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In the Cradle of Heredity; French Physicians and *L'Hérédité Naturelle* in the Early 19th Century

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Abstract. This paper argues that our modern concept of biological heredity was first clearly introduced in a theoretical and practical setting by the generation of French physicians that were active between 1810 and 1830. It describes how from a traditional focus on hereditary transmission of disease, influential French medical men like Esquirol, Fodéré, Piorry, Lévy, moved towards considering heredity a central concept for the conception of the human bodily frame, and its set of physical and moral dispositions. The notion of heredity as a natural force, with a wide ranging capabilities of transmitting differentially both fundamental and accidental characters was generalized by that generation of physicians with the help of contemporary naturalists and physiologists. By 1830 the term *hérédité* was widespread, and it shared the explanatory and semantic qualities of traditional medical concepts like constitution and temperament. An analysis is given of the main developments that led to the conception of biological (including human) bodies as consisting of a layered, hierarchical organization of characters, differentially affected by the laws of conservation (Heredity) and change (Inneity, Variation). The mid-century work of the French physician Prosper Lucas, *Traité Philosophique et Physiologique de L'Hérédité Naturelle,* is shown to be the culmination of the efforts of several generations of French physicians towards having a feasible, complexly structured notion of how heredity works.

Keywords: 19th century medicine, constitution, French medical history, hereditary disease, heredity, history of genetics, inheritance, Prosper Lucas, temperament

Introduction

For most naturalists heredity became a main feature of the living world after the middle decades of the 19th century. It had been an important presence since several decades before for physicians, agronomists and breeders. Heredity is a historically constructed concept, whose story is richer and more complex than most historians of biology have until recently recognized. For several decades in the early 19th century, medical men, many of them in the French milieu, gave the main steps in the construction of heredity. In this paper, I want to describe some of the most salient developments of those

early decades, and to show how as the 19th century went by they transformed heredity into a natural explanatory notion in biology, psychiatry, criminology, etc.

There have been several successful studies of the expansion of hereditarianism into different areas of medical practice and of natural history after the 1840's.[1] However, the earlier dramatic shift during the first decades of the century from 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 natural bodily (and thus, for some, moral) endowments of individuals has not been adequately described. William Coleman has persuasively shown how at the turn of the 18th to the 19th century, French physicians abandoned the Galenic old language of the "six non-naturals" when alluding to the external influences on health (like nutrition and climate, for instance) and began to speak of Hygiene. I believe that a parallel move occurred with the complementary concept of the "naturals" (like temperament), which was eventually substituted by heredity, in order to reproduce the previous dialectic between body and external milieu.[2]

The process by which heredity underwent transformation from its marginal metaphoric use to that of an important explanatory tool for biological disciplines and the momentum it gathered during these decades is difficult to capture under a single narrative. Besides post-revolutionary zeal, other factors influenced this transformation: the rise and fall of the phrenological movement and the disputes around vitalist or dynamicist physiology. The outbreak of hard hereditarian, degenerationist and racist thinking in the French scene after the 1850's is well documented. Its brewing phase among the aliénistes (early psychiatrists) in the decade of the 1840's has also been described.[3] What has not been studied is the groundwork accomplished by the previous generation of French medical men in shaping and structuring a working notion of *hérédité*. This is the task the present paper sets out to do.

It is important not to mistake the notion of hereditary transmission, with the concept of heredity itself. My story turns around this distinction. We can take Lamarck's position as a good example. Although posterior developments situated the name and the work of Lamarck in the center of the debates about the heredity of acquired characters, neither Lamarck (nor anyone else in his time for that matter) paid attention to heredity itself, as the notion of heredity was not yet developed. As André Pichot has recently phrased it, "even if

[1] Dowbiggin, 1991; Gayon, 1999; Orel,1996; Waller, 2001a.

[2] Coleman, 1974, 1984; Williams, 1994; and López-Beltrán, 2002.

[3] See Pick, 1989; Chamberlin, 1985; Borie, 1981; Carol, 1995; Dowbiggin, 1991.

heredity occupies a central part in Lamarck's theory, that center is not theorized; and thus when people speak today of Lamarckian theory of heredity, what they do is to project unto Lamarck's theory a notion of heredity that was only elaborated after his days."[4] I believe that this elaboration required that medical men integrate the notion of hereditary transmission within the semantic field of the powerful and prestigious concepts of temperament and constitution, and that they put it to work under the resounding noun they coined for that effect: "*Hérédité*."

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 concept. 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 found applications ranging from the medical to the zoological, from the agricultural to the ethnological. It was in those areas where during the first half of the nineteenth century in several European countries, our modern concept of biological heredity was first adopted.[5]

Le Trésor de la Langue Française mentions Joseph de Maistre's *Les Soirées de Saint-Pétersbourg* (1821) as the first registered occurrence of the noun "*hérédité*" with a biological meaning:[6] In the place referred to de Maistre writes of "cette triste hérédité" referring to the physical ailments bequeathed to infants by the sins of their elders from several generations back. I have located several previous instances linked also to the transmission of disease, where the notion of a noxious bequeathal (*facheuse hérédité*) to future generations is dominant.[7] The link between the Christian (Augustinian) notion that hereditary physical ailments stem from a divine punishment linked

[4] Pichot, 2002.

[5] For heredity during the 18th century see Rey, 1989; Rheinberger et al., 2002. For recent views on the history of the concept of heredity see Olby, 1992; López-Beltrán, 1994; Gayon, 1999; Gayon and Zallen, 1998; Orel, 1996; Orel and Wood, 2001; Waller, 2001b.

[6] 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.

[7] See Fodéré, 1813, Vol. V, p. 365. *Le Grand Robert* gives the same occurrence as the first one. De Maistre's book is really from 1822.

to the original sin (and from then on to sinful bloodlines) and the substantialization of hereditary diseases into a reified entity *hérédité* seems to me undeniable.[8]

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 paper is to describe that process. I set out from an empirical fact: after 1830 "*hérédité*" became an increasingly popular noun among 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's interpreters) was being transformed into phrases like "hérédité des maladies," "hérédité morbeuse," "héredité pathologique," transferring the stress of the fact of transmission from an adjective to a noun, which opened up the space for a more general notion, and somehow eroded the 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* was frequently 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 morale." The first pair was used to emphasize the growing perception that there was a natural aspect of hereditary phenomena, free from the common noxious connotations.[9] 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 consumption by a wider spectrum of savants. I speak of the "structure of the concept" because I want to emphasize the existence at that moment of a cluster of classificatory and explanatory elements produced by medical analysis and by disputes around the notion of hereditary transmission. Medics were thus 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

[8] Two contests set by the Royal Society of Medicine in the 18th century were instrumental for the development of these analysis (López-Beltrán, 1994). For the English world John Hunter did the most surprising and clarifying discussion in his *Principles of Surgery*. Hunter, 1835–1837 (1786), Vol. 1, pp. 353–359.

