from marriage if they are in any marked degree inferior in body or mind; but such hopes are Utopian and will never be even partially realised until the laws of inheritance are thoroughly known. […] all ought to refrain from marriage who cannot avoid abject poverty for their children; for poverty is not only a great evil, but tends to its own increase by leading to recklessness in marriage.[19]

All three of these passages, from Spurzheim, Combe and Darwin are what Francis Galton would later call "eugenics" in his *Inquiries into Human Faculty and Its Development* (1883) as "the study

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14 G. Combe (1836), 6th ed., pp. 109, 123, WSM Store PH-52.
15 Secord (1989). This point was made earlier by Chadwick ([1975] 1995). p. 165.
16 G. Combe (1828), pp. 247-8.
17 Spurzheim (1825), pp. 178, 179.
18 Hilts (1982), pp. 62-77.
19 Darwin (1882), pp. 618-9.

of agencies under social control which may improve or impair the racial qualities of future generations either physically or mentally." Victor Hilts observed that, "Spurzheim placed most of his faith upon the regulation of marriage, whereas Combe resurrected Lamarck by teaching that parents could transmit good qualities to their offspring by perfecting those same qualities in their own persons." To my knowledge there is no evidence that Combe borrowed this from Lamarck's writings. Instead Combe seems to have expressed a common-sense impression of heredity.

Descendants of Combe's hereditarianism

I have argued elsewhere[20] for the extraordinary influence of Combe's writings, especially the *Constitution of man*. Combe also promulgated his laws of inheritance in his *Moral Philosophy: or the Duties of Man Considered in His Individual, Social, and Domestic Capacities* (1840). His brother, Andrew Combe, a well-known physiologist and phrenologist also stressed the importance of the transmission of characteristics via heredity.[21] But Combe's hereditarianism was spread *much* more widely as it was picked up by *many* other writers, especially in America by popular authors such as the phrenological Fowlers whose works were often little more than paraphrases of Combe's writings. A number of their works dwelt particularly on the subjects of marriage and heredity including Orson Squire Fowler's *The practical phrenologist* (1869), his *Matrimony: or Phrenology and Physiology Applied to the Selection of Companions for Life* (1842[?]) and especially his *Hereditary Descent: Its Laws and Facts Applied to Human Improvement* (1852). There was also Lorenzo Fowler's popular *Marriage: its history and ceremonies: with a phrenological and physiological exposition of the functions and qualifications for happy marriages* (1847). The Fowler publishing industry also distributed similarly Combean works by the Rev. George S. Weaver such as *Hopes and helps for the young of both sexes. Relating to the formation of character, … and marriage* (1854).

Furthermore, as Victor Hilts observed, two English writers most associated with hereditarian ideas in the latter nineteenth century, Herbert Spencer and Francis Galton were both influenced by Combean phrenology. The Combean flavour of Spencer's hereditarianism is unmistakable. Galton was less influenced by Combean hereditarianism, but was nevertheless influenced by it.

Therefore from Volney, Gall, Cabanis and others we can trace a direct line of descent for these hereditarian concerns through Spurzheim to Combe and from Combe to the Fowlers, Spencer and Galton and from them to a larger audience than ever before.

Methodology and conclusion

John Waller remarks in his important recent article[22] that in the past we tended to conceive of eugenics popping into existence in late Victorian Britain from a context of "rival economic superpowers and an increasingly volatile metropolitan underclass." Waller is quite right to conclude that this was not the case and that Galton was not a founding father as he has been portrayed. Waller goes on to declare:

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[20] van Wyhe (forthcoming 2003).
[21] A. Combe (1834).
[22] Waller (2001), pp. 289-457.

> To identify Galton as a primary causal agent in the early history of eugenics is to over-personalise an episode and period in which, as I have sought to show, individuality is insignificant in comparison with context.
> […]
> By attaching too much importance to individuals we lose sight of the fact that--in terms of causal agency--the idea of eugenics arose from a *general* fascination for […] and a particular set of social, institutional and political circumstances of the mid-Victorian period.[23]

I completely agree that Galton should not be identified as an original source, but I think it is unjustified to conclude from this fact that "the idea of eugenics arose from a *general* fascination."[24] Ideas cannot arise in social contexts themselves – literally speaking ideas arise only in individuals' heads. Of course all individuals are within a social context and their ideas reflect their context – but to say that the ideas arose from the context is to be ahistorical. It is ahistorical because if ideas are spontaneously generated by contexts then they would have no history, that is they would not contain elements or characteristics of past ideas. We would not see the gradual cultural change, which we observe and the affinities between ideas in different periods. My discussion of the history of Combe's hereditarian ideas and more so Hilts' and Waller's work show that ideas of heredity developed gradually over time from person to person and from decade to decade.

I have suggested that Combe played a disproportionately major role in the propagation of hereditarian ideas in the nineteenth century due to the propitious success of his *Constitution of Man*. More people encountered and were influenced by his versions of heredity than other versions. No one proposes returning to writing only histories of Great Men but we cannot overlook that humans are the agents in history. The hereditarian ideas that were available in the late nineteenth century had the characteristics that they did, including notions of acquired characteristics, purity of blood, responsibility to breed only with healthy mates etc. not just because of the context of the moment, but also because of their history, that is, where they came from, or what they were before, because of the people who had possessed and promulgated them at an earlier time in different contexts. I think Waller is correct that the different context of the latter decades of the century explains why eugenics became the widespread phenomenon familiar to us but I think we must always consider context *as well as* the ancestry or earlier sources or inspirations of the ideas in a context.

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[23] Ibid.
[24] Ibid. Italics mine.

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Majorat: Literature and the Law of Succession in the 19th Century

Ulrike Vedder

This paper explores the lines of transmission between generations. It deals with what is passed on from one generation to another, in which ways, and who the agents mediating between the generations are. In dealing with these questions, I shall be looking more closely at the legal system, respectively the law of succession, as the principal cultural system of regulation that seeks to determine the transfer of material possessions and, as such, the relationships underlying such material transfers. Since we are dealing with definitions of the family and of kinship order, and how these are reproduced, respectively cast into the future, the discourses of nature and law clash time and again. The figure of the bastard, which I shall be considering briefly in the narratives of inheritance which this paper discusses, is a valid case in point, since the bastard recurs as a figure of conflict along the lines of inclusion and exclusion; of what is proprietary and native that is, and what is not and is therefore alien. As I intend to approach the discourse of inheritance and succession as it stands in the law by considering how it is 'breached' in literature, I shall focus on literary texts rather than legal ones. We shall see that the authority of the law, that is its power to determine and sanction, is challenged in literature, just as the boundaries that are drawn by those laws of nature considered valid at any point in time are unsettled when those forces are brought into play that cannot be separated from the processes of transmission between generations: passion, guilt and power.

1. Law, Nature, Literature

The law of succession governs the relationship between genealogy and legitimacy, kinship and property, and affiliation and transfer between generations. Genealogical and legal relationships are structured by semiotic systems, however, that need to be interpreted so that they become valid. This is one reason why literature is a preferred arena to debate issues concerning genealogy and the making over into law of property and kinship relationships. On the other hand, it is worth noting that a fictionalizing impetus takes effect time and again in the law and its dispensation. Specific ways of dealing with authority and authorship, with rhetoric and fiction, with interpretation and the production of meaning, to mention just some issues, play their part in the complex relationship of law and literature. Both – law and literature – develop strategies to posit and repeal what has been statuted. Both apply different strategies to make things of, and exist in, time. Both adopt a range of procedures to typify and represent events as what comes to be known as a case, a case history and a narrative; to make reality unequivocal or ambiguous; to bring into relation the normal case and the exception; to enforce, differentiate and abolish legal and aesthetic norms.

These various aspects of law and literature form a rich nexus of issues concerning the law of succession, where the problems of defining basic terms such as kinship and property become particularly apparent; likewise, so do the intricate entanglements of property and passions that are involved in the transmission between generations, or the difficulties of determining points of

rupture and devolution, of negotiating inclusion and exclusion, affiliation and alienness. These difficulties also include the fundamental doubt that turns every indication of paternity into a fiction or, to put it differently, that amounts to the potential conflict between maternal knowledge about the events of family reproduction, on the one hand, and the bequeathing of name and property along patrilinear lines of succession, on the other hand (whose principal interest it is to pass on the father's estate and affiliation to social rank to his own heirs on a continual basis). As we shall see in one of Balzac's novels, the gender war about fiction and reproduction, which no legal settlement can resolve, is waged in literature.

The law of succession expands through time to take up the past, build on tradition and determine directives for the future of a family order. Another element of its impetus to fictionalize lies in the fact that it casts existing law into the future, since each last will reckon with the case that has not (yet) occurred: death.

This problem is aggravated by a specific settlement of inheritance that is projected onto the open, unfinished future and remains nonetheless tied to a lineage endowed with a past that is still effective, and that is considered great and worth preserving: the *majorat* (in Germany and France, that is the entailed estate). The majorat is intended to transmit and make immortal the dignity, virtue and glory of a family by subjecting all future generations to a form of succession that privileges the "first born of the paternal line" (by way of the authority of the estate's founder) and preserves the indivisibility of the estate. This is meant to safeguard a family estate – real estate, in most cases – against fragmentation and loss, as much as against financial speculation and indebtedness. Thus, according to whichever economic point of view is taken, family property is transformed either into a security with maintained value or into dead capital.

Instituting a majorat (which became more and more common in Germany from the seventeenth century onwards, for example) thus determines that commodities and assets (special funds) are to be indivisible and unalienable – through a private declaration of volition, that is through a legal transaction.[1] According to its reformulation in the General Common Law of the Prussian States (of 1 June 1794), assets would go to "the next in line in the family, according to grade, […] among several close enough, however, to the elder". A later commentary states: "Individual-Succession innerhalb des Agnaten-Stammes; denn nur jene erhält den Reichtum, nur dieser den Namen."[2] What we recognise here is that the law produces a 'rhetorical' community – the family that is to be perpetuated – and points to the rhetorical essence of supposedly natural communities, while the law of succession and the majorat in particular are supposed to naturalise legal communities. The legal institution of the majorat indicates the status of 'Nature' in two directions: first, in that recourse to nature is taken in determining succession in terms of blood relationship, if succession is only able to occur within the male line of relatives, that is within the patrilinear filiation of the same blood; secondly, by taking recourse to naturalisation, which lies in the majorat being perpetuated forever, 'for all eternity', in that property is seen to be virtually sanctioned by the law of nature.

The majorat constitutes a regulated means of consolidating a family estate, and of bringing material goods into time. In turn, such an entailed estate materializes time. As a "materialized

1 Cf. Eckert (1992), p. 24.
2 Gierke (1909), p. 104.

medium"[3] for the continuity of a family and its assets, the majorat establishes a particular form of genealogy, which is charged with a high conflict potential, that makes it of interest for literature. This potential results first from the injustice that only the first-born inherits, secondly from the founder's claim to authority by committing succeeding generations to a specific form of tradition for all eternity through an immutable majorat, and thirdly potential conflict results from the problems of defining terms such as family, paternity, parental love and the concomitant difficulties of producing signs and their interpretation. Literature makes use of these uncertainties and complications. This can go as far as questioning not only the legitimacy of progenies, which means calling into question family affiliation, but, as we shall see in one of Achim von Arnim's stories, it can go as far as challenging the legitimacy of the laws of nature, which amounts to calling into question affiliation to the human species.

During the French Revolution, legislation refers to the new general principles of freedom and equality, thus aspiring to a "morcellement", a dividing up of the large estate holdings in the hands of the landed aristocracy. Accordingly, the so-called "substitutions" are abolished. There is a conspicuous rhetoric of excess and unnaturalness in the ensuing debates: "monstre des substitutions", "monstrueuse inégalité", "monstruosité politique".[4] In these debates, furthermore, the present is set against the adherence to the past as well as against the majorat being cast into the future, to which it keeps being sacrificed: Thus, there is mention of the Ancien Régime's regulations of the law of succession "qui subordonnent les intérêts du peuple vivant aux caprices du peuple mort" and where "la génération qui est se trouve constamment sacrifiée à celle qui n'est point encore".[5] The present's 'gap in time' becomes an insoluble problem in the literary texts embracing the majorat. The revolutionary legal texts, by contrast, look for a solution that is both unequivocal and final. Thus the Convention states in Article One of the *Décret sur les substitutions* of 14 November 1792: "Toutes substitutions sont interdites et prohibées à l'avenir." Now this did not mean that majorats had been done away with for good, however. There are numerous clashes in the first half of the nineteenth century, both in France and in the German states, such as Prussia, which lead to the alternating abolition and the (more or less clandestine) reconstitution of majorats.[6]

Arguments in favour of and against the majorat are also debated in the literary texts which I wish to look at. The rhetoric of the law and of jurisdiction come into specific operation in these texts, be it in trial scenes or in drawing up settlements. Beyond such instances of legal discourse, the narratives of inheritance and succession of the first half of the nineteenth century deal with the law's power to define and interpret what constitutes family and the linking together of generations; vice-versa, these narratives are also about how legal norms are made legitimate in the face of the threatening disruptions of property situations and the succession of generations, arising part and parcel from the transmission and recurrence of the guilt, deaths and passions inscribed in the majorat's very conception of succession.

