# THE APPREHENSION OF DISORDER:

# SCIENCE AND THE NATURALIZATION OF MONSTROSITY IN ENGLAND, 1775 - 1830

By

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ABSTRACT

This essay is about the history of teratology, the name given during the 1830's to that scientific discipline concerned exclusively with the study of physical malformations. Until recently, most writers interested in this subject have themselves been practicing scientists, committed to positivist views of science and its history. As such, they have tended to represent the history of teratology as a continuous and objective progression of knowledge, from error to truth. I would argue that such interpretations, mainly because they fail to contextualize past thinking about monstrous phenomena, perpetuate a false impression of the history of teratology. This essay offers an alternative interpretation of that history, one which seeks to restore the relation between the history of science and the history of ideas.

A basic premise of this paper is that the appearance of teratology in the nineteenth century is not best characterized as a continuation of eighteenth-century scientific thought and practice. On the contrary, between 1775 and 1830 the study of monstrosity was fundamentally transformed. Not only were the theories and the language of monstrosity revised, but the people who studied monsters during that period became increasingly conscious of themselves as professional scientists, differentiated from the world of popular understanding by specialized knowledge and expertise.

At a deeper level, these changes may be understood as part of a more general reformulation of biological knowledge which occurred toward the end of the eighteenth century. Until around

the 1750's, the study of monsters belonged to natural history and was informed by a code of knowledge which gave priority to structure, classification and the external appearance of living things. According to the principles of that order, monsters were "monstrous" precisely because, by virtue of manifest structural irregularities, they appeared to be so. Qualitatively differentiated from Nature's regular species, they were segregated in a special category of natural history and investigated as singular curiosities of nature.

Towards the end of the century, this view of living things began to give way to an historical-organic concept of "life." Absorbed into the larger study of life, investigations of monsters became dominated by the biological principles of "organization" and "development," and the monstrous became equated strictly with the pathological. Henceforth, scientific conceptions of monstrous organisms were radically altered. Among nineteenth-century teratologists, monsters were not irregular freaks of nature, but regular and objective specimens of abnormal development, capable of significantly enhancing scientific knowledge of the norm. According to nineteenth-century thought, such organisms, while they were quantitatively deviant, were by no means qualitatively different from other forms of life. Indeed since malformations were subject to the same invariable laws of physiology and embryology which governed all organisms, there was, in reality, nothing monstrous in monstrosity. It was with this transformation in the essential meaning of monstrosity that the science of teratology became possible.

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PREFACE

> Error is not eliminated by the muffled force of a truth which gradually emerges from the shadows, but by the formation of a new way of 'speaking true.'[1]
>
> -- Michel Foucault

From the early nineteenth century, most scholarship in the history of science has proceeded upon the twin assumptions of objectivity and continuity. Since then, if historical study has tended to authorize any one interpretation, it is the positivist view that science is an objective enterprise, and its history a linear "march" towards truth. In recent years, however, various historians have argued that these claims--and all the correlative themes of progress, scientific detachment and cultural immunity--are deeply fallacious. According to such scholars as Thomas Kuhn, Karl Popper and Michel Foucault, for example, they perpetuate an essentially flawed impression not only of science but also of its history.[2]

Such revisionist scholarship is not universally endorsed by scientists, but it has proved unsettling to traditional styles of historical thought. Indeed, most contemporary historians, while they would differ on particular issues of interpretation, would at least agree that the history of science is something other than this straightforward story of detached objectivity. It is now generally acknowledged that science is an activity deeply embedded in culture, internally linked with the philosophical, religious and social movements of a given period, and like other forms of human endeavor, inherently informed by subjective concerns. Moreover, far from being continuous, it now

seems apparent that its history is characterized instead by considerable discontinuity, by dramatic upheavals which at various times have transformed the very basis for what counts as science. Clearly, the old story of facts and discoveries is being overturned in favor of a more contextualized kind of history, one which seeks to restore the necessary relation between science, ideas and society.