[9] 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, Vol. 1, pp. 353–354.

other criteria were used as pointers towards the necessary separation between accidental and hereditary variation.[10]

Once the notion of heredity became accepted, different physiological schools struggled to take over the increasingly powerful new domain. Several generations of French physicians, early psychiatrists (*aliénistes*), physiologists and naturalists contributed with alternative accounts of how heredity shaped individual, familiar, and even national constitutions.[11] With the publication of Prosper Lucas' remarkable *Traité de l'Hérédité Naturelle* (1847–1850) the process reached its climax and conclusion. In spite of Lucas' adoption of a dubious physiology of forces, and an anachronistic methodological approach, he succeeded in organizing and structuring the realm of biological hereditary transmission in a way that most readers, of whatever persuasion in other issues, could profit.[12] As an exhaustive and detailed work of analysis and theorization, based on massive bibliographical research, Lucas' work shows the weaknesses of the French medical tradition in its approach to hereditary. At the same time, in support of heredity, it effectively displayed the wealth of evidence and understanding that was scattered in the medical literature ignored by many others. As Michel Lévy explained: "one finds in this work, besides some abstract theories, a real wealth of facts and proofs, and some ingenuity of induction."[13]

Hérédité, Old and New

The traditional medical concepts of temperament, complexion and constitution, adapted at different times 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.[14] In the late 18th century, when the trend favored materialistic approaches, medics adopted the medical concepts of tempera-

[10] López-Beltrán, 1992; Olby, 1992; Gayon, 1999; Waller, 2001a.

[11] *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*.

[12] Lucas (1805–1885) was basically a follower of Karl F. Burdach's physiological ideas, and as a physician had a penchant for collecting case stories around every issue. See last section below.

[13] Lévy, 1869, tome 1, p. 113. All translation from the French are of the author.

[14] Roger, 1963, remains the outstanding investigation of this for the French context from the 16th to the 18th centuries.

ment and constitution as framing devices for grounding the moral on the physiological; in turn, this relation between the physiological and the moral became a launching base for hygienist programs of physical and moral improvement of humanity. The influential work of Pierre J.-J. Cabanis (1757–1808) framed in a clear way the question of the plasticity or permanence of the inborn *temperamental* features with respect to the influence of the environment. According to him, temperament could be modified or improved, only up to a certain point. A crucial consideration of the hygienist project was that ". . . the habits of the constitution are transmitted from parents to children; they are preserved as an undeletable mark, in the midst of the most diverse circumstances of education, weather, or diet."[15]

Physicians progressively made the notion that some bodily features could become entrenched in some lineages through hereditary transmission explicit in the period. The transmission of the set of empirical facts that I have elsewhere called *the hereditary* (including the resemblance of offspring to parents, atavism, recurrence of disease or of striking peculiarities within families or groups)[16] provided a link between parents' temperaments (or constitutions) and those of their children; that connection, extended over time to whole genealogies, justified the tale of family, or even of national characters. Cabanis' improvement program (inspired in part by those followed by animal breeders) was of course one of the influences that shaped Lamarck's notion of the inheritance of bodily adaptations.[17]

After Cabanis, the marginal 18th century French medical disputes around "les maladies héréditaires" developed into a theoretical and ideological 19th century preoccupation with the general workings of *l'hérédité*. The last decade of the 18th century, and especially 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 (1788–1790).[18] These essays were soon followed up by a series of very authoritative works on the subject: Antoine Portal, Antoine Petit, and Emmanuel Fodéré wrote extensively on the topic.[19] With increasing frequency, general pathologies and treatises concerning main chronic diseases emphasized hereditary causation.[20] Despite

[15] Cabanis, 1824 (1802), Vol. 3, p. 431. For Cabanis' influence on the French medical world in early 19th century see Staum, 1980; and Williams, 1994.

[16] López-Beltrán, 2002.

[17] Cabanis, 1824, Vol. 3. p. 434. See also Carol, 1995, p. 24. For the influence of Cabanis and other *ideólogues* on Lamarck see Corsi, 1998.

[18] See López-Beltrán, 1994 for the story about that competition.

[19] See Fodéré "maladies hereditaires" in his 1813.

[20] Fodéré, 1809; Baumes, 1805; Portal, 1808.

some reluctance, the famous alienist Philippe Pinel unequivocally acknowledged the importance of hereditary predisposition in the onset of mental illness, and soon his followers enthusiastically took to exploring the theme. Among them, Esquirol and Fodéré promoted the hereditary influence from the "back row" of secondary influences on insanity to the forefront as one of its main predisposing physical causes.[21]

The understanding of hereditary transmission of disease was closely connected with 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 ways, 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. 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 based on the same principles, but its objects of transmission were deviant particularities that were predisposed to disease.[22]

The social and political developments during the French Revolution and during the Napoleonic reforms gave medical practitioners the opportunity to promote two new powerful conceptual weapons – hygiene and heredity – and thus to fulfill their aspirations to give their profession a major role in the reorganization of civil life. Hereditary transmission had never been viewed before as a subject of special analytical and theoretical interest that brought it into sharp focus.[23] There was a notorious change of emphasis, and what had been relegated to footnotes or short discussions became the subject of chapters in books and of 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. Among them we find Emmanuel Fodéré, Antoine Portal and Philippe Pinel, all of whom played leading roles in the post-revolutionary medical reforms. Although these authors had acknowledged hereditary influences in their early

[21] Pinel, 1812; Fodéré, 1817; Esquirol, 1820.

[22] Physiologists like Burdach, 1837; and Flourens, 1863, were among the most influential to propose a general physiological account of heredity.

[23] 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).

works, it was only at this moment that they gave hereditary influences a central role.[24]

The *Dictionnaire des Sciences Médicales* (1812–1820) and the Consolidation of *L'Hérédité*

With the exception of isolated cases of skepticism, the French medical community seems to have arrived at a sort of consensus about the centrality of heredity by the late 1820's.[25] It was disease that had driven the medics to pay close attention to hereditary transmission in the first place. Physicians had found a useful theoretical resource for the explanation of some diseases in the notion of actual physical transmission (by both parents) of some kind of casual influence at the moment of conception. This was especially true in the case of 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 at an early stage not particularly stressed.[26] The hereditary transmission of a whole range of physical characteristics and dispositions was considered proven by accumulated evidence but the reach, the power, and the limitations of this phenomenon in both humans and other species remained to be understood. For different reasons, it was particularly crucial to know 1) if some socially damaging diseases, especially 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 the traits that characterized each specific type of living organism 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 aliénistes, anthropologists and naturalists) could be tackled through

[24] Fodéré, 1792; Portal, 1781, 1800; and Pinel, 1785. Wide perspectives can be had in Poilroux, 1821; Caillot, 1818. See also Ackerknecht, 1967; Williams, 1994.

[25] 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.

[26] 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 (*morbi sacri*) 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.

a unified analysis of the phenomena: a general theory of hereditary transmission. This was an 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 sixty-volume *Dictionnaire des Sciénces Médicales*, whose different entries between 1812 and 1820 captured the progressive generalization of the metaphorical notion of hereditary communication into a unified, law-like approach to biological heredity. This dictionary emerges as a kind of forum where the positions of different influential physicians were being rehearsed and criticized successively and thus opens a window into the construction of the concept of heredity.

As late as 1812, Philippe Pinel (1745–1826) 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 staging by commissioning a further article on the overlapping subject of the "aliéné," to Jean Marc, a disciple of Pinel's. In his essay, Marc stressed the importance of hereditary predisposition to insanity: "it establishes – he wrote – one of the strongest presumptions in favor of the reality of mental disease."[27] But it was J. Etienne D. Esquirol (1772–1840), the crown prince among Pinel's disciples (himself teacher to the openly hereditarian generation that followed[28]) who gave heredity the leading role as an influence for mental disease in his thirteen articles for the *Dictionnaire*. In his entries for both "Folie" and "Manie"[29] he gave previews of what was to become his classic book on *Maladies Mentales* (1838). Esquirol was the first to organize cases of mental insanity into statistical tables, with the intention of sorting out the importance of each causal influence. He found heredity to be a major "physical" cause, and in certain circumstances, a dominant one.[30]

Under the entry on "Héréditaire" (maladie) the *Dictionnaire* included an essay published by Antoine Petit a little before, in 1817.[31] This piece remained the most influential analysis published on the subject until the 1840's. It was a clear and convincing attack on humoralist views of heredity. Echoes of Petit's precisely worded piece can be found in works written sixty

[27] Marc, 1812.