In the following, I shall discuss the legal-literary order and how genealogies run their course

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3 "[…] das Majorat in seiner Funktion als materiales Medium der Kontinuität der Familie […]" (Mangold 1989, p. 228).
4 Cf. Eckert (1992), pp. 180-185.
5 Ibid., p. 202.
6 Cf. Dietze (1926); Sybel (1870); Eckert (1992).

in three texts that deal with the antiquated legal institution of the majorat. Around 1800, legally sanctioned paternal authority enters not only a state of crisis, but leads straight to the downfall of families, as we shall see in E.T.A. Hoffmann's *Das Majorat* (1817). Thus, an entirely different social principle takes the place of the law: the power of money, respectively capital. This process is demonstrated in a polarised manner in Achim von Arnim's *Die Majoratsherren* (1819). The power of money, however, makes the exclusiveness of the 'old family' in some way contingent, as in Achim von Arnim's story and then particularly in Honoré de Balzac's novel *Le Contrat de mariage* (1835). Both narratives feature main characters that are hybridized, respectively creolized, that are contaminations of the legal discourse and of the discourse of race. This will amount to an account of the end of genealogies, that is the triple demise of old lineages.

2. The Genealogy of Death: Law, Writing, Fiction (E.T.A. Hoffmann)

In E.T.A. Hoffmann's *Das Majorat* (1817), the lineage of "Freiherr Roderich" comes to an end without any descendants; all members of the family have either been murdered treacherously, have fallen in battle, or have died in accidents or from grief. The ancestral castle lies in ruins and the rich landholding has fallen into the hands of the state. The *splendor familiae et nominis*, which is mentioned repeatedly in all arguments in favour of the majorat, and which features as a dazzling objective over this story, too, has become more and more tainted precisely *by* the majorat and has ultimately evaporated. "Eine verfehlte Operation", a failed operation which is not explained in any detail, but has obviously occurred in the field of "geheimer Wissenschaft",[7] leads Freiherr Roderich to seek the cause of his misfortune in his "ancestors' guilt", who had left the ancestral castle. Furthermore, he determines it to be a majorat, "um […] wenigstens das Haupt der Familie an das Stammhaus zu fesseln." Determining the future through the law of succession is thus supposed to bind together house and lineage, even more so since "deren Zweige schon in das Ausland hinüberranken."[8] Besides the injustice of the majorat and its consequences, though, shackling all these creeping branches to one place and its inherent laws, fatally causes them and hence the entire family pedigree to break off.

In Hoffmann's story, the majorat is marked by its almost imminently lethal effect, taking hold of all the founder's descendants. Both sons and their four descendants, as well as two wives and the manor's steward die due to the majorat, whereas not one single birth or fathering is recorded. The majorat thus consists in the recurrence of death: The sons die their fathers' deaths, and the first son's murderer keeps returning to the room of death – first as a sleepwalker, then as a dying man, and finally as a ghost. What this amounts to is in fact a genealogy of death and of the undead. In other words: Just as the naturalisation of the legal institution of the majorat turns into a rhetoric of unnaturalness and the monstrous, so does what has been regulated in supposedly 'rational' legal terms in E.T.A. Hoffmann, and later in Achim von Arnim, go over increasingly to the 'irrational', that is specifically to the genre of ghost and visionary stories.

Accordingly, the new beginning that Wolfgang, the founder's son, hopes for by taking on the name "Born" – he had married abroad against his father's will and under a false common law name – is impossible, since he has named his own son Roderich again – after his father. Besides

7 Hoffmann (1985), p. 200.
8 Ibid.

names and properties, there are various other agents that mediate between the generations, such as letters – letters announcing death, letters written from the deathbed – and written documents negotiating the past and future: certificates of baptism, certified excerpts from church registers, the sovereign's confirmation of the endowment, tally books and documents left behind, such as wills, collections of correspondence, or confessions. These documents compete for interpretation, only from which the factualness of the law begins to transpire. Thus, litigation proceedings are required to establish how the endowment of the entailed estate and the will are connected, as much as to ascertain the conclusiveness of the various proofs of identity, when the legitimacy of Wolfgang's son, who appears by surprise as an issue from the secret marriage and who is initially suspected of being a bastard not entitled to inheritance, is interpreted in court.

When the first-person narrator, a young "Justizmann", visits the ruins of the castle at the end of the text as the sole survivor of the story, it is not as if he has claimed victory in a historical process, as one might be tempted to gather from the analogy of the collapsed ancestral castle with the demise of the aristocracy. Much rather, he is caught up in the narration of a genealogy of death, a fact that is made concrete so to speak by Roderich inviting the narrator to be buried alongside the noble family in the same tomb.

3. Mixture and Exclusion (von Arnim)

In Achim von Arnim's story *Die Majoratsherren* (1819), which was almost written at the same time as E.T.A. Hoffmann's *Das Majorat*, the narrator seeks to elude such entanglements. Despite the many blendings and meddlings that traverse the text, Arnim's narrator is separated by a manoeuvre that cuts him off sharply from the age of the majorat and the lineage that collapses with it. He situates himself after the French Revolution, when, in the frame of the story, he discusses the changing of times that the French Revolution entailed and that severed the colourful and fulfilled pre-revolutionary past – the age of the majorat – from the post-revolutionary present – a monotonous and poor age. This shift is symbolized in the majorat house, which, by the end of the story and of the French Revolution, will have fallen into the hands of Vasthi, an old unscrupulous Jewess.

In dealing with Achim von Arnim's story, I shall focus on the key role of time, respectively temporality, on the one hand, and the mixing and separation of what is native and proprietary from what is not, on the other. Both aspects are crucial to considering the issues of inheritance and transmission by succession, since both are to be made governable by the law of succession. The organising principle of the majorat fails, however; for one, within the family, as the majorat order of succession is ignored in treacherous ways; for the other, failure occurs in historical-systematic terms, since the economy displaces the law – in its function as a dominant principle which rules the organisation of society.

The story of the young, indecisive majorat lord, who comes to his substantially older cousin – a grotesque, decrepit lieutenant, who spends his life waiting for a spouse and an inheritance – , only lasts for four days, during which the past history, that has occurred thirty years before, is revealed. At that time, the old majorat lord, who was without a male heir, had given away his only child, a new-born daughter, who was not entitled to inherit, to a Jewish "Roßtäuscher",[9] a horse-trader, who called the child Esther and took her in as his foster daughter. Concurrently, the old

lord secretly adopted the illegitimate son of a lady-in-waiting as his own to cheat the rightfully entitled cousin out of the majorat. This cousin is portrayed as being as immutable as the majorat house that has been unoccupied for thirty years, but whose clocks are still wound up, and as lifeless, too, as he goes out on the same walks in his worn out uniform coat and clings to unchanging snuff and visiting habits. Neither his preoccupation with heraldry nor his collection of coats of arms are able to enfuse his life with any of the old glory or hope for the future, as these interests are contaminated by economic necessity, which requires him to copy the collection, stick the coats of arms on with care and sell them to earn his crust.

The protection that the majorat sets against any form of change thus also amounts to a constraint of not being able to change anything. Both elder protagonists are subjected to this constraint – the cousin is stuck with the old lady-in-waiting (i.e. the illegitimate son's mother), for whose love he has been waiting in vain for thirty years, just as he has for the entailed estate – as well as the two younger protagonists, the young majorat lord and the horse-trader's foster daughter, Esther, who are both permeated by the ghosts of the past. They both fail to live in the present, which is not theirs, and which will ultimately lead to their deaths. The old cousin does indeed go on to take possession of the entailed estate and marry the lady-in-waiting, moving into the majorat house with her and a horde of animals – instead of a swarm of children, notably. However, life there, which he has desired so much for thirty years, is hell; the majorat lord is humiliated by his spouse and her horde of animals until one day he passes away unnoticed and ingloriously.

This draws attention to the issue of the present in genealogical and law-of-succession narratives. The generations that the majorat chains together are conceived as a continuum of the past and the future – without assigning more to the present than maintaining the majorat in due form. In Hoffmann, the present consists of administering the majorat and its documents and tally books. In Arnim, the loss of the present that is so fixed on the past brings forth a "Hohlraum in der Zeit",[10] a hollow space which can be identified in topographic terms as the unoccupied majorat house with its clocks ticking away emptily.

Vasthi, the old Jewess, Esther's step-foster mother, makes use of the hollow space of this empty present. In the wake of the Revolution, after the abolishment of the majorat, the release of the Jews and, as we are told explicitly, "unter der Herrschaft der Fremden",[11] Vasthi emerges as a war-profiteer to take over "das ausgestorbene Majoratshaus durch Gunst der neuen Regierung zur Anlegung einer Salmiakfabrik." And the last sentence of the story reads: "[…] es trat der Kredit an die Stelle des Lehnrechts."[12] In Achim von Arnim's story, the economy comes to occupy the place of the law, monetary transaction (with its Jewish connotation) takes the place of (feudally marked) real estate holding, and unalienable real estate – charged with family history – is displaced by its speculative, abstracting monetary value. This makes contingent affiliation with the family/the lineage, a contingency which the text produces as a blurred distinction between what is proprietary and what is alien.

Thus, the young majorat lord, who as a visionary is hardly capable of distinguishing between

9 Arnim (1991), p. 217.
10 Oesterle (1988), p. 29.
11 Arnim (1991), p. 250.
12 Ibid., p. 251.

reality and vision, is a foisted bastard in terms of matrimonial law and the law of succession. Esther is not only the foster daughter of a Jewish "Roßtäuscher" – who earns a living not necessarily from 'täuschen' (deceit) but from 'tauschen' (exchange) – but she is also an image of her Christian mother before she is cast – as she is dying – as a mythical, hybrid creature consisting of a Jewish angel of death and a Christian shining light. The two illegitimate children, the young majorat lord and Esther, reveal their exchanged and deceptive origin in a vision: "Ich bin Sie und Sie sind ich."[13] So what is proprietary can no longer be identified clearly, neither within family boundaries – given the multiplication of father- and motherhoods as natural, adoptive, step and foster parents – nor within the human species: In the end, the cousin, caricatured as a turkey, is obliged to wait upon the lady-in-waiting's cats and dogs at the majorat banquet table.

Given such narrative blendings of boundaries, one particular boundary that is brought into focus time and again in the text gains significance and explosive force: that between the town and the Jewish ghetto, which can only be crossed at the expense of death. The boundary between Christians and Jews, which first is introduced in topographic terms, is then sharpened and naturalised in a racist manner as that between the human and the non-human, f.e. when the Jewess Vasthi is strangling Esther, her Christian foster daughter, and when she appears as a monstrous sharpened silhouette:

> […] wie die ausgeschnittenen Kartengesichter, welche einem Lichte entgegengestellt […]: sie erschien nicht wie ein menschliches Wesen, sondern wie ein Geier, der lange von Gottes Sonne gnädig beschienen, mit der gesammelten Glut auf eine Taube niederstößt.[14]

The crisis of family authority and its inheritance is transferred into anti-Jewish denunciation to shift the decrepitness of feudal-patrilinear transmission, caricatured in the grotesque drawings of the elderly cousin and his lady-in-waiting, onto the takeover by the "foreigners" and their financial resources. As a universal means of exchange, money abstracts any tangible value (such as, for example, that of entailed real estate, with its family-historical significance). That it is exchangeable in general terms makes money function as that which basically devalues the specifically individual (and proprietary); in Lacan's terms, it becomes "the most annihilating signifier". This process becomes even more 'unnatural' in Achim von Arnim's story as family disorder, destruction and annihilation radiates from the mother's position in the system (Esther's mother, the lady-in-waiting, Vasthi). Honoré de Balzac's novel *Le Contrat de mariage*, which I would like to look at next, offers another account of the way in which the discourse of law (and lawfulness) and the discourse of nature (and race) compete with each other through money, which is in turn bound up with gender.