This revised historiography has produced much debate concerning the history of the life sciences in the eighteenth and nineteenth centuries, engendering many questions which were simply not raised in the context of previous historical thinking. Most prominently, Michel Foucault has argued that it is mistaken to speak of biological science before the nineteenth century, for the reason that the concept of "life," as a dynamic biological process, was unavailable to scientists before that time. In contrast to <u>life</u>, Foucault argues, eighteenth-century investigators studied <u>living beings</u>, which were seen as part of a fixed, divinely created order and analyzed according to the epistemological criteria of natural history.[3] However, from around 1775, there was a radical change in knowledge, an "epistemic" break, as Foucault tells us, which permitted investigators to conceptualize function, organization, development, norm and ultimately "life" as objects of a rational study. It was precisely at that time, therefore, that biology appeared as a science, or more specifically, as the science "of life." In the same process, "living beings," the object of eighteenth-century natural history, disappeared.

It was in reading Foucault's work on the history of biology

that I first became interested in the subject of this essay, in the problem of how, in the early nineteenth century, "monstrosity" was transformed into an object of scientific study. Though Foucault treats past investigations of monsters only in passing, it seemed to me that the subject constituted a particularly interesting sub-theme within the larger history of biology. Indeed, I think it is possible to comprehend how monstrosity was "scientized" only in reference to the larger transformation which occurred in biological knowledge towards the end of the eighteenth century. For it was only when scientists defined life as a self-regulating process, dependent upon internal laws of organization, that they were able to explain monstrosity as a purely pathological phenomenon, subject to regular, organic laws and amenable, therefore, to an objective study--a study known since the 1830's as teratology. In the widest sense, then, the following essay may be read as a study in the history of the life sciences. More specifically, it is about the appearance of teratology, the life science concerned exclusively with physical malformation. Necessarily, because one "event" is a corollary of the other, it is also about the disappearance of monstrosity. At bottom, it addresses one fundamental question: what were the conceptual conditions which made teratology possible?

My answer to this problem rests on two very basic propositions. The first of these is that nineteenth-century scientists, when they spoke of the "science" of monstrosity, did not do so because they had finally discovered some truth which had been there all along, but rather, as Foucault argues, because they had formulated a new way of 'speaking true.'[4] Teratologists were

able to "know" monsters only to the extent that they were successful in reducing them to objectively diseased specimens, in reducing them, in Canguilhem's terms, to "a single form of knowledge."[5] Indeed, much of the project of early teratologists--the establishment of an objective disease terminology, the articulation of teratological laws, the reliance upon quantitative concepts--can be understood as an attempt to devise a purely objective way of knowing. However, while teratologists claimed to have made the study of monstrosity into an objective science, they nonetheless spoke of monsters as "anomalous" and "abnormal," terms which, in their essential ambiguity, cannot be reduced to a single meaning. Certainly, if these concepts were objective in the sense that they referred to the statistical incidence of monstrosity, they were at the same time evaluative; they embody the judgement that some organic conditions--for both biological and social reasons--are more desirable than others. Yet, among nineteenth-century scientists, the judgement of abnormality was not seen as a judgement, because it had been elevated to the status of a fact by a science which sought to naturalize both abnormality and normality as quantitative and therefore empirical concepts. In fact, it was because scientists believed that the study of monsters could enhance their factual knowledge of the normal that monstrosity assumed a special importance in nineteenth-century studies of life. In any case, given these considerations, it is clear why the history of teratology is not best understood as a detached progression towards "truth."

Secondly, I think that the work of nineteenth-century teratologists represents not a continuation of eighteenth-century

science, but rather a discontinuity, a fundamentally new way of understanding the phenomenon of physical malformation. Monsters became regularized specimens of pathology; they had not always been seen as such. Between 1775 and 1830, the underlying rules which conditioned thinking about monstrosity changed, and it was this shift, manifested in changing patterns of language, theory and investigation, which ultimately permitted the institution of teratology as a scientific discipline in its own right. By the 1830's, monsters had all but disappeared, eclipsed by deranged organs, pathological specimens and structural malconformations. In this sense, I think it is true to say that monstrosity is a category of eighteenth-and not nineteenth-century thought, for by the nineteenth century, there were viable and non-viable organisms, there was life and disorganization, but nature produced nothing so inexplicable as monsters. According to teratological thinking, since there was nothing in monstrosity that could not be explained by the laws of organization, there was, in reality, nothing "monstrous" in monsters. It was only then, when wonder for the unnatural had yielded to interest in the pathological, that teratology became possible.