[28] Like Georget, Moreau de Tours, Baillarger, Morel. For accounts of Esquirol and his school's work see Ackerneckht, 1959, Chap. VI, pp. 37–51. See also Semelaigne, 1894.

[29] Esquirol, 1816, 1818. "Madness" and "Mania."

[30] 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.

[31] Petit, 1817.

or seventy years later. Petit summarizes what he considers to be the medics' main achievements in the definition of the hereditary cause. Heredity, he asserts, has to be based on particular states of the bodily constitution communicated to children by parents. These states create an "organic disposition" to reproduce a given effect, for instance, a particular disease. He adds that they can be both localized states, or states of the whole *economie*, 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 also to be understood as 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 in dealing with hereditary transmission.[32] He summarizes, with more clarity than any previous author, the determinant features of heredity. Latency, homochrony (to use Haeckel's later term for occurrence at the same period of life), and atavism can all be accounted for with proper causal analysis. He upholds the importance of separating clearly real hereditary (in his words congenital) from later uterine (connate) influences, and insists that only through the process of generation can real hereditary influence be transmitted. He joins previous authors in condemning attempts to solve the mystery of heredity by an even deeper and more unsolvable mystery of biological reproduction (generation). Hypothetical *systèmes* of generation only confuse the issue. He adds that it is far more likely the proper observation of the patterns and nature of hereditary disease will illuminate the theorizing on reproduction, than the other way around.[33] Although he is skeptical about the feasibility of any success, Petit leaves it to other specialists to decide on the real (intimate) nature of the inherited dispositions. The good observer can occasionally find visible, exterior characters that are linked to the disposition, before its effects are noticeable. Generally, however, this is not the case; though there is an organic base to hereditary causes, they usually remain hidden (latent) until the time for their expression arrives during life's course. This theme of the hidden cause that exposes itself at a given time was taken up by others of the *Dictionnaire's* authors both from a medical and a physiological perspective.

After Petit's solid defense of heredity, the *Dictionnaire* articles on all constitutional, chronic diseases gave a preeminent role to heredity. The entries on "Scrophules" and "Phthisie," for instance, join vigorously the attack

[32] "luminuos distinction . . . that rests entirely on facts, and will be forever one of the most nourishing sources from which the skillful physician will draw the more positive notions." Petit, 1817, p. 59.

[33] Petit, 1817, p. 63.

on humoralistic explanations of hereditary transmission,[34] favoring without reserve the view that heredity is to be ascribed to inborn constitutional (organic) peculiarities that predispose for certain conditions. Several authors make an explicit attempt to clarify that there is nothing particularly pathological about the route (or mechanism) through which structural anomalies are communicated from parents to children. Normal physiological processes are responsible for transmission. Once the constitution acquires a flaw, the natural trend would be to transmit it via reproduction, as is the case with constitutional features and qualities responsible for general and particular resemblances between parents and offspring. The open end of the discussion (which Petit shied away from) was the question of how to understand *constitution*,[35] 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. These different attitudes were rooted in the tension between material and functional explanations, between anatomy and physiology, and within physiology itself, between materialistic and vitalist approaches.

"Constitution" had traditionally been a term broad enough to encompass different, 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 the details and operations of which had still to be fought over by the proponents of different physiological theories. Alphonse de Montenegre, in his *Dictionnaire* piece on "maladie constitutionelle" provides a striking illustration of this view of the body as a battlefield: "the animal body can be considered as formed by several beings, up to a point independent from each another by the way they behave; but all converging in the general result that life is. There must by necessity exist a sort of balance of action between these parts ... That is how one can conceive those individual dispositions that touch both the physical and the moral and that establish among us an infinite variety."[36]

A constitution could be assigned general states, or forms of being, that in turn would be responsible for reactions to stimuli and for dispositions. Or it could be assigned particular states or forms of organization responsible for

[34] Fournier-Pescay and Begin, 1820, pp. 278–386. Maygrier J.P., 1820, pp. 15–168.

[35] Fournier, 1820, tried to make the differences between these concepts explicit. "There are – he wrote – between the words temperament, constitution and complexion, notwithstanding there synonimity in certain cases, different subtle differences that impede the indistinct subtitution of one for the others."

[36] De Montenegre, 1820, p. 246.

localized reactions, in a given organ or part. The peculiarity of constitutional variation could be material, and observable in principle, or it could be only a potentiality rooted in some special quality (like irritability) or a vital or dynamic force of some kind. The important coincidence was the existence of a basically fixed set of physical dispositions that characterize each individual.

No author doubted that there was a link (a rapport) between the parents' constitution and that of the new being they gave rise to. And "hérédité" was deployed when it became necessary to highlight such relationship. As Michel Lévy summarized it "heredity appears in man in its general form and in the relative proportions of his parts; it manifests itself through the intimate properties of the organic fiber."[37]

As with "constitution," "hérédité" became a generally accepted explanatory frame, whose contents were debated and defined en route. Resemblances, in form and function, in health and illness, in body and mind, had to be somehow rooted in a causal link. But how could this be? Which kind of properties or characters was really communicated? Could only a physical (physiological) heredity account for all resemblances, or was a special, moral (or psychological) kind of hereditary transmission needed to account for the increasing number of statistics and observations of, for instance, insanity running in families?

Thus, physicians' notion of heredity was a basic structure that could accommodate different hypotheses. Naturalists and anthropologists that adopted it began their struggle to compartmentalize "hérédité" into a rational explanatory scheme, in which its boundaries and ways of actions would be clearly defined. For these groups it was of crucial importance that the characters affected by heredity be chosen from clearly defined sets in a hierarchical classification: from species, through racial, to individual, on one axis, and from physical to moral (or mental) on the other, authors would debate the reality of proposed hereditary transmission. The main problem these generalizations faced was the proliferation of exceptions and irregularities.

At this stage many medics had strong feelings about allowing general hypothetical systems from other disciplines to impose definitions of constitutional dispositions and heredity without giving enough weight to accumulated medical experience.[38] For them "l'hérédité pathologique" should inform "l'hérédité physiologique" rather than the other way around. Thus, the definition of heredity itself was to be based on medical men's assessments of its workings: to what extent each kind of bodily feature was actually affected by hereditary transmission was a question best answered by observing the

[37] Lévy, 1869 (1844), tome 1, p. 114.

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

patterns of disease communication, considering that a disease (or a malformation) was a much clearer sign than other normal resemblances; similarly, in the case of moral phenomena, it was easier to follow a pattern of a distinctive set of symptoms, as those of insanity running in a family, than it was to follow vaguer, positive qualities like honesty or strength of will.

It is a sign of the effectiveness of the *Dictionnaire's* articles that their discussions and definitions of hereditary transmission became a natural base for future elaborations by French medical men. The schools of medicine of Paris, Montpellier, and Strasbourg were constantly producing theses, both by students and professors (for tenure), which addressed different aspects of hereditary transmission of diseases, frequently trying to find generalizations and law like features of heredity. D.A. Lereboullet (1834), Michel Lévy (1844), Claude Béclere (1845), and especially Pierre A. Piorry (1840), produced good expositions of how heredity worked 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 argued for decades about the hereditary base of human nature finally captured the attention of broader sections of mid-19th century French intelligentsia. The latter perceived heredity as capable of accounting for the unaccountable: the human soul in its collective and individual dimensions and its dependence upon the body's constitutional make-up.