4. Classification and Gender War (Balzac)

In Balzac's novel (first published in 1835, then republished in 1842 in the *Comédie humaine*, in the *Scènes de la vie privée*), a contract between spouses is concluded in which the establishment of a majorat features as a key clause that will ultimately ruin the marriage. What is highly significant

[13] Ibid., p. 232.
[14] Ibid., p. 245.

about this contract is that it is concluded between two 'hybrids', of which one, as we are told, is assigned to the social order – "un métis social" – and the other to the natural order – "la créole […] une nature à part". One of the parties to the contract is Paul de Manerville, a rich heir from landed gentry stock, gentle and naïve, whom the text names as "un métis social",[15] a social mestizo, a bastard in other words. Paul owes this designation to his uncapability of exercising any male-aristocratic power. Though he is forced to follow the customs of the aristocratic habitus, he pursues the entirely unaristocratic and quite bourgeois-sentimental ideal of love, desiring wedlock with a woman who stands by him, shares his thoughts and secrets, forms a unity with him in order to lead a married life shaped by intimacy, love and naturalness: "Un cœur à qui confier mes affaires et dire mes secrets."[16]

Provincial society nicknames Paul "Fleur des pois", "pea-flower" (which was what the novel was first called), which is an early eighteenth century designation for an "homme à la mode". At the beginning of the nineteenth century, when the novel is set, however, this name is no longer "à la mode", but an anachronism that the novel uses as a marker of a political-social conflict: to be named a "fleur des pois" is considered an honour by the "royalistes", whereas it evokes irony among the "société liberale"[17] – not least, perhaps, because the pea is a hermaphrodite. The pea-flower is known to have acquired a key systemic position at the end of the nineteenth century, among others in Mendel's experiments and creation of "plant-hybrids" (recorded in his *Versuche über Pflanzenhybride*, first published in 1866). Mendel chose the *fleur des pois*, because it allows one to reconstruct and calculate – and thus produce by experiment – the purity and hence proportions of a mixture in an optimal manner. This admittedly anachronistic association draws attention to Balzac's arrangement of the novel as an experiment, specifically as an experiment in the domain of nature, and in the social and legal spheres – as an experiment that concerns the unity (of the species) and the difference (between the genders), where two hybrids are supposed to unite.

As it happens, the "métis social" happens to choose a stunningly beautiful Creole, whose inheritance from her deceased father, a businessman, has long been squandered and who is thus in search of a marriage that will bring her profit in economic and social terms. She and her mother are not only Creoles, but female, and these two features of 'nature' make up her dangerous character: "La créole est une nature à part […]; nature gracieuse d'ailleurs, mais dangereuse."[18]

These dangerous hybrid-formations transcend the modes of the natural and the social, since their boundaries and transformations are constantly subject to discursive negotiations that Balzac explores in various different ways: as those occurring in the area of the law (within the novel) and as those in the sciences (in the programmatic preface to the entire *Comédie humaine*). In the "Avant-propos" (written 1842), he ponders his dream – a "chimère"[19], as he calls it: the comparability of "l'Animalité", and the human, "l'Humanité". As is well-known, Balzac also refers to Cuvier's dispute in the Académie with Geoffroy Saint-Hilaire (1830) about the relationship between unity and variety; he follows Geoffroy Saint-Hilaire's position of a *unité de composition*

[15] Balzac (1976b), p. 530.
[16] Ibid., p. 534.
[17] Ibid., p. 537.
[18] Ibid., p. 605.
[19] Ibid., Balzac (1976a), p. 7.

when he states: "Il n'y a qu'un animal. […] un seul et même patron pour tous les êtres organisés."[20] Tracing back all milieu-determined *species* to a fundamental, unified model encourages Balzac to undertake his programme of a comprehensively catalogued society, of classifying the social, in the *Comédie humaine*, on the analogy of the organising principles of Buffon's *Zoologie*. He then goes on to cite the "drames", "hasards" and "confusion" that stand in the way of such organising principles. Contrary to the writing of literature, which he at first conceives as the application of a theory, Balzac's novels in the *Comédie humaine* are precisely about the inscrutabilities of classification, about how coincidences and passions intervene in the drawing up of boundaries and distinctions between the various genera, and about the inconsistency and lack of uniformity of the *composition*. This becomes apparent in *Le Contrat de mariage*, not only by featuring hybrid characters, but by negotiating a contract between the two family lawyers that reaches more and more into the arena of warfare.

And this is where we find the calculating – and in this way 'unnatural' – Creole, who will emerge victorious from the battle waged over the contract between spouses, in which the newly inserted majorat is supposed to act as a barrier preventing the flow of money from the male to the female side. The Manerville's longstanding family lawyer had after all managed to bring the heir's estate through the French Revolution and the wars unscathed. But neither the lawyer nor the amorous husband are up to the gender war that the young wife and her mother wage, which entails the husband's complete and utter financial ruin, and ends in his departure for Calcutta, while his mother-in-law takes possession of his rich commodities and assets.[21]

Classifying human beings into social species, on the analogy of classifying animals into zoological species, which Balzac plans in his preface to his cycle of novels, comes up immediately against the difficulty of gender difference, which compounds his classification: "La description des Espèces Sociales était donc au moins double de celle des Espèces Animales, à ne considérer que les deux sexes."[22] Whereas Buffon had managed to describe the females of a particular species in a few lines in his "Zoologie", Balzac makes it quite clear that one annotation on the female 'variant' will not do in cataloguing the social species; moreover, Balzac's basic hypothesis, which follows Geoffroy Saint-Hilaire's, that there is a unity of the genus, whose wealth of variations is developed by each particular milieu and which can, given the analogies between these variations, ultimately be put down to the notion of unity again – this hypothesis can no longer be sustained once the gender issue is taken into account: "[…] dans la Société la femme ne se trouve pas toujours être la femelle du mâle. Il peut y avoir deux êtres parfaitement dissemblables dans un ménage."[23]

The programmatic text of the "Avant-Propos" does not go into more detail about this discrepancy, which explodes the analogy of *humanité* and *animalité* and thus, too, the notion of the unity of the human being as a basis of a social world that can be catalogued. By contrast, the novel acts out this area of conflict, by inserting a legal construct – in the shape of a contract between spouses – in the place of a mediating natural entity. Within this contract, the majorat appears as the unifying central character, with whose assistance all differences between the sexes

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20 Ibid., p. 8.

21 In other words, and to quote Balzac's: "J'ai peint toutes les infortunes des femmes: il est temps de montrer aussi la douleur des maris." (Balzac: "Lettres à l'Etrangère", 1: p. 275; cf. Perrod 1968, p. 221.)

22 Balzac (1976a), p. 9.

23 Ibid., pp. 8 f.

and families are supposed to be resolved by way of the law of succession, but which actually causes the conflict, respectively the war to erupt with all possible passion and to ultimately put it beyond reconciliation. It is the Creole's young lawyer – a modern-type profiteer of speculative transactions, who later goes on to marry "une mûlatresse riche"[24] – who manages to pull off a surprise coup by inserting a clause quite by the bye that the old lawyer fails to take seriously because of its entirely fictitious character. This clause sketches the case of an absence of descendants, in which case the majorat is to be transferred into the spouses' community of property; as it happens, the young wife brings about this very case and makes this fiction a reality by evading descendancy. The descendants no longer die of the majorat, but they are even not brought into life.

And just as it is merely a clause that is slipped in *ex post facto*, inserted into a comprehensive majorat contract like a foreign body, and becomes the decisive moment in the spouses' sexual and genealogical life, thus it is but one single word on the morning of the wedding with which the young bride tells her mother "que si Paul avait gagné la partie au jeu du contrat, sa revanche à elle commençait." For she had already gained her husband's complete obedience – "la plus parfaite obéissance"[25] – in the wedding night. We are not told which word the bride tells her mother, but the fact that her husband's ruin goes ahead according to plan is clear enough evidence that it was one of negation, such as 'no', perhaps even 'never', that expresses her refusal of 'natural reproduction' and denial of conjugal rights.

To conclude: Balzac scholarship has shown that the old lawyer would have been able to prevent the husband's downfall with legal means, since the subsequently inserted contractual clause is in fact ineffective.[26] Balzac, however, demonstrates that it is the institution of the majorat itself that is ineffective and that it is the fact that it is drawn up at all that leads to destruction.

But this means, for Balzac, Hoffmann and Arnim, giving up the conception of the direct and linear transmission, first of property and title, that is *position*; secondly, of name and affiliation to what is proprietary, that is *identity*; thirdly, of resemblance and essence, that is *nature*; and finally, of time and future, that is *perpetual continuity*. Troubling, even thwarting the genealogical thinking is highlighted in the literary texts with their specific means in three ways: first, by the unpredictable passions and entanglements that are always also transmitted and that the three texts that I have considered set in motion; secondly, by the increasing abstraction of the property that it is to be entailed, which has a tangible shape as real estate and gold nuggets in Hoffmann, features as the transition from a feudal system to credit in Arnim, and appears as a speculative capital investment in the shape of bonds and shares in Balzac; and thirdly, by the fact that all three texts present figures of the hybrid, the bastard, the undead, since these are all characters that thwart the majorat and its underlying principles, namely its determination of affiliation, its determination of the perpetuation of the proprietary, and its inherent logical consistency in one generation succeeding another.

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[24] Ibid., 3: p. 623.
[25] Ibid., p. 618.
[26] Cf. Perrod (1968).

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"Victor, l'enfant de la forêt" – Experiments on the Heredity of Human Nature in Savage Children

Nicolas Pethes

1. Observing the innate: cases of wolf children

At the end of the 18th century heredity was not discussed within the empirical sciences. Although natural historians such as Linnaeus, Buffon, or Maupertuis already suggested theories on the generation of human beings and the inheritance of their traits, it was a philosophical debate that dominated the field: the discussion surrounding the innateness of human faculties. Before the rise of the life sciences, evolution theory, and genetics, 'heredity' is a problematic concept not only within the realm of experimental science, but also within the realm of ideas.

The philosophical concept of innateness addresses two questions: Is there a 'human nature' common to all of humanity? And are the individual faculties of a single human acquired or inherited? The latter distinction hints at the discursive context in which the question of inheritance is addressed. This context is the distinction between 'nature' and 'culture' and the various evaluations both concepts experience in the course of the 17th and 18th centuries. Schematically speaking, the notion that culture provides the best possible state for human beings, as represented by Samuel Pufendorf, is opposed to Jean-Jacques Rousseau's pessimistic account of the depravation of man's nature within society.[1] Transferred to the philosophical issue of heredity, this opposition reads as follows: Is the education within society responsible for every positive trait within otherwise 'savage' humans? Or do we have to strip away everything society has taught and trained us in order to find our 'essential nature', the state in which none of the current political depravations have spoiled our innate knowledge of a good life?

Rousseau, of course, was well aware of the methodological problems associated with the latter choice, given the fact that all of humanity seems to live within larger or smaller social units. Consequently, he asks at the beginning of his *Discours sur l'origine et les fondements de l'inégalité parmi les hommes* from 1755: "What experiments would be necessary to achieve knowledge of natural man? And what are the means for making these experiments in the midst of society?"[2] How can we validate the idealistic claim of the 'naturalness' of human nature? Can we think of any empirical data, let alone experimental research, able to support the theory of innate human qualities?

Obviously, human nature itself provides the answer: No! Due to the lengthy time spans between two generations, the transmission of characteristic traits between two generations and the comparison of their development within humanity as a whole cannot be analyzed under laboratory conditions.[3] Inheritance between humans seems to be a field of speculation or, at best, analogous reasoning. Twin research, the main field for studying inheritance in humans today, was introduced only in 1893 by Francis Galton. Before him, one of the central areas of research in the

1 Cf. Baecker (2000), p. 44.
2 Rousseau ([1755] 1992), p. 13.

19th century, heredity in human individuals or races, was not able to meet the standards of the main epistemological paradigm of the time: the experiment.

There seems to be one exception, and Rousseau – after admitting that not even natives from the Carribean islands qualify as "noble savages" because they too tend to live in communities – mentions it in a footnote of his *Discours*.[4] The only possible way to address the problem of human heredity by using – however extremely restricted – empirical data is research on the cases of so called 'wolf children' or 'savage children' that were documented numerous times in the 18th and 19th centuries. Referring to rumors about the deliberate isolation of children by pharaoh Psammetich, the Mongolian king Akbar, or emperor Friedrich II, as well as to the early example of the wolf boy of Hessia (1344), authors report on Wild Peter of Hanover (1724), Marie-Angélique de la Champagne (1731), Victor de l'Aveyron (1800), Kaspar Hauser (1828), and the wolf children of Sultanpur (1843, 1848), to name only the most prominent cases before Mendel, Darwin and Galton.[5] As the natural historian Johann Friedrich Blumenbach wrote in his chapter on Wild Peter's growing "Celebrität" in the middle of the 18th century: "Sie traf in die Zeit, wo gerade der Streit über die Frage: ob es angeborene Begriffe gebe, mit voller Lebendigkeit und *respective* Hitze geführt ward. Und da schien Peter ein erwünschtes Subject zur Entscheidung derselben."[6]

In this paper, I will analyze one of these case studies in order to demonstrate how the philosophical discourse on heredity at the end of the 18th century implemented, for the first time, the method of the new experimental sciences of the same period. Earlier reports about wolf children had not yet addressed the problem of heredity. Instead, they were interested in the kinship and differences between humans and animals, and savage children seemed to be a kind of hybrid 'in-between-state', or 'monster', in Foucault's sense of the word.[7] Nevertheless, Linnaeus subsumed the *homo ferus* as a subspecies in his classification and mentions nine examples of such *homines feri* in the twelfth edition of his *Systemae Naturae* from 1766. He attributes Latin classification names to each one of them (*Juvenis lupinus hessensis*, *Puella campanica*, etc.), and points out their major traits: they are unable to speak, covered with fur, and walk on all fours.[8]

Obviously, from this description, wolf children seem to be more closely related to the animals, who had been their companions, than to the human beings, who were their parents. Transferred to a model of inheritance, this implies that it was their way of life rather than their genealogical descent that influenced the faculties as well as the place within nature's order of these children. It

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3 Müller-Wille (2002), p. 14, shows in a similar sense that the synthesis of empirical data from single case studies into a theory of heredity posed a problem "that could not be solved in anthropology". The field for experimental studies in heredity was restricted to plants and minor animals. For the relation between speculation and experiment in 18th century theory of human heredity, see Terral (2002). Maupertuis' studies on inheritance in families that Terral mentions (pp. 36f.) are not experimental insofar as they do not enable Maupertuis to manipulate the objects of observation. Maupertuis' suggestions for actual experiments in human-animal-hybridization were not carried out.