NOTES TO THE PREFACE

[1]Michel Foucault, Introduction to On the Normal and the Pathological, by Georges Canguilhem, trans. C. Fawcett (Dordrecht: D. Reidel, 1978), p. xiv.

[2]Thomas Kuhn, The Structure of Scientific Revolutions (Chicago: University of Chicago Press, 1965); Karl Popper, Conjectures and Refutations: The Growth of Scientific Knowledge (New York: Basic Books, 1965); Michel Foucault, The Order of Things, a translation of Les Mots et les choses (New York: Basic Books, 1970). For a comprehensive discussion of the historiography of the history of science, see Aant Elzinga, The Growth of Knowledge (University of Goteburg: Department of Theory of Science, Report 116, November 1979). Other useful historiographical discussions are found in G. Rousseau and R. Porter, eds., The Ferment of Knowledge: Studies in the Historiography of Eighteenth-Century Science (Cambridge: Cambridge University Press, 1980); Karl Figlio, "The Metaphor of Organization: An Historiographical Perspective on the Bio-Medical Sciences of the Early Nineteenth Century," History of Science 14 (1976), pp. 17 - 53; R. Young and M. Teich, eds., Changing Perspectives in History of Science (London: Heinemann, 1973).

[3]Foucault, The Order of Things, p. 160. See also pp. 127-8, where Foucault writes:

> Historians want to write histories of biology in the eighteenth century; but they do not realize that biology did not exist then, and that the pattern of knowledge that has been familiar to us for a hundred and fifty years is not valid for a previous period. And that if biology was unknown, there was a very simple reason for it: that life itself did not exist. All that existed was living beings, which were viewed through a grid of knowledge constituted by natural history.

[4]Foucault, Introduction to On the Normal and the Pathological, p. xiv. For similar approaches to the history of the life sciences, see Georges Canguilhem, On the Normal and the Pathological; Karl Figlio, "The Metaphor of Organization;" Stephen Cross, "John Hunter, the Animal Oeconomy, and Late Eighteenth-Century Physiological Discourse," Studies in History of Biology, ed. W. Coleman and C. Limoges, 5 (Baltimore: Johns Hopkins University Press, 1981), pp. 1 - 110; Francois Jacob, The Logic of Life: A History of Heredity (New York: Vintage Books, 1976). None of these authors have written specifically or in any length about monstrosity, but each has been influential in determining my approach to the history of science, and by extension to the history of teratology as well. All challenge the positivist assertion that the history of science is about the discovery of truth. Foucault, for example, in the introductory comments to Canguilhem's study, writes that the history of biology is "not a history of the true, of its slow epiphany; it would not be able to claim that it recounts the progressive dis-

covery of a truth 'inscribed forever in things or in the intellect,' except to imagine that contemporary knowledge finally possesses it so completely and definitively that it can start from it to measure the past"(p. xiv).

[5]Canguilhem, On the Normal and the Pathological, p. 7.

## INTRODUCTION

> --All moveables of wonder from all parts,
> Are here--Albinos, painted Indians, Dwarfs,
> The Horse of Knowledge, and the learned Pig,
> The Stone-eater, the Man that swallows fire,
> Giants, Ventriloquists, the Invisible Girl,
> The Bust that speaks, and moves its goggling eyes,
> The Wax-work, Clock-work, all the marvellous craft
> Of Modern Merlins, wild Beasts, Puppet-shows,
> All out-o'-the-way, far-fetch'd, perverted things,
> All freaks of nature, all Promethean thoughts
> Of Man; his dulness, madness and their feats,
> All jumbled up together to make up
> This Parliament of Monsters. Tents and Booths
> Meanwhile, as if the whole were one vast Mill,
> Are vomiting, receiving, on all sides,
> Men, Women, three years' Children, Babes in arms.
>
> -- William Wordsworth,
> on Bartholomew Fair, 1802[1]