D.A. Lereboullet summarized the general importance of heredity, outside the purely medical realm, stressing the uniqueness of the human case. Among humans, he wrote "organization presents us with individual differences" based on the innumerable combinations that different constitutions, temperaments, and idiosyncrasies can produce. Together with the many modifications brought about by external or circumstantial factors (climatic, passions, education), these combinations can "make intelligible the infinite nuances that we observe among men ... on the relation between their physical and moral characters." But, he added, these subtleties can be further analyzed: "If we apply to the physiological study of the human species the method of the naturalists we could still distinguish, among those many differences, certain common characters, certain original types many of which would have persisted through a long series of centuries. The points of resemblance would be more numerous among the individuals of an isolated nation that would have stayed free from interaction with foreigners. Thus if we direct our gaze to the members of the same family we will find between the children and the parents the most obvious conformity: features of the face, of the stature, the sound of the voice, the color of the skin, the constitution, temperament, habits,

character, moeurs, inclinations, everything is similar. It is under the influence of this unshakable law, in virtue of which man gives life to beings similar to him, that one can see sometimes that vices of conformation are transmitted from generation to generation. In such way we inherit the constitution and temperament from our parents; we inherit their physical and moral characters; we inherit their conformational vices."[39]

The possibility, described by many 18th and 19th century authors,[40] of stable, hereditarily and genealogically based, natural human groups *under* the level of the species (races, varieties), could easily be extended to sociohistorical 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. The vagueness of key working concepts, like disposition, was an open invitation for imaginative theoreticians. "Heredity" was too good a gift for all those interested in explaining (and controlling) humanity; as hereditary inferences eventually became main rhetorical tools used by medically-based (and biased) schools of thought, they began to receive wider hearing, and among other things a reaction by thinkers of other persuasions made everyone pay closer attention to the rationality and grounding of hereditary claims. "Hereditary transmission" first, and "The Laws of Heredity" later, became too important to be left in the hands of the doctors. But the initial medical input survived in the structure of the concept, and even in the late 19th century, after Darwin, Galton and Weismann had changed the shape of the domain of biological heredity, the original, pathological connotations of the theme persisted, especially in the French milieu. As late as 1873, under the entry "Hérédité," Larousse's *Grand Dictionnaire Universel du XIXe Siècle* described physiological heredity as mainly a medical concern, although it was also linked with the "general tendency of Nature to reproduce in children certain physical and moral characters that occurred in the parents' organization."[41] It seems that the main reason for describing a physiological (normal) pattern of heredity was to contrast it with the pathological one, and to subdivide it into two main kinds of transmission according to two distinct types of characters, physical and moral. "Heredity" had by then become a diverging tree, and each of its branches carried a suitable adjective.[42]

After the 1840's, it was the "moral" and later the "psychological" aspects of heredity in humans that received attention. The branched and qualified

[39] Lereboullet, 1834.

[40] Among them Maupertuis, 1745; Hunter, 1786; Joseph Adams, 1814; Prichard, 1813; Pujol, 1802.

[41] Larousse, 1873, tome 9, pp. 217–218.

[42] For a typical example see for instance definition of *hérédité* in Littré, 1863.

"heredity" that French aliénistes made use of in the second half of the 19th century was a much more complex concept than the one which was delivered by the physicians' early explorations. After an increasing number of French physiologists, naturalists, ethnologists, and later on, psychologists had incorporated the term into their theoretical resources, "heredity" became charged with a whole range of theoretical assumptions. 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-up 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 a medical chair at Strasbourg, could confidently assert that the majority of authors understood *Hérédité* as the transmission of particular (bodily) dispositions that tended to reproduce in children the same characteristics (like diseases, inclinations and other resemblances) their parents had at the same age, or in the presence of the same exciting cause. But how to understand the meaning of the clue word "disposition" would still be a subject of debate. In its medical (pathological) sense, the concept was closely linked in the early 19th century to the idea of "diathesis."[43] When it was adopted and generalized by other scientists, imperatives from the much broader physiological and taxonomical realms made important inputs. In the case of "moral" or "mental" heredity, the traditionally disputed dichotomy between matter and mind also featured heavily.

Heredity and the Hierarchy of Characters

With the emergence of heredity as a biological force,[44] the question of which kind of characters came under its domain became an increasingly important one. Naturalists had classified organisms' characters, establishing a hierarchy that reproduced their "difference within similitude." Necessary attributes

[43] "*Diathèse*" according to Pariset and Villeneuve, 1812, is a term that can be synonymous to Galen's habitus, and other author's "disposition" and "predisposition." It refers to the perception that medics have shared since antiquity that "individuals organized in such a way, constituted in such a manner, . . . are constantly subject to certain disease rather than certain other." The diathesis, they write later on, "can be original or acquired: the first set depend on our primitive organization and are the one more ordinarily transmitted to us by our parents; the acquired diathesis are the result of action . . . of everything that can act upon our economy . . ." Vol. IX, pp. 248–250. See also Olby, 1992; and Ackerknecht, 1982.

[44] For insightful analysis of mid-19th century views of heredity as a force see Gayon, 1998, 2000.

persist, and are the same within each taxonomic group, while accidental peculiarities can change and are responsible for variety and individuality. Buffon wrote that "The imprint of each species is a type of which the main features are engraved forever with permanent ineffaceable characters ... but all the accessory touches vary; no individual resembles perfectly another, there no species lacks a great number of varieties."[45]

Between the individual and the species lies the race. A race, to use an anachronistic description, is characterized by a set of correlated variations. The original type, regardless of how it is conceived, is responsible for preserving the unity and the integrity of the species. But what keeps the race as a stable entity? Is it a similar typological (necessary) "force"? Or is it a contingent set of coordinated influences? The former answer is difficult to defend, as a proliferation of types and subtypes would end up leaving the concept too thinly spread, and the evidence, by the early 19th century, of mutable varieties and hybridization certainly weakened such a position.

What kind of influence(s) was then responsible for the persistence of stable varieties? This question was relevant for both the human case and for more general biological inquiries. The geographical distribution of most varieties suggested an external, climatic set of causes, which could prompt internal potencies or shape the malleable portions of the constitution. At the same time, since Hippocrates had used the example of a tribe of macrocephalic people to illustrate the hereditary transmission of non-essential (accidental) variation, the genealogical explanation of the origin of races (or of stable varieties) had been seen as a possibility by some. That resemblances communicated through the reproductive pathways of the species could certainly produce stable varieties was one of the most influential opinions of Pierre L.M. Maupertuis (1698–1759). By the late 18th century an increasing number of authors considered this idea proven by the selective behavior of breeders and horticulturalists.

Some late 18th century thinkers showed that a hierarchical, typological view of species characters, which formed the constitution, could be combined in different ways with a genealogical approach to variation and hereditary transmission. Thus, without breaching the main typological assumptions of his day, the Scottish agriculturalist James Anderson (1739–1808), developed a sophisticated account of why carefully selecting the mating partners (as had been notoriously done by the British breeder Robert Bakewell (1725–1795)) actually contributed to the creation of new breeds.[46] His model was based on concentric series of hierarchical levels of properties. The species,

[45] Buffon, 1854, tome VII, p. 418.