4 Rousseau ([1755] 1992), pp. 68-70.

5 For a survey on all reported cases cf. Singh/Zingg (1942), and Malson ([1964] 1972), pp. 62-82. Seitter (1986), pp. 45ff., points out the intrinsic power-relation within this attempt to create knowledge about humans.

6 Blumenbach (1811), p. 18.

7 Cf. Douthwaite (1997). Clark (1948), p. 42ff., reckons the case studies on wolf children in the 18th century, focusing mainly on the connection between men and apes, among the "precursors of Darwin."

was only at the turn of the 19th century that this focus on the natural history of man was replaced by the focus on human beings as objects of experimental science. This shift also redefined the image of wolf children as well as the significance that was attributed to them with regard to the question of human heredity. In the chapter of their *Practical Education* from 1798 that deals with language teaching, Maria and Richard Edgeworth report about an experiment they conducted with Wild Peter:

> In 1779 we visited him, and tried the following experiment. He was attended to the river by a person who emptied his buckets repeatedly after Peter had repeatedly filled them. A shilling was put before his face into one of the buckets when it was empty; he took no notice of it, but filled it with water and carried it homeward: his buckets were taken from him before he reached the house and emptied on the ground; the shilling, which had fallen out, was again shown to him, and put into the bucket. Peter returned to the river again, filled his bucket and went home; and when the bucket was emptied by the maid at the house where he lived, he took the shilling and laid it in a place where he was accustomed to deposit the presents that were made to him by curious strangers, and whence the farmer's wife collected the price of his daily exhibition. It appeared that this savage could not be taught to reason for want of language.[9]

In using Peter's lack of abstract reasoning as proof for Condillac's *anthropological* claim that man can have no ideas without words, the Edgeworths consider the wild boy – however hopelessly impaired – a representative of humanity. Ever since, savage children who grew up isolated from any social influence were regarded as "'experiments with nature'"[10] – experiments that were supposed to answer the question as to which of our faculties were 'human' from the core: reason, language, memory, consciousness of the self, morality, social skills?[11] If any of these features were found in children that had never experienced any kind of educational 'input', they could rightfully be called part of the basic and general heredity of humanity. The traits that the children lacked, however, had to be attributed to society, culture, and education alone.

Instead of *stating* human nature as Rousseau had done, experimental anthropologists now began to *question* and *test* its genealogy. And instead of trusting in the god-given innateness of human faculties, the possible influence of education becomes an important element within the theories of the progressive sciences.[12] Of course, the proclamation one chose to follow – Rousseau's 'Back to Nature!' or Helvetius' 'Ahead towards Education!' – depended on specific

8 It is precisely the last aspect Rousseau ([1755] 1992), pp. 69f., refers to in his footnote mentioned above, claiming however that the evidence of a few human beings using their hands for the purpose of walking because of a different upbringing does in no way contradict the *natural* law according to which humans are meant to walk upright. Jean-Pierre Bonnaterre, to whom I will return later, uses the example of Victor de l'Aveyron to prove Linnaeus wrong as far as the traits of furriness and animal-like walking are concerned. However, it is still within this context that the third feature, the language acquisition, is going to be the *experimentum crucis* of Victor's treatment.

9 Edgeworth and Edgeworth ([1798] 1815), pp. 61f.

10 Malson ([1964] 1972), p. 49.

11 It is the interest of this examination itself that makes it a "forbidden experiment" for Shattuck ([1980] 1994), p. 41. Shattuck hints at the tradition of deliberately isolated children as well as at the modern sciences that emerged from discourses like the ones circulating around wild children. "What I call the forbidden experiment is one that would reveal to us what 'human nature' really is beneath the overlays of society and culture. Or at least an experiment that could tell us if there is any such thing as human nature apart from culture and individual heredity."

interests. In the same way, interpretations of case studies on wolf children are – up to today – structured according to current scientific ideologies. Just as in the late 18th century wolf children were used as proof for the opposing claims that there is both an essence and an absence of human nature, 20th century research has been split on this point according to the ruling paradigm: The rise of molecular biology in the middle of the last century (as well as its recent success) established the belief that there are genetic patterns that make us human. The foreword of the report on the wolf children of Midnapore reads:

> It must also be pointed out that although extreme distortions can be produced, both mentally and physically by unusual elements in the environment, it by no means follows that heredity is eliminated either under the normal or the abnormal condition. On the contrary, genetic experiment makes it clear, that heredity is at work in both cases, and that the fundamental bases even for quite small physical and mental differences are determined by heredity, however they may happen to be distorted or suppressed in an unusual environment.[13]

In the 1970s, however, when behaviorist approaches and social theories dominated, scholars dealing with wolf children rejected any notion of human faculties developing without environmental influence and adaptation pressure: "If any further proof is needed that the term 'human nature' is completely devoid of sense, the following study of wolf children will provide it."[14]

In any case, these examples show that wolf children are subjected not only to the scientists experimenting on them, but also to the various interpretations of these experiments, and I will compare some of these experiments and interpretations in the following pages. But in doing so, I will refer not merely to philosophical or scientific sources. The appearance of a savage child is not only a spectacular event for scientists, it is also 'spectacular' in the core meaning of the word: it is a sensation, an attraction, public entertainment. In most reports on wolf children – be it Peter at King George's court, Victor in Rhodez, or Kaspar Hauser in Nürnberg– it is pointed out that they spend the first days in society like animals in a zoo or, for that matter, like the native inhabitants of European colonies, who were put on display at fairs, in vaudeville acts, and at world exhibitions later in the 19th century.

But it is not just the wild child who is a spectacular phenomenon. The new methods of his examination are, too. As Barbara Maria Stafford has shown, the early 19th century demonstrations

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12 It is important to note that both attitudes are part of enlightenment thought: Rousseau's claim of the innate nobility of every human ("nature is everything") constitutes the idea of equality, whereas Helvetius' belief in the significance of education follows from the principle of progress and perfectibility ("education is everything") – a belief that was not at all alien to Rousseau himself, as I shall point out below.

13 Singh/Zingg (1942), p. xvi. Cf. from today's point of view Pinker (1994), p. 282: "The muteness of wild children in one sense emphasizes the role of nurture over nature in language development, but I think we gain more insight by thinking around the tired dichotomy. If Victor or Kamala [the girl from Midnapore] had run out of the woods speaking fluent Phrygian or [the assumed first language] Proto-World, who would they have talked to?"

14 Malson ([1964] 1972), p. 35. Malson claims that there is no human life outside of society and therefore no such thing as a "pre-cultural state", either. Wolf children, who missed the time-window for language acquisition, demonstrate neither typical species-behavior nor are they in any way similar to the myth of the 'noble savage'.

of experimental science were received like magic shows in front of stunned audiences.[15] Moreover, the exotic and spectacular dimension of experiments on wolf children is met by a response to these discoveries that can be found within popular culture: Theatre-presentations, cabaret-shows, and novels regularly took up on and popularized the observations made in anthropological case studies.[16] The scenarios of these popular performances did not necessarily respond to actual discoveries, but sometimes even preceded them. In his analysis of the various documents, texts, and discourses that paved the way and accompanied the discovery of Kaspar Hauser, Jochen Hörisch states: "Tatsächlich entspricht sein Nürnberger Erscheinen nur den ihm vorausliegenden diskursiven Ereignissen, die es verdoppelt."[17] Wild children, who are not able to speak, enter a universe of discourse which, in this sense, always precedes them.

The constellation of scientific experiments on heredity and the popular discourse on human nature is precisely what interests me here: A *cultural history* of heredity must take into account the discourses that accompany and structure a certain scientific practice. Such discourses, as is the case with both empirical and fictive commentaries on wolf children, present conceptions and re-conceptualizations of what is considered to be 'human' at a certain time.[18] Around 1800, the question of heredity is an anthropological, physiological, linguistic, psychiatric, and pedagogical one and therefore cannot be answered by any of these disciplines alone. What I offer in the following is therefore an analysis of three different discourses on the isolation of humans and experiments that attempt to undo the effects of this isolation. These three discourses present three possible solutions to the problem of whether human faculties develop by hereditary or educational means – or both. My analyses of a novel, a case study, and a scientific treatise will also show, however, that the notion of 'heredity' that circulates within a number of discourses at the turn of the 19th century is very different from the current scientific notion. While striving to be experimental, it nonetheless remains a 'macro-discourse' on 'human nature' and 'humanity' as a whole, instead of being an analysis of individual traits, their genealogy and inheritance. Only with the historicization that Foucault pointed out for the knowledge systems of the 19th century was the synchronic concept of innateness replaced by the modern concept of heredity.

2. Isolation and education: the experimental paradigm of anthropology around 1800

Before I turn to the analysis of the three examples for a discourse on heredity concerning wolf children, I shall elaborate briefly the notion of experimentation within these studies. One of the main features that actually connects the experimental approach and the discovery of savage

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15 Cf. Stafford (1994). Daston (1998) argues that the description of 'strange facts' – among others monstrous appearances – is the take-off of modern natural philosophy in the 17th century.

16 Cf. Gineste (1993), pp. 29-32. Malson ([1964] 1972), pp. 37f., emphasizes the mingling of fact and fiction in any of the reports on wolf children insofar as they "involve not only metamorphoses of nature but human dramas as well. One should hesitate, therefore, before rejecting a story just because part of it is invented. Hoaxes here are as common as they are anywhere else: every so often the press reports the discovery of yet another Mowgli waiting for his Kipling". In the same way, Lane ([1976] 1977), pp. 185ff., stresses that a case such as the Wild Boy of Aveyron's produces "a legend, a tale of epic proportions".

17 Hörisch (1979), pp. 270f. Since discursive signifiers precede Kaspar's actual appearance, to Hörisch Kaspar Hauser marks the switch from the subject-centered paradigm of enlightenment to the modern semiotic paradigm.

18 On the popular "re-writing" of the savage to this end, cf. Douthwaite (1994-95).

children is the element of 'isolation' that, when taken as a discursive concept, seems able to combine various approaches at the end of the 18th century. On the one hand, both the rise of the experimental sciences and the emphasis on controlled observation require the elimination of unwanted influence and the reduction of any distracting context – in a word, they require the isolation of the subject of observation; we have learned to call the realm of this experimental isolation the 'laboratory'.[19] On the other hand, but in a structurally very similar manner, Rousseau's 'natural state' of humans is emphatically situated opposite any kind of 'social state'. Primarily, this opposition merely serves the function of hinting at the 'original' qualities of human beings before their cultural and societal transformation. But on a different level, the opposite of 'being social' is, obviously, 'being alone', and there are several passages within Rousseau's *Discours* that struggle with the logical consequences of his argument: We have to picture the 'natural man' *per definitionem* as an isolated man, because any contact with another human being establishes the basic structures of a community and all the mischief it causes, such as possession, inequality, and effemination.

According to Rousseau, as long as man is alone, he lives without knowledge of good and bad and the feeling of want. There are only two elements that distinguish him from being a mere animal: the instinct of compassion (responsible for his pre-moral 'nobility') and the perfectibility of his reason (responsible for his eventual abandonment of the state of nature and community-building – the first step of the depravation of mankind). These two faculties – for Rousseau the only innate ones – contribute to a twofold characterization of human nature: On the one hand, Rousseau attributes a basic dignity to every human being – especially the wild, natural, and uneducated. On the other hand, he admits the possible education of human beings. Though he paints a distinctly pessimistic picture on the outcome of education in his *Discourse*, at the beginning of the fictive pedagogical experiment on *Émile* he admits: "Under existing conditions a man left to himself from birth would be more of a monster than the rest."[20]

Thus, the principle of isolation and the principle of education do not exclude each other. Rather, at the end of the 18th century, they both contribute to a common discursive matrix that is especially successful within revolutionary France. The revolution was based on Rousseau's idea of the original equality of man. The privileges that used to come with a noble descent were replaced by the notion that anybody had a natural right and chance to lead a good life, regardless of his birth. Conversely, there were various proposals to re-educate the dethroned nobles and turn them into 'natural' humans. The attempt to give the dauphin a 'civil' education after the execution of his mother, Marie Antoinette, or the scenario of Sylvain Maréchal's *Le jugement dernier des rois* (1793), in which a group of royals is stranded on a lonely island and forced to cope with the law of nature, equally express the pedagogical optimism that accompanies the belief in the natural state of mankind.[21]

The constellation of isolation and education within an experimental paradigm that aims to produce insights into human nature can thus be considered a basic idea within late 18th century

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[19] For the emergence of the experimental paradigm and its socio-historical contexts – especially the modern discourse of political control – see Shapin and Shaffer (1985).