From the sixteenth century, whether they appealed as divine omens, natural wonders, scientific curiosities or side-show oddities, monsters provoked a considerable amount of interest and speculation. Surveying the substantial body of writing on the subject between 1550 and 1750, one is immediately struck by the tremendous diversity in thinking about monstrosity, by the wide range in response and explanation. There are descriptions of "God's judgement shewn upon Children" (1580),[2] of his "Handy-worke" (1615),[3] his "works of wonder" (1635),[4] and of his "displeasure against Sin" (1748).[5] There are cases of demonic intervention, wayward maternal imagination, unnatural connections between men and beasts, and mechanical interferences with the foetus.[6] In some monstrous productions, Nature has reportedly "sported herself" (1740),[7] and other times she has "erred."[8] One reads alternatively of astonishment, surprise and fear, of

beings which were prodigious, odd or singular, of monsters "terrible to behold" (1670),[9] of those which "amused" (1740),[10] and of the most common curiosities, "the like of which were never hitherto observed" (1740).[11]

Though overwhelmingly varied, there is nevertheless one sense in which all early accounts of monstrosity are similar. All are dominated by the view that monsters, whatever else they may be, are "monstrous," that is, extraordinary, singular and irregular. According to the popular consensus, monsters were wonders of the highest order, for they illustrated the infinite capacity of divine, demonic or imaginative forces to intervene at will in the ordinary course of Nature. From the seventeenth century, if the more scientifically-inclined rejected such explicit supernatural speculations, they nevertheless continued to understand monsters as wondrous irregularities, though with the important proviso that these were irregularities of nature. Still, monsters appealed primarily as curiosities, as beings which, by virtue of manifest structural irregularities, were qualitatively differentiated from the "regular" productions of God or Nature. Arising from the erratic play of chance, accident, error and sport, or original productions of God, they were ultimately inexplicable and decidedly wonderful. Clearly for Wordsworth, monsters still placed prominently in this wonder category, along with a staggering panorama of other out-o'-the-way things. Sideshow exotica, prodigy of nature, Godly wrath; fear, awe and curiosity--well into the eighteenth century, "monster" continued to embody these themes. And, above all, monster signified irregularity.

It was precisely on this point that late eighteenth- and early nineteenth-century scientists broke with previous patterns of thought, and if such traditional images continued to inform the popular understanding, by the 1770's, they had become anathema to the more scientifically-minded. Concerned to discredit the view of monsters as irregularities, many scientific writers subjected the whole range of past theorizing to the most scathing criticism. According to the learned establishment, "such opinions . . . could have been entertained only in an age of gross superstition and credulity."[12] So argued John North, a nineteenth-century doctor who, in his "Lecture on Monstrosities" (1840), dismissed the hypotheses of sixteenth- and seventeenth-century writers as "whimsical" and "absurd:"

> Upon this part of the subject [the efficient causes of monstrosity] writers of the 16th and 17th century gave full play to their imagination, and accumulated many whimsical and absurd hypotheses. Monsters being, in their belief, entirely out of the pale of the general plan and ordinary rules of nature, they were compelled to have recourse to the influence of wonderful causes. Hence those extraordinary births which were attributed to the adulterous connexion between men and beasts, from which deplorable and absurd prejudices some paid the price of their liberty, and others of their lives. Hence also the supposed intervention of the Deity, who was thought to create monsters for the purpose of astonishing or terrifying man; or of demons, the origin of evil, placed almost universally after the Deity, by the singular consent of the gross superstition of the people, most of the ecclesiastics, and even the philosophers of various sects.[13]

It was in a similar manner, too, that Dr. W. Cooper berated the notion of 'photographic' maternal imagination, a theory proposed by numerous eighteenth-century investigators to account for monstrous births. According to Cooper (1775), it was a "very weak supposition, entirely void of foundation, directly contrary to

all philosophy and experience," with "nothing to support it but vulgar opinion, transmitted to us from the ages of anatomical ignorance."[14] Whatever differences of interpretation may have divided them, nineteenth-century scientists were in unanimous accord in scorning such traditional "opinions" as products of credulity, ignorance, or "the darkness of the middle ages."[15] Such opinion, based on appearances which masked a truer reality, could no longer constitute real knowledge.