[46] For Bakewell and his importance in the history of heredity see Russell, 1986, and the excellent new book by Wood and Orel, 2000.

the race, the family, and the individual, each had its determinant characters. In his view, each inferior level can suffer (spontaneous) variations in any direction, but only up to the limits set by the superior level, which constituted its boundary.[47] Racial characters can vary within the specific type, familial characters can vary within the racial type, and individual characters within the familial. By going down through the hierarchy, the breeder can select individual variations within the family, varieties within the race, racial varieties within the species; and it can eventually stabilize, in a new variety, a genealogical line with the desired characteristics. Anderson's scheme, which denies any influence to Buffonian climatic causes, assumes that variations that do not transgress the boundaries of the hierarchy can be, and are, transmitted hereditarily. For Anderson (as for Maupertuis and Hunter before[48]) variation occurs spontaneously and is fixed in the constitution from the moment of its "first formation." Crossing different varieties one obtains new ones and consequently, the number of different varieties could possibly be unlimited. By contrast, the number of species is fixed.[49]

Anderson's scheme is an attempt to solve the contradictions between a stable, fixist, hierarchical view of biological taxa and the instability introduced by domestication and by the genealogical preservation of peculiarities. This kind of scheme bestowed on hereditary transmission a more important role than it had held before the turn of the 19th century. During the early years of the 19th century, the groundwork done by breeders and by physicians opened a useful explanatory space for a special concept associated specifically with the transmission of different kinds of characters, and prompted a de-marginalization and a de-pathologization of heredity.

As a consequence of heredity's newly acquired central position, there emerged a clear-cut opposition between heredity and variation. Naturalists dedicated much thinking and research to sorting out which kind of character was under the control of each tendency.[50] Heredity began to be identified as the reason for the stability of taxonomical groups, arguing that it was the general bodily structure, or organization, rather than its particulars, which was the main object of hereditary transmission. For some authors, the heredity of essential characters accounted for the preservation of the types; for others heredity of accidental characters gave rise to differentiated families, nations, and races.

47 This model of concentric circles of variation was still in place several decades afterwards, and was used by Fleming Jenkins in his well-known criticism of Darwin's argument.

48 Maupertuis, 1745; Hunter, 1786.

49 Anderson, 1799.

50 The above sketch applies particularly to France. But in England for instance, a similar reflexion can be made on the works of Prichard, 1813, 1826, 1829; and those of Lawrence, 1816, 1819.

These not entirely inconsistent positions created the polarities and tensions amidst which the domain of heredity was investigated. When the existence of a normal (non-pathological) hereditary influence ceased to be a disputed issue, the question drifted towards its characterization and powers. Once not only *accidental* variations and diseases were considered hereditary, but heredity played a leading role in the re-production of the basic organization (or constitution), there arose the question of which characters *are not* lawfully transmitted, and why. Irregularity had always constituted a main obstacle for any defense of a general hereditary cause. But the inconsistency of transmission, especially of the transmission of peculiar, accidental features, sharply contrasted with, and was counterbalanced by, the occurrence of striking positive and convincing cases, not likely to be undermined by rational analysis.

Viewed as a conservative influence, heredity had to be linked primarily to the characters of the species, which had to be the most stable from generation to generation. The stability of other sets of middle range genealogical characters (for example, racial) could also be understood with it. But the transmission of lower level characters, down to individual peculiarities, posed now a difficult question. Why should a conservative force working for the stability of the type preserve them? Paradoxically, as we have seen, it had been the conservation of the whimsical from family resemblance to monstrosities that had brought hereditary transmission to the attention of people in the first place. The rampant irregularity and variation in characters that were seen as belonging to subservient levels, such as the national, the familial, and the individual were not an obstacle for the proliferation of the notion that these intermediate classificatory categories depicted a reality underpinned by heredity itself. This was done by the use of genealogical criteria as a substitute for the unity of a type. The view that there was a biological substrate to people's identification with a family, a national group, and a race was *strictu sensu* a reality. Heredity, with its powerful metaphorical appeal, became the mechanism of preservation of the family's (and the nation's and the race's) physical and moral heritage or patrimony, which consisted of a correlated set of peculiarities with an organic (constitutional) basis. Thus, Julien-Joseph Virey (1775–1847) wrote in 1821: "Natural family traits are thus a heritage of the races ... All the individuals emanated from the same bosom, living together from the same foods, form but a same body that adopts uniform affections, the same ideas and ways."[51]

Likewise, Michel Lèvy had stated that "each family has its organic patrimony; the elements from which it is made are its aptitudes, its health, its life chances." Francis Bleynie added a few years later that this applies also to

[51] Virey, 1821. "Physiognomie."

"each people and each race" and added that such patrimonies were without doubt "controlled by the law of *l'hérédité*."[52] This linkage between sets of hierarchically arranged hereditary characters and the way human groups varied and were geographically distributed attracted a fair number of authors. It provided a frame for the discussion of the opposition between polygenists and the monogenists concerning the origins of Human races.[53] The barriers of race, like those of the species, could be candidates to supply a limit to variation, as much as any other category within the hierarchy. At the same time, this scheme accommodated both materialistic and vitalist physiological metaphysical commitments; the detailed explanation of properties and their transmission remained open for debate and speculation.

The explanatory depth acquired by the idea of hereditary transmission in the early 19th century, due to the theoretical efforts of physicians, was put to work. That the hereditary cause was capable of remaining hidden (latency), and that it acted through organically based predispositions, whose effects only are made apparent at given moments, and possibly through the concurrence of additional causes, gave it an explanatory malleability that was promptly employed. For instance, heredity came to explain the tendency to revert to type (via atavistic regressions) and the tendency to deviate from it (through the inheritance of variations). Heredity could also account for the sequenced fashion in which different characters appear during embryological development and life cycles. Virey, for one, craftily mixed this idea with his genealogically based view: "The traits are blunt, enveloped in the child at birth. As the child grows in age the forms develop, the family features and those of race engrave themselves principally in this period to serve as the initial frame."[54]

In short, heredity became a theoretical device that did part of the work previously done by "temperament" and "constitution." Defenders of all positions could call on it for support: fixists and transformists employed heredity to explain "normal" characters, of natural history and anthropology; in the domains of "deviant" characters (pathology and teratology) both degenerationists and anti-degenerationists made recourse to it. Fodéré, in his more general and theoretical contribution to the *Dictionnaire* ("Vie") reflected this general enthusiasm for linking all the properties of life to heredity: "Each species has its own organic form, transmissible through generation, life is thus

[52] Lévy, 1844 (1869), t.1, p. 114; F. Bleynie, 1865, p. 9.

[53] Virey refused to accept that the black and the white races of humans could possibly have come from the same stock, defended the idea that health and perfection were related with purity of race, and breeding isolation. Other authors saw on the other hand, the inbreeding and the isolation as a source of degeneration, and a solution to it in the crossing between different groups.

[54] Virey, 1821. "Physiognomie," Vol. 42, p. 204.

a heritage." Fodéré describes how some dramatic organic variations, as in the case of monstrosities, can break the mould of a species and produce a new one; yet, no degeneration can really become a permanent feature of a group: "All to the contrary – he writes –, the propagation of the same figures within each race, the resemblance of the offspring to its parents, even the inheritance (*l'hérédité*) of several conformational vices and organic diseases, under the influence of the causes that produce them, everything reveals that nature aspires to preserve its forms . . . continuously to reestablish the integrity of its productions."[55]

Heredity gave an acute lens to focus the parallel discussions (in health and illness) between the proponents of fixity and those of change. But in the French dialectical style, it needed its opposite to properly account for processes or equilibriums. In order to know if families degenerate or species are transformed, or if certain inbuilt mechanisms impede these trends, the interactions between heredity and variation had to be sorted out.