[20] Rousseau ([1762] 1911), p. 5.

[21] Cf. Gumbrecht ([1981] 1992), pp. 206-211. Sanja Perovic is currently preparing a dissertation on the trial of Marie Antoinette and Maréchal's plays at Stanford University.

anthropology. The latter term seems to indicate the new type of science that comes along with this aim, but it is interesting to see how differently it is used: Whereas in the German tradition 'anthropology' means to reason on human nature on a conceptual level, the French (as well as the English) notion of 'anthropology' is a much more empirical one, often referring to ethnological and experimental research.[22] In 1799, the *Société des Observateurs de l'homme* is founded, declaring human experiments as the main method of the science of man. In his opening address, one of the founding members, Louis-François Jauffret, names the aims of the society as follows: "Tatsachen zu sammeln, die Beobachtungen zu erweitern und zu vermehren und dabei alle leeren Theorien, alle verwegenen Spekulationen beiseite zu lassen."[23] The society's interests concerned the physiological, intellectual, and moral nature of humans, and the two main research projects Jauffret proposed are firmly grounded within the discursive scenario unfolded so far: One is called *Considérations sur les diverses méthodes à suivre dans l'observation des peuples sauvages*, but it is the other in which Jauffret really invests his hopes, and it is worth quoting in its entirety:

> Eines Tages muß die Gesellschaft wohl prüfen, ob es, um die fortschreitende Entwicklung der physischen, intellektuellen und moralischen Fähigkeiten des Menschen auf eine so neue wie umfassende Weise zu verfolgen, nicht günstig wäre, mit Genehmigung der Regierung ein *Experiment über den Naturmenschen* zu unternehmen, das darin bestünde, *während zwölf oder fünfzehn Jahren vier oder sechs Kinder, zur Hälfte männlichen, zur Hälfte weiblichen Geschlechts, sorgfältig zu beobachten, nachdem man sie von Geburt an am selben umfriedeten Platz, fern jeder gesellschaftlichen Einrichtung ausgesetzt und die Entwicklung ihrer Ideen und ihrer Sprache dem natürlichen Instinkt überlassen hätte.* Zweifellos erhielte man zahlreiche außerordentlich nützliche Beobachtungen, um uns mit Sicherheit über die Entwicklung unserer Fähigkeiten aufzuklären, indem die Philosophie einige von Geburt an von unseren Sitten, unseren Einrichtungen, unseren Vorurteilen und sogar von unserer Sprache getrennte Kinder beobachtete, die nicht anders als auf Grund des allen Menschen gemeinsamen natürlichen Instinkts und Naturzustandes handeln und sich ausdrücken würden.[24]

Although such an experiment would demand the "sacrifice of an entire life" – the life of the researcher, not of the research subject, *nota bene* – it would enable science to solve "die schwierigen Probleme der Entstehung der Sprachen und der Ideen überhaupt sowie der Grundbegriffe des menschlichen Geistes" for the first time.[25]

Jauffret refers to the historical precedent of such an experiment mentioned above – what he really seems to refer to, however, is the discursive matrix that connects insights into the human's true nature with the examination of his isolated state. In his analysis of the emblematic architectural design of the new scientific approach to humans, Jeremy Bentham's prison that allowed permanent surveillance of the inmates, Michel Foucault suggests the same connection:

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[22] There is a short period of an empirical approach to anthropology in Germany, too, connected with the names of Platner, Wezel, and Moritz who develop a systematic notion of 'observation' within the sciences of man. I tackle this approach in my current book project, *Fallgeschichten. Die literarische Anthropologie des Menschenversuchs.* Cf. also Eckardt, e.a. (2001).

[23] Quoted from the German translation of Jauffret's address in Moravia ([1970] 1973), p. 209.

[24] Ibid., p. 215.

[25] Ibid., p. 216.

> But the Panopticon was also a laboratory; it could be used as a machine to carry out experiments, to alter behavior, to train or correct individuals. […] To try out pedagogical experiments – and in particular to take up once again the well-debated problem of secluded education, by using orphans. One would see what would happen when, in their sixteenth or eighteenth year, they were presented with other boys or girls; one could verify whether, as Helvetius thought, anyone could learn anything; one would follow 'the genealogy of every observable idea'; one could bring up different children according to different systems of thought, making certain children believe that two and two do not make four or that the moon is a cheese, then put them together when they are twenty or twenty-five years old; one would then have discussions that would be worth a great deal more than the sermons or lectures on which so much money is spent; one would have at least an opportunity of making discoveries in the domain of metaphysics.[26]

As long as the *Société* lacked both a government grant and suitable experimental subjects, the only way to realize Jauffret's proposal, however, was fiction. As the example of Maréchal's play shows, literature at the end of the 18th century reinvestigated the topic of isolation on lonely islands that Defoe's *Robinson Crusoe* had introduced.[27] And it is not by chance that novels were the primary formal vehicle: As an art form that is produced and received in the lonely states of reading and writing, it seems to present the best possible solution for dealing with the question of human behavior under perfectly isolated circumstances. The foundling topic in the first half of the 19th century – e.g. in Heinrich von Kleist's *Der Findling,* Walter Scott's *Legend of Montrose* or George Sand's *François le champi* – is one example of this. It is important to note, though, that the renaissance of the genre takes place earlier, contributing to the discursive matrix of isolation and education in post-revolutionary France as well as allowing the staging of experiments hardly possible in reality.

3. Fanfan et Lolotte*: case study on a lonely island*

In 1797, François-Guillaume Ducray-Duminil published a popular novel that will serve as my first example for the common discourse on isolation and education within the emerging practice of experiments on human heredity though it was published before any such experiment was actually conducted. *Fanfan et Lolotte* is the story of two English children who were washed up on a desert island in the Carribean at the age of three and manage to survive the fierce conditions and the proximity of native inhabitants until they are discovered four years later by the person who was to become their enlightened teacher of civilization.

The Carribean setting shows how close at hand Rousseau's vision of the "noble savage" was to any scenario set to examine the 'natural' faculties of humanity as opposed to the ones provided by culture. The two children from England are experimental subjects who are isolated but still dispose of a background of Western culture. At the same time, lacking any instructions from Western culture, the natives on the surrounding islands are forming communities, while living much closer to a natural state. The 'scientific' question addressed by Ducray-Duminil's fictive case study is obvious: Will the children turn out to be savages, reduced to their natural faculties? Do

[26] Foucault ([1976] 1977), p. 204.
[27] For the connection of *Robinson Crusoe* as well as the social experiment reported in Schnabel's *Insel Felsenburg* with the scientific debate of the time, cf. Campe (2002), pp. 188-276.

they possess such faculties at all or will they be dependent on the native's help? Or will they instead be able to develop some of the basic principles of the culture from which they stem?

Although Lucy Peacock, who translated *Fanfan et Lolotte* into English, omitted from the original many passages supposedly unsuitable for younger readers, she fully subscribes to Ducray-Duminil's experimental interest in the relation between human nature and the influence of education that can be analyzed in isolation. In her preface she describes the topic of the novel as "the native feelings of the heart unadulterated by vice, docility and industry of two children abandoned to themselves at an early age, the lessons of a watchful and enlightened preceptor."[28] This "preceptor" is the shipwrecked Colonel Carlton who discovers the children. At first, they take him to be their long lost father and express hope that now finally they will be "loved" – a first hint that there are indeed basic emotions that can be developed without instruction. But apart from that, the children speak a "jargon he could just distinguish to be English"[29] and know nothing about their family and home country. The Colonel

> was astonished to conceive it possible that two children, so young and so delicate, should provide for all their wants at an age when others scarcely know how to walk or think: he wished to discover by what means this miracle had been effected, but they expressed their ideas very imperfectly.[30]

Here, the novel presents an issue that we will encounter time and again in the debate on human heredity in savage children: Do isolated children possess natural faculties, or is education necessary for their development? Peacock's translation of Ducray-Duminil's novel demonstrates that *both* alternatives are able to coexist. Carlton finds that his "pupils of Nature"[31] are normally developed as far as their "heart" and their "intelligence" are concerned.[32] They established a Robinson-like calendar and expressed basic religious feelings towards the sun – two cultural phenomena developed on their own. Also, they greedily eat the meat the Colonel offers them, although they never had it before and – as evidenced by Victor de l'Aveyron and Kaspar Hauser – should detest it.

At the same time, the Colonel decides that the children nevertheless need further instruction: "It is time, my children, that I think of the great work to which God has appointed me, that of your education."[33] He teaches them to bury the dead (they had kept the corpse of their sole travel companion in their hut for over four years), to build a house (in which the bedrooms are separated by sex), and to tell their story (which he takes as evidence for the providence of God, who provided the children with the natural instincts that helped them survive).

After a few days, the acculturation of the savage children is perfect: The Colonel takes the boy hunting, while the girl is "employed in baking the bread or other little offices of domestic oeconomy."[34] The goal of Western education seems to be the separation of the sexes. The report

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28 [Ducray-Duminil (1797)]/Peacock (1807), p. iii.
29 Ibid., p. 3.
30 Ibid., p. 6.
31 Ibid., p. 10.
32 Ibid., p. 31.
33 Ibid.
34 Ibid., p. 51.

about the progress also makes a clear statement on the relationship between heredity and culture in humans: human beings are born with innate faculties sufficient to keep them alive and to develop the basic moral and religious ideas that distinguish them from *animals*. But they need further education in order to develop higher cultural qualities that distinguish them from the *savages* who visit the island every now and then. Carlton's education serves the *cultural* development of humanity whereas his observations of the children prove that the *biological* development is provided by nature.

The Colonel teaches his charges farming, gardening, reading, writing, and religion. Thus, the novel suggests that the evolutionary elements of humanity can be repeated and taught to single individuals in the very same order they developed on a macroscopic level. Consequently, the last lesson the children learn is politics: "Men living in society, my son, said the Colonel, in which there are good and bad, it is necessary to establish rulers, that order and peace may be maintained."[35] Witnessing the children's natural detest of his mentioning the bad, the Colonel observes how much better these "rational and attentive" children of nature are compared to the "depravity of human nature" in society.[36] The fictive experiment on isolation in *Fanfan et Lolotte* reinforces Rousseau's conviction of the good nature of humanity that can also be detected in the natives of the neighboring islands:

> They do not like to be called savages; this name, they say, belongs to beasts of prey; they equally detest that of cannibal, which is with them equivalent to man eater; but they are very fond of the title of Carib, because in their primitive language this word signifies a good warrior, a courageous man.[37]

At the same time, the novel emphasizes the importance and necessity of an education that develops the higher faculties within humans. In a way, Fanfan and Lolotte, who are confronted with the civilized world on a journey at the end of the novel, combine the better elements of both human heredity and education: They lead a natural as well as a cultural life – both without the depravations of modern society.

4. Victor de l'Aveyron: idiot or pupil?

Ducray-Duminil's novel is not merely a romantic escapist fairy tale; it contributes to the debate on human heredity and its possible observation in isolation at the time. Another of his novels is also worth mentioning here *en passant*. It tells the story of a boy who grew up among a band of robbers in the woods where he is found by a nobleman, who grants him higher education without depriving him of the natural instincts he acquired in his earlier life. This plot does not seem to address exactly the issue we are interested in here. However, the title of the novel that came out in 1796 – four years before Jauffret proposed his experiment to the *Société* – is the precise prophecy of how Jauffret's wish would be fulfilled just a few months after his opening address. Ducray-Duminil's earlier novel was called *Victor, ou l'enfant de la forêt* – and after January 8th, 1800, almost everybody in Paris knew what it *really* was about.

35 Ibid., p. 54.
36 Ibid., pp. 59 and 56.
37 Ibid., p. 96.

On January 8th, 1800, a boy of about 11 years of age, who had been seen running about naked in the woods like a wild animal on several prior occasions, entered a farmer's workshop and started his career as the only actual experimental subject of the *Société des Observateurs de l'homme*. From all evidence, it seemed that the boy – who could not speak, wore no clothes, preferred smelling to his other senses, and appeared to be unable and unwilling to engage in any kind of contact with other human beings – must have spent most of his life alone in the forest, living on roots and nuts. He was the perfect *enfant de la forêt*,[38] and although his teacher Jean Itard would later report different reasons for the name he gave his pupil, it seems only too obvious why the name he did chose had to be 'Victor'.[39]

The various reports of the initial examination of the savage child from Aveyron indicate the shift of interest in human nature at the turn of the 18th century. The Abbé Pierre-Joseph Bonnaterre who is taking care of the child in Rodez reports to the *Société* that Victor shows "purely animal functions": He has no knowledge, no wants, no memory, no imagination, and no moral sentiment whatsoever. "You might say his mind is in his stomach."[40] Bonnaterre's interest is mainly in natural history, and he uses the common comparison to animals in order to classify the savage child. The two experiments he conducts on the boy emphasize this interest: Bonnaterre strips his charge naked, exposes him to temperatures below zero Celsius and notes with amazement that the boy "appeared glad indeed to be rid of these garments."[41] On another occasion, he tests the ability of the "child of nature" to share food with others and observes: "[H]e has no idea of property, wants everything for himself, because he thinks only of himself."[42] The Abbé concludes his report with a far-seeing remark:

> Such an astonishing phenomenon will furnish philosophy and natural history with important ideas about the essential nature of man and the development of his intellectual faculties, provided that the state of imbecility we have noticed in this child places no obstacle in the way of his instruction.[43]

The two options presented here – a possible education or the diagnosis of idiocy – are precisely the ones the wild boy from Aveyron faces when he is brought to Paris on request of the *Société*. Two

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38 There was, in fact, a novel that dealt with the case of Victor de l'Aveyron itself: Lane ([1976] 1977), p. 352, refers to a book by J.A. Neyer: *Rodolph ou le sauvage de l'Aveyron*. Paris: Jouanaux 1800, that I could not track down in any library. Cf. Gineste (1993), p. 482: "Ce roman n'a pas été retrouvé. L'annonce de son publication figure pourtant dans les *Journal général de la littérature française* du 2 Octobre 1800 (10 vendémiaire an VII): 'Rodolphe ou le sauvage de l'Aveyron' par J.A. Neyer, auteur des Extraits d'Hervey etc... vol in 18, fig. Prix 60c et 75c. franc de port. Paris, Garnier impremeur, rue du Gd. Hureleur n° 5; et Sombert lib., boulevard Saint-Martin."

39 Itard ([1801 and 1964] 1972), p. 119, does not refer to Ducray-Duminil but writes instead he chose the name because the vowel 'o' was the only one the boy reacted to – a hardly convincing explanation, considering the very different vowel the name Victor begins with. One should think that names such as Jean or Georges should have been more appropriate. The assumption that Itard's choice was influenced by Ducray-Duminil's novel and its adoption for theatre is also expressed in Shattuck ([1980] 1994), p. 92.

40 Quoted from the first English translation of Bonnattere's *Notice historique sur le sauvage de L'Aveyron et sur quelques autres indivus qu'on a trouvés dans les forêts à différentes époques* (Paris: Pancoucke 1800) in Lane ([1976] 1977), pp. 35-54, here pp. 41 and 42.

41 Ibid., p. 49.

42 Ibd., p. 47.

43 Ibd., p. 53.

of the leading *Observateurs* represented the two different approaches the savage child was confronted with: On the one hand, the Abbé Roche-Ambroise Sicard, principal of the first school for deaf and dumb children in Paris, one of the most progressive teachers of his time. On the other hand, Philippe Pinel, the renowned reformer of mental hospitals, who had been systematizing diagnostic methods for the retarded. The wild boy's trip from Bonnatere's Rodez to Pinel's Paris is also the journey from natural history to natural science. Whereas Bonnaterre had likened the boy to animals, Pinel, in his report to the *Société* from 1800, added a different comparison: "[H]e is much inferior to many individuals who are locked away in our hospitals. I should not be afraid to say that in this respect even elephants have a marked advantage over him."[44] The imbeciles Pinel knows so well show "clear parallels with that of the child of Aveyron". Like him, they are mute, emotionally unstable, without memory, etc.[45] But more important than the parallels is the verdict that follows immediately from the chosen comparison: Since there is no hope of ever educating or integrating the wild boy into society, he ought to be locked away with his fellow sufferers at Bicêtre.

Obviously, both Bonnaterre's and Pinel's diagnoses make an implicit statement on the hereditary outfit of the boy from the woods. Bonnaterre's approach is still part of the 18th century's tradition of dealing with *homines feri:* his experiments attempt to discern the relation between the boy's behavior and animal behavior. Pinel, on the contrary, replaces this approach with clinical diagnosis[46] and an interest in the boy's relation to society rather than nature. The question he raises with regard to heredity now reads: "finding out the nexus of ideas and moral sentiments which are independent of socialization."[47] Since he is unable to find this nexus, Pinel concludes that he is not a suitable subject for further experimentation.[48]

At this point Jean Itard came on the scene, protesting Pinel's view vehemently without siding with Bonnaterre. Itard, who shortly after Pinel's report took the boy into his household and kept him there for six years, conducted one of the first and longest systematic educational experiments and simultaneously introduced a new approach to human nature: He agreed with Pinel that Rousseau's belief in the 'nobility' of savage humans had to be rejected. Obviously, the intimidated,

44 As in the case of Bonnaterre, I quote Pinel's *Rapport fait al la Société ddes Observateurs de l'homme su l'enfant connu sous le nom de Sauvage de L'Aveyron* (1800, deuxieme partie 1801) from Lane ([1976] 1977), pp. 64-79, here p. 66. Lane discovered the report which, until than, had been thought missing in a Journal of Anthropology from 1911. The original text (with a different date) is now available in Gineste (1993), pp. 249-260 and 271-278.

45 Quoted from Lane ([1976] 1977), p. 69.

46 Cf. the title of Gineste (1993), *Dernier enfant sauvage, premier enfant fou*, as well as Douthwaite (1997), p. 191: "Earlier, the wild child had been embraced as an example of nature, but by the 19th century his antisocial habits and insensitivity gave rise to claims of mental pathology."

47 Quoted from Lane ([1976] 1977), p. 64. Authors at the turn of the 19th century even extended this diagnostic approach to earlier examples. Cf. Edgeworth and Edgeworth ([1798] 1815), p. 61: "Peter, the wild boy […] had all his senses in remarkable perfection. He lived at a farm house within half a mile of us in Hertfordshire for some years, and we had frequent opportunities of trying experiments on him. He could articulate imperfectly a few words […]; he could in a rude manner imitate two or three common tunes, but without words. Though his head […] resembled that of Socrates, he was an idiot: he had acquired a few automatic habits of rationality and industry, but he could never be made to work at any continued occupation." Blumenbach (1811), pp. 26f., comments on the same case: "Kurz als Ende vom Lied, das vermeinte Ideal des reinen Naturmenschen, wozu spätere Sophisten den wilden Peter erhoben hatten, war durchaus nichts weiter, als ein stummer, blödsinniger Tropf." That is the reason why "von dem blödsinnigen Buben für Psychologie oder Anthropologie eben keine bereichernde Ausbeute zu erwarten sei" (ibid., p. 22).

spastic, and autistic child did not provide much evidence that human beings develop best in a natural state. What he refused, moreover, this time contrary to Pinel, was the belief in the innateness of the boy's defects readily observable in the wild boy, to whom he will, as a first step toward humanization, give a name. To Itard, the fact that Victor was a child of nature proved all the more greatly how much the development of our faculties depends on training. Drawing both from Condillac's theory of sensory education and from Sicard's success with the deaf and dumb, Itard planned to prove this theory by turning Victor into a well-educated, conversational, social being. Should he succeed, he would have evidence for his basic hypothesis on human heredity – or non-heredity, for that matter:

> Cast on this globe, without physical powers, and without innate ideas; unable to obey the constitutional laws of his organization, which call him to the first rank in the system of being; man can find only in the bosom of society the eminent station that was destined for him in nature, and would be, without the aid of civilization, one of the most feeble and least intelligent of animals – a truth which, although it has often been insisted upon, has not as yet been rigorously demonstrated.[49]

5. Itard's sincere observations: laboratory nature

Itard's two case studies on Victor from 1801 and 1806 will serve as my second example for the discourse on isolation, education, and experiment surrounding the concept of heredity at the turn of the 19th century. It is important to note that Itard, despite his refusal of the *Société's* recommendation to leave Victor in the asylum, still shared the basic methodological approach sketched out by Jauffret. After the news about the wild boy had spread from Aveyron to Paris, Jauffret wrote a letter to the orphanage of Saint-Afrique where the spectacular discovery was initially kept:

> If it is true that you have currently in your orphanage a young wild boy, twelve years old, who was found in the woods, it would indeed be important for the progress of human knowledge that a zealous and sincere observer take him in charge and, postponing his socialization for a little while, examine the totality of his acquired ideas, study his manner of expressing them, and determine if the state of man in isolation is incompatible with the development of intelligence.[50]

This "zealous and sincere observer" turned out to be Itard. Whether he was in fact "postponing" Victor's progress cannot be decided retrospectively. In any case, he shared the experimental attitude implied in his proposal: to design a realm in which a savage child could be fruitfully

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48 Cf. Moravia ([1970] 1973), p. 116: "Nachdem man den Knaben, der einer der sensationellsten wissenschaftlichen und kulturellen Fälle zu Beginn des neuen Jahrhunderts gewesen war, vom 'Wilden' zum 'Idioten' deklassiert hatte, verlor er für die spezifischen Interessen der 'Société des Observateurs de l'homme' an Bedeutung."

49 Itard ([1801 and 1964] 1972), p. 91. Itard's first report was published as *De l'éducation d'un homme sauvage ou des premiers développements physiques et moreaux du jeune suivage de l'Aveyron* with Goujon in Paris.

50 Quoted from Lane ([1976] 1977), p. 15. Lane also quotes various contemporary newspaper articles that express hopes for 'pure' laboratory conditions for the study of human nature in Victor (ibd., p. 20).

observed. As Itard notes at the beginning of his first report, this was a rare opportunity that had remained unused on all earlier occasions. People were interested only in 'seeing' the spectacular discoveries, whereas "actual observation was reckoned of no value; and these interesting facts tended little towards improving the natural history of man."[51]

Remarks like these reveal that Itard's incentive for taking care of the child was motivated not only by his philanthropy. Or, to put it differently: it was definitely motivated by the love for humans, but this love was much more directed toward the laws of human nature and less toward individual representatives of the species. Whereas Pinel's devastating diagnosis had at least been directed on the boy, for Itard he is but a means to gain general knowledge.[52]

In order to contradict Pinel's verdict effectively, Itard had to revise the diagnosis of the wild boy's idiocy and trace instead back Victor's developmental backwardness to his isolation: "[T]he Savage of Aveyron is much less a simple youth, than an infant of ten or twelve months old."[53] His attempt to avoid Pinel's medical rhetoric, however, drives him back into the realm of colonial projections similar to those already encountered in Ducray-Duminil: "[L]ike some savages in the warmer climates, he was acquainted with four circumstances only; to sleep, to eat, to do nothing, and to run about in the fields."[54] Itard's principle of education entailed first tending to these basic – obviously innate – needs and thus mitigating the hostility the boy felt toward the society that ended the life he was used to in such an aggressive and irretrievable way. A further method of education Itard applied to his increasingly accepting charge, though, took no regard of any kind of need the boy might feel. Rather, Itard designed a series of experiments to verify his basic theoretical conviction, according to which human senses and understanding are not innate but – as Locke and Condillac had claimed – subject to experience and training. When he first met the boy, he had no sense for heat and cold, no fear of anything, and no sense of justice. Itard, consequently, exposes him to warm baths, extreme height, calculatedly unfair treatment and many more stimuli intended to awaken his dormant senses.

If we summarize, rather than enumerate these various experiments, there are two general conclusions that can be drawn from Itard's approach: The five steps of his educational program – socialization, sensualization, development of ideas and concepts, language acquisition, general education and instruction – mirror the order that Condillac had introduced in his theory of human development: first the establishing of sensation and perception, then consciousness and attention, and finally imagination and memory – the latter requiring the ability to use signs.[55] Viewed from this model, Victor's progress is a complete repetition of the process of becoming human. Just as in *Fanfan et Lolotte* the process of education followed the steps of humanity's *cultural* evolution, Victor's education mirrors the order of each individual human being's *intellectual* evolution as stated by Condillac.

The second anthropological implication of Itard's experimental set is closely related to the first: The experiments resulted in Victor's growing ability to *distinguish* his impressions and

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51 Ibid., p. 92.
52 For a critique of Itard's methods cf. Mannoni ([1965] 1972); Moravia ([1970] 1973), p. 102f.; and Lane ([1976] 1977), p. 104.
53 Itard ([1801 and 1964] 1972), p. 101.
54 Ibid., p. 103.
55 Condillac ([1746] 2001), pp. 15-40.

reactions: hot and cold, pleasant and unpleasant, comfort and fear, love and anger. These distinctions are the ones that 'civilized' and 'socialized' the wild boy in the first place. Itard's experiments were a means not only of observing Victor, but also of training and shaping him. Scholarly criticism of Itard's work so far has focused on the therapeutic nihilism expressed in Victor's treatment that had rather produced an "experimental neurosis"[56] within the boy instead of helping him to fight his previous ones. But from a theoretical perspective what is even more interesting is that Itard's experiments in fact *produced* what they were supposed to analyze: 'human nature'.