Heredity as a concept was the product of the reification of a set of related phenomena, a sort of projection to the inner (intimate) workings of the physical organization of the body from the observation of patterns of occurrences. The concept of biological variation, heredity's dialectical partner, experienced a similar fate starting in the 1830's. The Cuvierian naturalist and physiologist Pierre Flourens in 1863 wrote in his *Ontologie Naturelle* "I find within organization two very notorious tendencies: First, a tendency to vary within certain limits. Second, a tendency to the transmissibility, to the inheritance, of these variations." These variations, he adds, are spontaneously generated, and do not die with the individual. As they are transmitted from generation to generation, they are transformed from individual to hereditary characters: "*et voilá* race is formed."[56]

Genealogical criteria for defining taxonomical groups could be compatible with a fixist position like Cuvier's and Flourens', or with a transformist one, like Isidore Geoffroy-St. Hilaire's. The kind of characters that were believed to be transmitted through hereditary (through generation) were intimately linked to the major preconceptions about bodily structure, organization and the depth (or superficiality) of variations. During the 19th century, as both Joseph Schiller and François Jacob have proposed,[57] there was a "decoupage" of the notion of biological organization that crucially affected the analysis of hereditary transmission. The hierarchal characters, in their reflexion of taxonomical divisions, began to be perceived as independent elements of a multi-layered entity. The "first formation" of the individual's body was

[55] Fodéré, 1821. "Vie," Vol. 57, pp. 434–603.
[56] Flourens, 1863.
[57] Schiller, 1978; Jacob, 1970.

perceived as the site where different (hierarchically divided) struggles took place. The hereditary relationship that parents' constitution was supposed to have with its offspring's was thus fragmented. Heredity was seen as working independently at the species, the racial, and the individual level. The parents' specific characters would influence the child's specific characters independently of how the parents' individual characters were influencing the children's individual characters. The body's final structure or constitution was then the product of all these complex interactions.

The contradiction faced by the fixist in having to account for the tendency to (hereditarily) perpetuate the type, and for the tendency to re-produce the individual variations in the following generation could thus in principle be solved. Heredity (and variation) could act with differential strength. The essential structure of the organization repeated itself in all generations with unfailing regularity (except in the case of monsters and "sports") while the strength of transmission diminished with the increasingly accidental and particular characters of race, family and individual. In these cases variation could occur in higher proportions. Resemblances that were very particular and striking (both normal and deviant) could also be easily accommodated in this rational scheme. This generalized view of hereditary transmission was to become the most accepted one in the post-Cuvierian decades of the French 19th century, and was to attain its highest point in the work of the alienist theoretician Prosper Lucas, who will be the subject of the final section of this paper. Before turning to Lucas, I will analyze briefly the other major axis – from physical (physiological) to moral (psychological) heredity – along which Lucas based his analysis.

Heredity and the Mind

Ian Dowbiggin, Daniel Pick and John C. Waller have ably explored recently the sociological reasons why the hereditary cause acquired a great importance after the 1840's among the French and other aliénistes.[58] Dowbiggin has insisted on the importance of institutional power relationships and on the struggle to establish an autonomous professional domain by the emerging community of psychiatrists.[59] Pick, on the other hand, searches for his explanations in the general field of European social, cultural and political anxieties, linked to the fears of hereditary degeneration and loss of national and racial purity. None of these scholars provide an in-depth-discussion on the medico-physiological origins of the concept of heredity itself and to how it was

[58] Pick, 1989; Dowbiggin, 1991; Carol, 1995; Waller, 2000a.

[59] R. Nye, 1984, used a similar argument for criminology.

already an important presence in those disciplines in the first four decades of post-revolutionary France. Pick limits himself to point out that "In the wake of 1848, heredity had hardened into a key term in many aspects of medicine and anthropology."[60] This "hardening" was complex and, certainly, had been taking place for several decades, but the French troubles of 1848 gave it, as Pick says, an important push. "Hérédité" had moved some distance from its early 19th century simplistic attributes. It had become sophisticated in several ways. But it was with regard to the communication of moral characters that it suffered the more dramatic expansion. For some years after Cabanis the notion that mental qualities could have a simple, straightforward, organizational (material) base was a claim mobilized to challenge dualist, vitalist and spiritual views of the mental. As a budding medical discipline, "aliénisme" made use of such assumptions from the beginning, and associated some mental diseases with organic (constitutional) states, including insanity, epilepsy, and other moral ailments among the hereditary diseases.[61] It was however a strategy also adopted by the more dubious projects of physiognomy and phrenology.

Among the first medical authorities to argue for a move away from reductionist physiological causes with regards to hereditary transmission was Emmanuel Fodéré. In an explicit attempt to undermine the phrenologist appropriation of hereditarianism he wrote a long analysis of the notion of "hereditary predisposition" that challenged the simplistic solidist and localized interpretations. He argued that to make constitutional dispositions reside in specific, concrete structural arrangements of the body was to ignore the way the very same arrangement could sometimes have different dispositions, as it could be, so to speak, in different *states*. To make mental qualities depend on concrete parts of the brain, their form, size, etc., was certainly an extreme case of the same error. Leaving aside the deterministic absurdities that such beliefs would oblige us to accept, Fodéré continues, the atomization and localization of mental faculties is simply unacceptable. Higher mental abilities are too elaborate to be situated in single parts and to be disturbed by simple physical changes. It is in the principles of life, he adds, where the meaning of hereditary predisposition is to be found. It is not by focusing on matter itself, but in the "emergent" properties that this principle is to be understood. The matter that constitutes a body changes continually, he writes, but the properties and dispositions are preserved nevertheless.[62]

[60] Pick, 1989, p. 23.

[61] Lonie, 1981; Burton, 1651; Adams, 1789.

[62] Fodéré, 1817, pp. 121–136. Fodéré identifies his principle of life with Virey's "principe vivifiant" and tries also to account for the success of Pinel's moral treatment with it.

This reaction to reductionist materialism in the interpretation of hereditary transmission was not reserved to the explanation of mental faculties. In 1840, in his very influential treatise *L'Hérédité dans les Maladies*, Pierre A. Piorry dedicates a whole chapter to normal hereditary transmission of physical characters; while upholding the resistance to ancient humoralist views of hereditary transmission (through "vices" and "taints"), he reintroduces the idea that protean hereditary principles, apart from sometimes being rooted in solid (organic) parts, could also be founded upon, and be communicated by, the fluid parts like blood or other humors. For many medics these mobile and protean qualities of hereditary influences were a necessary complement to their predispositional nature, as different chronic diseases appearing sequentially within the same family could be brought together under the same "diathesis."

A common explanation of the dependence of moral qualities on physical ones, and thus of the hereditary nature of the former, was sometimes described in terms of functional, emergent, dynamic physiology: "Intellectual and psychic heredity considered as an effect of the plastic form over the dynamic form of the organism."[63] This allowed for a new kind of hereditary "proteism" that was enthusiastically adopted by many French aliénistes, whose overarching schemes of mutating mental diseases and degeneration within families were precisely based on the acceptance of a non-localizable, multifaceted, proliferate hereditary basis for degenerate dispositions.[64] By the time Jacques-Joseph Moreau de Tours (1804–1884), Benedict August Morel (1809–1873), and other mid-19th century hereditarian aliénistes wrote their most influential work,[65] physiological (and pathological) heredity had become an unquestionable explanatory tool, capriciously adaptable to all evidential patterns, and underpinned by a very thick network of general reasoning based on the prevalent dualist materialism that other French theoreticians endorsed.

So what was this amazing presence that, physicians claimed, could explain so many things? Was heredity really the first cause of physical and mental qualities in human and other living beings? What did the transmission of weak eyesight and of musical talent from parents to offspring have in common? Was society right in fearing a proliferation of individuals from affected, ill stock? Whoever achieved a useful synthesis of that vague and irregular territory would be making an invaluable contribution. That was

[63] Lévy, 1869, 1, p. 115.

[64] Dowbiggin, 1991, analyzes insightfully the hereditarian tenets of some French alienists, specially of J.-J. Moreau de Tours (pp. 54–75, 116–143). He fails however to acknowledge the extent to which these authors based their positions in the works of previous writers, like Piorry and Lucas.

[65] Moreau de Tours, 1859; Morel, 1857.

the task that a relatively obscure, bookish and imaginative alienist, Prosper Lucas (1805–1885) set himself to accomplish during the 1840's: to synthesize all the known facts about hereditary transmission and to organize them around a coherent theoretical scheme. The revelation that the French medical community had accomplished a considerable amount of constructive, theoretical work around the concept of hérédité became crystallized in Lucas's work, which ordered and structured the growing number of empirical claims and theoretical proposals that circulated in the medical and agricultural literature. He collected, so to speak, the dividends.

Prosper Lucas' *Hérédité Naturelle*

Perhaps the best place to begin an analysis of Prosper Lucas' *Treatise of Natural Heredity* is the quote from Laplace's *Essai Philosophique sur les Probabilités* he chose as his epigraph. "The most secure method that could guide us towards the investigation of truth is to climb by induction from the phenomena to the laws and then from the laws to the forces." This typical Newtonian methodological stance describes accurately, if not the result, at least the intention of Lucas' oeuvre. That it is based on an impressive array of facts and evidence there is no doubt. His aim was to uncover the regularities buried behind a jungle of irregularities, of claims and counterclaims, while bringing together and organizing the scattered field of *l'Héredité*. He then proposed to show how those regularities (patterns of occurrence of traits through the generations) could be neatly accounted for by the coordinated interaction of two opposing principles: heredity and inneity (*innéité*: the source of variation). The inference towards the actual existence of these forces completes the movement. The reification of heredity and inneity is then justified by the naturalness with which the evidence falls under their spell. But the truth is that Lucas proceeded the other way round, accepting the reality of both forces, and from there he rationalized and organized the facts he had collected.

All in all, Lucas performed an outstanding task of fact gathering. There was practically no important source of evidence about hereditary transmission, of whatever age or reliability, which he did not consult and quote. In fact, in the last quarter of the 19th century and for the early years of the 20th century, he was remembered as the man who sorted out the evidence and put beyond reasonable doubt the importance of heredity in the investigation of the human condition. Most recent writers have largely ignored the theoretical scheme around which he organized his factual display. However, I believe this scheme was crucial to both the enterprise and the strength of the evidence he collected.

On the whole, historians have disdained the theoretical aspect of Lucas' work, which has begun to receive some attention only recently.[66] His work exerted an important influence beyond its immediate French milieu (where it played a strong role in wide-ranging works by Jacques-Joseph Moreau de Tours, Benedict August Morel, Théodule Ribot, Gabriel Tarde, Emile Zola), to play a role in the works of Herbert Spencer, Charles Darwin, George Henry Lewes, and Francis Galton in England, and of the Swiss botanist Alphonse de Candolle.[67] His grandiose scheme attempting to root the forces of heredity and inneity in the springs of life themselves (creation and innovation) was not in tune with the developments in the biological sciences of the latter part of the 19th century. This anachronism and his exhaustive use of the "case by case" method of induction, so popular in older medical hereditarian literature but under suspicion in his age, condemned his analytical skills to a very short-lived success. Only the first generation of his readers could appreciate the sense of order he brought to the field of heredity. Of no less importance, from a sociological perspective, is his lucid analysis of the deep links between the attention received by human biological heredity in his age and the worries and aspirations of his contemporaries.

A medical man and an alienist himself, Lucas had no doubts about the reality of the "force" of heredity.[68] He was also keenly aware of the actuality and relevance of its effects for the social and political discussions of the post-revolutionary 19th century. The forces of conservation and of change that struggled for political dominance were projections of the deeper biological principles he was trying to reveal. As a conservative himself, he felt that the preservation of the essential fabric of society was to be attained by the healthy conservation of its elements: the national and familial (genealogical) groups, and within them the individual. Hereditary transmissions of power, of property, and even of crafts were seen by him as "naturally" justified by the dominion physiological heredity exerted over a whole range of hierarchical characters that constituted the individual. Like the early 19th century French agriculturist Girou de Buzareingues (1773–1856), Lucas believes "there is nothing in the animal that cannot be transmitted through generation."[69] But Lucas takes the pain to back this statement with examples of all the kinds of

[66] Churchill, 1987; and Balan, 1989, have analyzed Lucas' work on heredity. The former in a limited way, as he chooses only to see the aspects of Lucas that are directly relevant to Darwin's pangenesis theory. The latter's piece makes an anachronistic complaint against Lucas for not having foreseen that the positive science of genetics was just round the corner.

[67] For the situation of hereditarian ideas in Britain in mid 19th century see Waller, 2000a; Hilts, 1967; López-Beltrán, 1992.

[68] Biographical data on Lucas can be found in *Grand Dictionnaire Universel du XIXe* siècle, X, 1er partie, p. 760.

[69] Buzareingues, 1828, p. 67, quoted by Lucas, 1847, Vol. 1, p. 605.

characters he accommodates along two axes: the hierarchical axis of taxonomical and genealogical groupings, and the dualist axis that divides the physical from the mental.

All the way from the basic organization that made an individual belong to the human species to the most indifferent and accidental of individual characters, heredity, he tried to show, had some bearing. In other words, a child would always have a greater possibility of resembling any one of his parents (or ancestors) in any given character, peculiar or not, physical or mental, than he would of resembling someone else, due to the action of this force.

Lucas had to confront the problem that plagued any claim to lawfulness in hereditary transmission: widespread irregularity and inconsistency. For any case (however striking) of recurrence of a given character within a genealogical line, an indefinite number of failures could be pointed to. This was particularly true of nonessential, individual variations. To face this Lucas took what was perhaps his boldest step, the coinage of the term "innéité" to refer to a force that was to be paired with "hérédité" to produce the empirical data of character occurrence.[70] *Innéité* was conceived as a way to tame the spontaneity and unpredictability of variation, especially of congenital variation (i.e., of deviations from the type capable of being inherited because they had been incorporated to the individual's intimate constitution; the one he acquired at his first formation). Lucas relates this force to the capacity for innovation shown by the order of nature; Frederick Churchill would associate it with a directional, adaptive force.[71] But Lucas only stresses the capacity for producing change (be it good or bad) at sub-specific levels. *Innéité* is the tendency to modify the parents' original (individual) type, which serves as model for the offspring. For Karl Friedrich Burdach (1776–1847), who was the inspiration behind Lucas' concept of inneity, such tendency for variation is due to a search for a realization of the multiple modes of existence that a given type possesses in potency.[72]

A way to describe Lucas' model of how heredity and inneity work is to focus on the moment of the acquisition of organization (or the "first formation") of the individual, which Lucas regards as the moment when a multi-layered compromise between many influences is established. Resemblances are promoted by heredity, dissimilarities by inneity. The hierarchical relations among the characters allow for an independent bargaining process at each level. Each character, within each level, can be influenced by heredity

[70] In this, as in other matters, Lucas followed the work of German physiologist Burdach, 1837.

[71] Churchill, 1987

[72] Burdach, 1837, Vol. II, p. 245. This is an idea that can be traced back to Kant's essays on Race.

or by inneity. If heredity prevails, the options of resemblance are open: the mother or the father have the strongest potential influence (resemblances can be complete or partial), but behind them are the possible resemblances to more distant ancestors, whose influence survives in latent form (as atavistic recurrences). If inneity wins, the character adopts a non-modeled state. At the species level only heredity is active and inneity cannot affect specific characters, so the transformation of a species into another one is blocked.