Itard's own account of his first results does not go that far: After one year of treatment, he notes the "mental equality between the boy and the brute"[57] – to which Victor had been inferior upon his arrival in Paris. The crucial distinction applied to Victor in order to measure his humanness is the distinction between 'speaking' and 'non-speaking'. The question "'*Does the savage speak*'?"[58] is at the core of Itard's experiments – as well as of Condillac's and Rousseau's theoretical treatises on the development of language in the 'natural state', well known to Itard. Victor could hear and was able to distinguish sounds, but he did not utter them. Still, Itard rejected the assumption of hereditary defects and attempted to prove that Victor *did* have the language competence necessary to express his needs and wishes:

> I satisfied myself of this one day by an experiment of the most conclusive nature; I chose, from amongst a multitude of others, a thing for which I was previously assured that there did not exist between him and his gouvernante any indicating sign; such was, for example, the comb, which was kept for his purpose, and which I wished him to bring to me. I should have been much mistaken, if, by disordering my hair with my hand, and showing him my hand in this state, I had not been understood. Many persons see, in all these proceedings, only the common instinctive actions of an animal; as for myself, I confess, that I recognize in them the *language of action*, in all its simplicity; that primitive language of the human species, originally employed in the infancy of society, before the labour of many ages had arranged and established the system of speech, and furnished to civilized man a fertile and sublime means of indefinite improvement, which calls forth his understanding even in his cradle, and of which he makes use all his life without appreciating what he is by means of it, and what he would be without its assistance if he were accidentally deprived of it, as in the case which at present occupies our attention.[59]

Again, it is Condillac's description of a "language of action" that accounts for Itard's judgment, and – just as in Condillac's example for the development of human ideas from the acquisition first of sign and then of spoken langue – it is a judgment derived from experimental observation. Condillac, in his *Essai sur l'origine des conaissances humaines*, proposed a thought-experiment: "But I am assuming that two children, one of either sex, sometime after their deluge, had gotten lost in the desert before they would have known the use of any sign."[60] He concluded that the two

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56 Lane ([1976] 1977), p. 136; cf. Mannoni ([1965] 1972).
57 Itard ([1801 and 1964] 1972), p. 104.
58 Ibid., p. 106.
59 Ibid., p. 126.
60 Condillac ([1746] 2001), p. 113. Condillac also mentions a Lithuanian wolf child in his *Essai*. For the relation of fictive thought-experiments to scientific research, cf. Moser (1989).

children would habitually develop signs for situations that repeated themselves, such as the search for food:

> These details show how the cries for passion contributed to the development of the operations of the mind by naturally originating the language of action, a language which in its early stages, conforming to the level of this couple's limited intelligence, consisted of mere contortions and agitated bodily movements.[61]

In Itard's closely related observation of an actual experiment, it is again the experiment itself that produces the anthropological feature: Humans are humans as long as they engage in language, and if Victor demonstrates sign usage, he has entered the realm of human nature. For the time being, he is at the stage of primitive man – a stage identical to the stage of the isolated children in Condillac –, but Itard planned to demonstrate by further educational experiments that the *inherited* faculties of the species can be *acquired* by the single specimen under proper circumstances.[62]

That Itard himself called his ensuing attempts to teach Victor how to talk a failure is mainly due to the very stable theoretical concepts that guided his observations. Victor did indeed learn to use written letters in order to denote certain objects, but Itard did not acknowledge this achievement because his concept of language requires spontaneous voiced articulations.[63] While conceding his failure, he concludes his report with the remark that there are "most important inferences relative to the philosophical and natural history of man, that may be already deduced from this first series of observations!" Itard claims that Victor is already "endowed with the free exercise of all his senses; that he gives continual proofs of attention reflection, and memory; that he is able to compare, discern and judge, and apply in short all the faculties of his understanding to the objects which are connected with his instruction." [64]

Thus, both Pinel's rejection of Victor's possible education and Ducray-Duminil's Rousseauian belief in innate human qualities are repudiated. "The moral superiority which has been said to be *natural* to man, is merely the result of civilization."[65] Itard calls this statement on human heredity the destruction of "prejudices […] which […] constitute the most amiable, as well as the most consoling illusions of social life."[66] But it is only through his own prejudices that the experimental production of human qualities within Victor succeeded to a certain degree.

The second report Itard submitted five years later at the behest of the French Secretary of State (the *Société* had ceased to exist two years earlier) provides even more examples for this productive

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61 Ibid., p. 115; cf. Lane ([1976] 1977), pp. 92f.

62 This is, if you will, the complementary view to Lamarck's theory of heredity, according to which *acquired* faculties can be *handed on* to descendants.

63 The "language of action", on the contrary, is supposed to be but a deficient supplement for true human language that not only serves as communication, but also enables the development of ideas. This is why Edgeworth and Edgeworth ([1798] 1815), p. 60, call Wild Peter an idiot – precisely the diagnosis Itard wanted to avoid, though referring to the same theoretical background: Condillac. Mannoni ([1965] 1972) criticizes the way Itard subsumes all of his observations under Condillac's principles and, by doing so, completely ignores the suffering he caused Victor – a suffering that indeed can only be read between the lines of Itard's report.

64 Itard ([1801 and 1964]1972), p. 137.

65 Ibid., p. 138.

66 Ibid., p. 140.

use of experiments. This time, Itard immediately begins with the acknowledgement that his report is "less a story of the pupil's progress than an account of the teacher's failure."[67] Victor's language training failed whenever he was supposed to perform something beyond mere imitation. Itard, consequently, closed this case and turned to another essential realm of human nature:

> You have seen, my lord, how civilization awoke the intellectual faculties of our savage from their lethargy first by applying them to the satisfaction of his needs, then by extending the scope of his ideas beyond his animal existence. Your Excellency will now see the same order of development in his emotional faculties, first aroused by the feeling of need inspired by the instinct of self-preservation, then stirred by less selfish feelings, by more generous impulses and finally by some of those noble feelings which are the happiness and glory of the human heart.[68]

Again, in order to be successful, these "emotional faculties" must be reconsidered as the result of education rather than heredity, since Victor was emotionally completely indifferent when first found. Therefore, Itard engaged Victor in a training of his emotions, e.g. the feeling of remorse after his final attempt to escape. He is brought back and encounters his benefactor: "But when he saw that instead of going to him I stood where I was with a cold demeanour and an angry face, he […] began to cry."[69] Itard deliberately provoked Victor's emotional reaction by staging an appropriate stimulus. The same holds true for the second example, this time aimed at Victor's sense of justice: After Victor successfully performed an achievement, Itard refused to congratulate him but instead criticized him. As a result of this "test",[70] Victor bit Itard:

> I could only delight me, for the bite was a legitimate act of a vengeance; it was an incontestable proof that the idea of justice and injustice, the permanent basis of the social order, was no longer foreign to my pupil's mind. By giving this feeling to him, or rather by stimulating its development, I had raised savage man to the full stature of moral man through the most striking of his characteristics and the most noble of his powers.[71]

As in the case of his sensual and intellectual training, Itard's experiments provoked in Victor those emotional reactions claimed to be absent in the first place. This entanglement of observation mode and observation object, however, makes it impossible to distinguish between what was actually observed and what was generated by the observation.

There is a general conclusion that can be drawn from this analysis of my second example: the example of a plea for education alone. The omnipresence of the experimental gaze in Itard's pedagogical laboratory prevented the visibility of any kind of 'natural' processes whatsoever. Victor, the savage child, can only be analyzed as such if he is, at the same time, deprived of this genuine savagery – or, as Sergio Moravia has phrased it: "Jetzt, da der immer fluchtbereite, immer gewaltsam zurückgehaltene und gezwungenermaßen als 'Gefangener' lebende Victor ein Leben führte, dem das typischste Merkmal des Naturzustandes fehlte, nämlich die Freiheit?"[72] This

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67 Itard ([1806 and 1964] 1972), p. 141.
68 Ibid., p. 168.
69 Ibid., p 170.
70 Ibid., p. 173.
71 Ibid., p 174.

paradox is not an avoidable misconception, but the result of the experimental approach itself: the need to replace the wild boy's isolation from society with Victor's isolation from nature. Itard had to draw "Victor back into a cocoon in which life alternated between the household and the classroom, nearly abolishing all Victor's opportunities for unstructured contact with the natural and social environment; instruction became the predominant means of learning."[73]

Thus, the question as to whether innate human faculties can be experimentally refuted cannot be answered precisely because laboratory observation fundamentally changes the situation to be observed. Contrary to Ducray-Duminil's example, the experiment takes place in 'culture', not in 'nature' – and consequently results in the assumption that education is more significant than heredity. Indeed, the only possible experiment that could reveal Victor's nature and hereditary outfit would bring about the deconstruction of its intrinsic observational hierarchy: Had Itard followed Victor into the woods in order to see him in his 'natural state', it would soon have become clear that the deficiency in coping with the environment changed sides. In the woods of Aveyron, Itard would have learned from Victor that it is less important whether one's faculties are inherited or acquired, but imperative that they adjust to the requirements of the immediate environment, be it cultural or natural.[74]

6. The first principles of anthropology: Gall and Spurzheim visit the 'pretended savage'

I will now turn to my final example for the various discourses on experiments in heredity with savage children, and this time it will be neither a fictive nor an actual case study, but a systematic scientific treatise. From the perspective of contemporary science, there was another problem with Itard's hypotheses, aside from the methodological concerns just mentioned: they were all wrong. Parallel to Itard's efforts, the early 19th century witnessed amazing progress in physiological and neurological research that arose from revolutionary models of physical and cognitive functions of humans. The result of these models was a renewed optimism in the possibility of explaining human nature according to its own principles and without the need to refer to external factors such as society and education. It was the beginning of the positivistic age that would in fact develop theories that were able, for the first time, to suggest a scientific model of heredity. Returning to the concept of innate human faculties, but altogether abandoning the philosophical realm in which authors such as Rousseau had been claiming this concept, observations of wolf children headed in a new direction.

In 1809, Johann Christoph Spurzheim publishes a volume that summarizes his and Franz Joseph Gall's physiological theory of the nervous system. There is no doubt that this field is connected directly to the topic we have dealt with thus far: "The first question perhaps in Anthropology is, Whence has man his faculties? Is man born indifferent; or does he come into the world endowed with determinate faculties?"[75] There are two possible answers. One is the position as represented by Itard:

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72 Moravia ([1970] 1973), pp. 103f.
73 Lane ([1976] 1977), pp. 191f.
74 Cf. ibid., p. 198; as well as Mannoni ([1965] 1972), p. 229.
75 Spurzheim ([1809] 1815), p. 53.

> According to this opinion, not only man but also animals are born without determinate faculties – indifferent – as tabulae rasae or blank paper. All the instincts and aptitudes of animals, from the insect to the dog and elephant, are the effects of instruction. […] It must be answered that neither in animals nor in man does education produce any faculty whatever.[76]

The other one is represented by Gall's and Spurzheim's attempt to "demonstrate that external influences are not the cause of the internal faculties of the mind."[77]

Spurzheim mentions the physical condition of humans and their unconscious "automatic life" as an example for innate qualities. With regard to the aspects of conscious "animal life", this evidence also seems to apply to faculties such as motion and the senses. They are obviously "determined by creation", insofar they also can be found in animals.[78] But what about qualities specific to human beings, such as affects and understanding? They can be explained "either by external impressions, or by internal causes". Spurzheim argues that the former, as random events, cannot account for the emergence of structures:

> It is certain that external circumstances must be presented, otherwise internal faculties cannot act; but opportunities do not produce faculties. Without food I cannot eat; but I am not hungry because there is food. […] How many children are exposed to the same influences without manifesting the same energy of faculties?[79]

But at the same time, Gall and Spurzheim are strongly opposed to the assumption of a 'natural state' drawing from this rejection of 'cultural' influences. The claim of a natural state lacks empirical evidence and is therefore absurd: "According to this hypothesis, man is made for solitude."[80] That man is never – or, for that matter, only very seldom – found in solitude is not proof for the depravation of his natural instincts, but the very result of these instincts. Spurzheim claims: "society itself is a natural institution," following the "social instinct" of human nature.[81]

This is, of course, nothing less but a complete reversal of Rousseau: the natural heredity of human beings is his striving to surpass the merely natural state. Society is part of human nature and the faculties we need to be able to live in it are not acquired but inherited. Spurzheim presents two empirical proofs for this claim. One is the example of geniuses: "Children sometimes show particular disposition and faculties before they have received any kind of instruction. Almost every great man shows in his infancy the character of future greatness. […] Nero was cruel from the cradle."[82] We encountered the other proof earlier, albeit in a different sense:

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76 Ibid., p. 68.
77 Ibid., p. 60.
78 Ibid., p. 59. Spurzheim emphasizes: "It results from these considerations, that the comparison of man with other beings (not only with animals, but also with plants and minerals) must be admitted, and cannot be repugnant to our feelings."
79 Ibid., p. 62.
80 Ibid., p. 63.
81 Ibid., p. 64. In the same way, Blumenbach (1811), p. 44, in his reconstruction of the story of Wild Peter of Hanover, rejects any notion that children who were exposed at an early age would develop back towards an "ursprünglich wilde Stammrasse" of humans: "Überhaupt läßt sich für den zum Hausthier geborenen Menschen gar kein ursprünglich wilder Naturzustand gedenken."
82 Spurzheim ([1809] 1815), p. 70. Moreover: "Why are we not all men of genius" and perfectly peaceful and social behavior (p. 70) if these faculties could be acquired and taught?