A further complexity to Lucas' model has to be mentioned at this point. The process of opposing influences I have described (what Lucas would call the *rapports*) does not take place between the parents' or ancestors' actual characters and the organization of the new being, but between what Lucas calls the *types* and the new being. For reasons that will be clear later, Lucas makes an ontological separation between (hierarchical) types and their actual embodiment in the new individual. The types are the real bearers of the hereditary force, and they strive to make the elements of the new organism resemble (or embody) their structure and qualities. The species' type, in Lucas' view, only determines, dictatorially, the general aspects of organization, leaving different ranges of possible variation in the inferior types, that go down to the individual type, which is a particularization of all the subtypes it is embedded in. As Jean Borie accurately pointed out,[73] the postulation of the existence of an individual type seems a paradoxical statement, as type implies a collective, a series of possible instantiations of the abstracted, and that clashes with individuality. But it is not a gratuitous element in Lucas' scheme. As it is the individual type which, by the genealogical connection,[74] is the origin of the familial type, and through it of the national, racial, or any other collective type that one can discern under the level of species. It is only the species and the individual that have a definite status. The other subtypes are derivative. It is the conflict between the individual and the species that produces the new organism. Each parent's individual type represents the interests of all its ancestors and these interests can be related by the degree of resemblance to wider and wider genealogical groups: the family type, the national type, the racial type. They all had stakes in each and every conception. The more distant the mating partners, the stronger the clash. Crossings between species, as they involve an unbreachable boundary, are therefore doomed to infertility. Heredity, to summarize, is the procedure by which the

[73] Borie, 1986.

[74] Genealogy, however, was not the only source of resemblance for Lucas. As Prichard and many others, Lucas believed that a similar external (climatic, for instance) stimuli could trigger parallel variations in the same or different species. Thus the white fur of artic animals, or the geographical variations in transplanted plants.

past generations influence the present ones. Although the species' type is strictly non historical, the individual type, by freezing the explorations of inneity, incorporates a historical dimension. Inneity, in this scheme, pushes the individual's constitutions to explore the possibilities within the type's range. Heredity tends to re-produce the results of such explorations.

The separation between types and actual constitutions serves the purpose of allowing a multi-layered causation. The continuity of a group's characters is ensured by each individual instantiation. It allows the space for a direct causal link (rapport) between an individual's original makeup and that of its offspring, leaving aside the vagaries of its actual life story; this option steers clear of an obstacle previous authors (like James C. Prichard) faced when they could not find a way to separate the individual's initial ("congenital") constitution's contribution to its offspring's hereditary makeup from that of its actual adult constitution. Lucas's analysis gives latency of transmission, dispositional causation, atavistic recurrences, homochrony, and all other earmarks of heredity a deeper, more fundamental meaning. The gap between hereditary disposition and actual occurrence was the same as the one between the type's causal input and its actual embodiment. If we wanted to use an anachronistic analogy, we could say that Lucas' division between specific type and individual type (with all its intermediaries) is an idealistic ancestor of the modern distinction between a species' genomic structure and an individual's genotype. Each instantiation would be a phenotype in modern terms and a constitution in Lucas's term. The analogy is quite fragile, but the complexities of the schemes are similar.

The outcome of such elaborate theorizing was that Lucas' s empiricist pretensions contradicted this heavy reliance on idealist and rationalist strategies. Just like the existence of heredity and inneity as forces, Lucas claimed that the individual type was an inductively arrived at concept, forced upon him by the evidence, its paradoxical flavor notwithstanding.

To deal with the problem of mental or moral inheritance Lucas again made use of some of the physiologists' current dichotomies, dividing the constitution or organization of organisms into two components: the plastic (or material) and the dynamic. Heredity and inneity acted upon both components in a similar fashion. The plastic referred to all the properties of the constitution that derived from the matter and material structure. The dynamic, although always rooted in the material (i.e., could not exist without it) consisted of the "emergent," vital properties, among them the set of all the mental qualities and dispositions.

Lucas opposed the vitalist approach of the Montpellerian school (mainly of Jacques Lordat (1773–1870)), and firmly defended the inheritance of all mental dispositions, with the possible exception of "genius," which he

believed was always a product of (spontaneous) inneity. However, with his grand notions of *hérédité* and *innéité*, as with his forces and types, Lucas fell into the nominalist trap, and all his rhetorical claims to a purely empiricist base proved to be quite untenable.

Lucas's deployment of evidence remains nevertheless memorable. Within his highly rationalistic, branching scheme, he inscribed himself within the medical tradition of proving causal links by carefully selecting cases, usually of striking improbability; the effect, resting on a rhetorically well-constructed narrative, was convincing. Most of his readers were strongly impressed and he converted many skeptics to the cause of heredity. The pervasive nature of spontaneous, original variation was also sufficiently well presented to impress readers like Darwin and Spencer.[75]

The structure of Lucas's two-volume treatise is a reflection of his very complex, multi-layered approach to the individual's constitution and to the forces that impinge on it. He arrived at that scheme after carefully assimilating both the long medical tradition of dealing with hereditary transmission and the more recent attempts by physiologists, ethnologists and naturalists to incorporate those findings into wider hypotheses. But the field was riddled with contradictions and inconsistencies, as the many skeptics, within and outside the medical community, had repeatedly pointed out. That Lucas meticulously followed a rationalistic scheme, argued his way through (or around) all the objections, and found abundant evidential support for all his claims has been perceived as signs of his stubbornness and infatuation with his own fanciful ideas.[76] It is better understood, I believe, as an admirable synthetic effort that showed the existence of a valid, unique domain of biological phenomena in need of a general theoretical and experimental effort of comprehension and understanding.

Hereditarianism as a medical, psychiatric, cultural and social movement in 19th century France was strongly influenced by Lucas, and his complicated analysis and effective rhetoric contributed to its long life. The fact that he failed to convince many biologists or physiologists with his outmoded causal explanations should not be cause for denying his work the central role it played. In many other ways, Lucas's book determined the profile that the idea of (biological) heredity was to have in France for the next forty years after the book's publication. For example, his categorization of the main pathways of hereditary transmission (indirect, atavistic, and "d'influence") was employed repeatedly and by late 19th century authors were defined by

[75] Darwin annotated profusely his copy of Lucas' *Traité* . . . several notes touch the reality, and independence of variation. See for this Di Gregorio, 1990, p. 514.

[76] Balan, 1989.

it.[77] The following generations of researchers in heredity read Lucas' work attentively and profited both from his array of evidential support and the subtlety with which he analyzed hereditary causation. The groundwork for the acceptance of a general biological law responsible for the transmission of characters through the generations achieved complete expression in his work.

Conclusions

One cannot understand the rise of heredity to prominence in Europe around the middle of the 19th century if one does not take a closer look at what happened within the medical community in France during the first decades of that century. Heredity began its life as a metaphor that captured the observation of marginal, quasi-accidental transmission of peculiar features (mainly pathological) from parents to offspring; through a complex process that I have sketched above, it eventually acquired a central role in explaining homogeneity between taxonomical and genealogical groups. Such a move set the scene for our modern opposition between heredity and variation, and its future integration under the same explanatory scheme. Through the work of Prosper Lucas and other authors, the long tradition of human heredity was linked to other related pursuits in the second half of the 19th century and contributed to the flourishing of the posterior kind of hereditary theorizing with which most histories of genetics begin.

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[77] See Littré, 1853, Vol. 42; Delage, 1903, made a review of all the heredity theories of the late 19th century, the divisions established by Lucas still seemed to him the most useful.

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