> In order to prove that man acquires all his moral and intellectual faculties by education, it is asserted that savages who are found in woods, destitute of all human faculties, are like beasts, only because they have not received any education. This objection is refuted, as soon as the condition and state of these pretended savages are known. These unfortunate creatures may be referred to in two classes. Ordinarily they are wretched persons of a defective organization, with heads too large, being increased in size by dropsy of the brain; or they have heads too small and deformed. These individuals have almost always scrofula, hanging lips, a thick tongue, a swollen neck, a bad constitution in general, a wavering and unsteady gait; they are more or less completely idiots. They generally consist of persons who have been exposed and given up to care of Providence, because they were burdensome to their parents. The pretended savage of Aveyron, who is kept in the Institution of Deaf and Dumb at Paris, is an idiot in a high degree. His forehead is very small and much compressed in the superior region: the eyes are little, and lay in the orbits. We could not convince ourselves that he hears; for it was impossible to make him attentive to our calling him, or to the sound of a glass struck behind him! His attitude and manner of sitting are decent, but his head and body are incessently in motion from side to side. He knows several written signs and words, and points out the objects noted by them. The most remarkable instinct in him is the love of order. As soon as any object is displaced, he puts it in order. Such unfortunate creatures therefore are idiots, not because they have not received any education, but because they cannot be educated on account of their imbecility. It is difficult to conceive that in our populous countries, a well organised person should long wander about like a savage, without being discovered. However, if a well organised individual, who has escaped in his infancy, be discovered in a forest, though he cannot be acquainted with our manners and determinate education, yet he will manifest the essential and characteristic faculties of mankind; and such an individual, living in society, will soon imitate the manners and receive the instruction of others. The girl of Champaigne proves this assertion.[83]

It is interesting to see how Spurzheim, in the last sentence, replaced an inadequate experimental subject – the "pretended savage" Victor – with a more suitable one, Marie-Angélique de la Champagne[84], without changing the basic principle, previously employed by Pinel and Itard: to test and observe wild children in order to draw conclusions about the natural outfit of human beings. It is stunning to see to what extent the interpretation of the observations of the same experimental subject differ from one another: What for Itard proves the influence of education on human behavior is for Gall and Spurzheim an example of the determination of the same behavior by innate faculties. Education is replaced by physiology, and physiognomic details illustrate the description of Victor, the idiot.[85]

For Spurzheim, there is no doubt that the "first principle of anthropology", according to which "every special faculty is innate,"[86] holds true even when confronted with the case of wild children. Individual deviations such as Victor's prove the influence of education no more than

[83] Ibid., pp. 71f.

[84] For the various discourses on Marie-Angélique within the paradigm of natural history, cf. Douthwaite (1994-95). The fact that the wild girl of Champaigne had a companion – which could well account for her ability to learn how to speak – is not mentioned by Spurzheim.

[85] Blumenbach (1811), pp. 19ff., also collects the physiognomic evidence from various reports on savage children and concludes, obviously influenced by the teaching of Gall and Spurzheim, "daß das samt und sonders naturwidrige Mißgeschöpfe waren" (p. 41). It is only at the end of the 19th century that Rauner (1885) suggests abandoning the deterministic discourse of biology on wolf children and reflecting, instead, on cultural influence.

cultural differences. Only the use of faculties may be dependent on external circumstances and the existence of these faculties is granted by heredity. "In one word, all that man does he did at first through nature alone."[87]

Both the strict opposition between Itard's and Spurzheim's interpretations of Victor's behavior and the fictive combination of both view-points in *Lolotte et Fanfan* hint at one important observation: As soon as scientific observation takes the stage, there is nothing left in isolated children that can be called their 'natural inheritance'. All that remains are theories, and Victor is judged far more according to the principles of these theories than according to the principles guiding his behavior. Although wolf children seem, for the first time in the history of studies on human heredity, to provide empirical material for experimental evidence, at the turn of the 19th century the relation between innate and acquired faculties result in various interpretations of the experiments on human nature. Therefore, instead of trying to add yet another interpretation to the endless and irresolvable debate on whether Victor was genetically or socially deprived, it is – as I have done here – more rewarding to take a step back and examine the circumstances under which all these interpretations arose: It is the coincidence of experimental observations and scientific ideologies that contribute to the concept of human nature at a given time.

The result of this coincidence either *combines heredity and education* (Rousseau/Ducray-Duminil), claims the *sole influence of education* (Condillac/Itard), or emphasizes the *exclusive significance of heredity* (Gall/Spurzheim). The three discourses on human heredity lead to the development of three models for a philosophy of innateness. Human faculties are: 1) the result of *noble nature plus education*; 2) the result of *savage nature and education only*; or 3) the result of *only nature without education*. The fact that the last model is most recent and established scientific model does not imply that it is necessarily the 'master discourse' on heredity in the first half of the 19th century. Despite the rise of the age of biology, all three discourses are perpetuated on the level of popular communication. George Sand's foundling-novel *François le champi* begins with the author's statement: "I have educated several foundlings of both sexes, who have turned out well physically and morally. It is no less certain, however, that these forlorn children are apt, in rural districts, to become bandits, owing to their utter lack of education."[88] The book continues with the introductory confession of the narrator:

> I should like to be what the existing state of society allows a great number of men to be from the cradle to the grave – I should like to be a peasant; a peasant who does not know how to read, whom God has endowed with good instincts, a serene organization, and an upright conscience; and I fancy that in the sluggishness of my own useless faculties, and in the ignorance of depraved tastes, I should be as happy as the primitive man of Jean-Jacques's dreams.[89]

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86 Spurzheim ([1809] 1815), pp. 94 and 74. Cf. ibid., p. 83: "How indeed could the Creator abandon man in the greatest and most important occupations, and give him up to chance?"
87 Ibid., p. 92.
88 Sand ([1852] 1894), p. 5
89 Ibid., p. 18.

And at the beginning of the main plot the miller's wife remarks, after finding the boy who is not able to tell her about his whereabouts: "It is a pity […] that he seems to be so idiotic."[90]

As for the debate on further discoveries of savage children, the contribution of such cases to a theory of heredity is limited. When Kaspar Hauser appeared in 1828, he too became subject to experiments by his foster father Georg Friedrich Daumer. The goal of these experiments, however, was no longer the identification of the innate faculties of human nature. Instead, Daumer tested Kaspar's magnetic abilities to detect metal and to react to gestures that had not actually touched him.[91] But Daumer did not speculate as to whether these abilities are innate or result from the circumstances of Kaspar's imprisonment, during which he had no contact with humans for over ten years. Rather, the evidence he reports was designed to reject assumptions that Hauser's story may have been a hoax.[92]

Thus, a new discourse arises that addresses the issue of savage children: the legal discourse. Kaspar's exposure is considered not an experiment in human nature, but a *Verbrechen am Seelenleben des Menschen*, as Anselm Feuerbach called his case study from 1832. Instead of questioning Kaspar's natural faculties, this discourse focused on the biographical childhood that was stolen away from him. The question of heredity enters a different realm here: The main issue surrounding the discovery of Kaspar Hauser was his possible descent from the Duke of Baden. Where experiments fail to prove that savages are noble, they might at least demonstrate that nobles can be savages.

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90 Ibid., p. 31.

91 Cf. Daumer ([1832] 1983), p. 28: "Auf einem Spaziergange machte ich einst im Beisein Herrn Prof. *Wurms* zu Nürnberg folgenden Versuch. Ich ließ ihn in ziemlicher Entfernung vor mir hergehen und sagte ihm, ich wolle gegen ihn mit der Hand herabfahren und er solle sagen, wann er etwas empfinde. Ich fragte ihn zweimal, ob er nichts spüre, so daß es schien, als mache ich hinter ihm die Bewegung, die ich unterließ, worauf er verneinend antwortete. Als ich aber wirklich, und zwar sehr schnell, mit der Hand herabfuhr, sah man in diesem Augenblick die Äußerung des Frostschauders an ihm, worauf er sich umdrehte und sagte, nun sei ich mit der Hand herabgefahren."

92 Cf. the documentation in Hörisch (1979), pp. 214-222.

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Sunday, January 12

Session IV: Heredity, Man & Society

9:30 **Constitution, Diathesis, and Genetic Susceptibility: An Aspect of the Cultural History of Medical Genetics**
Robert Olby
(University of Pittsburgh)

10:15 Coffee Break

10:45 **Heredity, Milieu and Sin: The Work of B.A. Morel (1809-1873)**
Jean-Christophe Coffin
(Centre Alexandre Koyré Paris)

11:30 **Majorat: The Law of Succession and Literature in the 19th Century**
Ulrike Vedder
(Zentrum für Literaturforschung Berlin)

12:15 **Comments**
David Sabean (University of California)

13:00 Lunch Break

14:30 **George Combe's Law of Hereditary Descent or Hints on the Heredity of Ideas of Heredity**
John van Wyhe
(University of Cambridge)

15:15 **Acquired Character: The (Pre-Genetic) Material of the 'Self-Made Man'**
Paul White
(University of Cambridge)

16:00 **Comments**
Sigrid Weigel
(Zentrum für Literaturforschung Berlin)

16:30 Coffee Break

17:00 General Discussion

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE
Wilhelmstraße 44 D–10117 Berlin
Telefon (+4930) 22667–0
Telefax (+4930) 22667–299
www.mpiwg-berlin.mpg.de

Max-Planck-Institut für Wissenschaftsgeschichte
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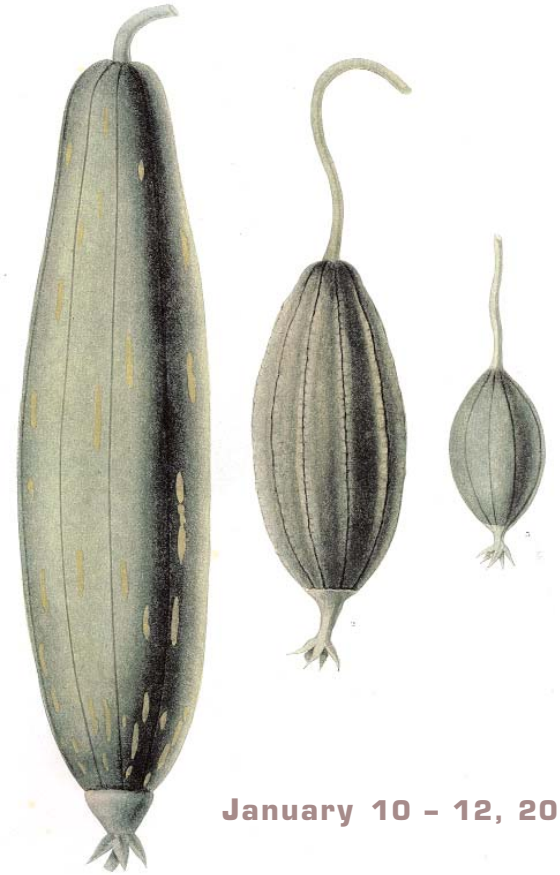
A Cultural History of Heredity II

18th and 19th Centuries



January 10 – 12, 2003

Friday, January 10

14:30 Welcome and Introduction

15:00 **Hérédité, Old and New**
Carlos López Beltrán
(Universidad Nacional Autónoma de Mexico)

15:45 Coffee Break

Session I: Heredity & Breeding

16:15 **The Sheep Breeder's View of Heredity (1723-1843)**
Roger Wood
(University of Manchester)

17:00 **Characters Written with Invisible Ink. Elements of Hybridism 1751-1875**
Staffan Müller-Wille
(MPIWG Berlin)

17:45 **Comments**
Raphael Falk
(Hebrew University Jerusalem)

Saturday, January 11

Session II: Heredity & Biology

9:00 **Adaption and Heredity in Lamarck's and Geoffroy Saint-Hillaire's Biological Theories**
Wolfgang Lefèvre
(MPIWG Berlin)

9:45 **In Search of Lost Generations. Life-Cycles and Organisms between 1800- 1860**
Ohad Parnes
(University of Bern)

10:30 Coffee Break

11:00 **Heredity and Adaptation in Kant**
Peter McLaughlin
(MPIWG Berlin)

11:45 **Comments**
Pietro Corsi
(Centre Alexandre Koyré Paris)

12:30 Lunch Break

Session III: Heredity & Medicine

14:00 **Erasmus Darwin on Hereditary Disease: Conceptualising Heredity in Enlightenment English Medical Writings**
Philip Wilson
(Penn State's College of Medicine)

14:45 **"Poor Old Ancestors": The Popularity of Medical Hereditarianism 1770-1870**
John C. Waller
(Wellcome Trust Centre London)

15:30 Coffee Break

16:00 **Pathological Heredity as a Bid for a Greater Recognition of Medical Authority in France, 1800-1830**
Laure Cartron
(University of Paris I – Sorbonne)

11:45 **Comments**
Gianna Pomata
(University of Bologna)

19:30 Dinner