Between 1750 and 1850, scientists expended considerable energy in an attempt to wrest malformation from its "vulgar," "superstitious," and "unscientific" associations, to empty it of all that was illusory and metaphorical, in short, to transform monstrosity into a "purified" concept of science. In fact, the entire study of monsters changed dramatically during that period, and these changes may be comprehended in three very apparent trends. Firstly, from the early nineteenth century, scientific research into monstrosity drew on a fundamentally new set of theoretical assumptions. The most explicit of these was that malformations were cases of pathology, arising from abnormal (i.e. quantitative) deviations in the otherwise normal processes of life. By the 1820's, the embryological researches of scientists such as J.F. Meckel, Etienne Serres and Isidore Geoffroy Saint-Hilaire had authenticated the epigenetic interpretation of foetal development. Henceforth, malformations were understood in strictly biological terms, as cases of arrest or excess in embryological development. Or, as John North explains:

> . . . the greater number of monsters are beings whose growth has been arrested, and in whom the organs of the embryo have been retained until birth, and are

> associated with the foetal organs. This arrest of development is very instructive as to those cases of monstrosity in which there is a deficiency of organs . . . other phenomena arise from excess of development, in which the organs are larger or more numerous than usual.[16]

Almost all cases of monstrosity could be explained and classified according to this new principle of arrest and excess. For example:

> Individuals are occasionally seen, the whole surface of whose bodies, instead of being covered with skin, is covered with scales . . . Such persons have been called porcupine families. This condition constitutes a species of disease, of which there are several varieties, termed ichthyosis.[17]

Such "anomalies," the author explains, arise from an "induration of parts which are naturally soft," and are "attributable to an excess of development."[18] Eventually this theory entirely supplanted older conceptions of monstrosity. It contained assumptions--notably that malformations were subject to internal physiological laws--which, in North's words, were "fatal" to certain "old doctrines."[19]

Secondly, while rationalist theories were working to dislodge past beliefs about malformation, a new language, infused with specialized vocabulary and a precise medical terminology, tended at the same time to displace past ways of talking about monsters. Embedded in a new conceptual frame, monsters were no longer described as prodigies, singularities and wonders, but designated instead in objective terms of anomaly, disease, malformation, embryological arrest and physiological disorder. Since they were understood as disease entities, monsters were specified accordingly, as cases of diplogenesis, cyclopia, ichthyosis, etc., and their malformations classified as phocmeles, trichiasis, exom-

phalos, etc. Clearly, this was a language available only to those with expert medical knowledge. In comparison, old patterns of speech, deemed overly subjective and metaphorical, came to signify an ignorant and vulgar mode of understanding and hence, were rendered "off limits" in scientific discussions. Dislodged in favor of a more scientifically circumscribed set of words and realities, the old language of wonder, and all of the images that went with it, disappeared from the scientific discourse on monstrosity. Similarly, as for expressive responses of fear, wonder or unrestrained curiosity, they simply ceased to be learned options.

Finally, after 1750, investigators of monstrosity became increasingly specialized and professionalized, with the result that scientific thinking about malformation was more and more detached from the broad base of popular understanding. During the 1830's, the scientific study of monsters was given a name--teratology--and was thereby designated as a specialized branch of knowledge, a professional discipline in its own right.[20] By the 1850's, teratology had become an institution: doctors could enumerate the "fundamental laws of teratology," could evaluate past researches as more or less worthy "contributions" to teratological knowledge, and could list the "great names" in teratological research.[21] Unlike the loosely affiliated amateurs of the eighteenth century, who had investigated monsters as one of a wide range of other topics in natural history, those engaged in teratological research were conscious of themselves as belonging to a coherent community of professionals, with a specialized interest, expert knowledge, a precise language and shared

attitudes, not only about abnormality, but also about how it ought to be studied. By the late eighteenth century, conceptions of monstrosity were clearly differentiated along lines of what was scientific and what was not. By the early 1800's, there were two disparate modes of describing, representing and understanding physical malformation, one which was "expert," and one which was "popular," a word which by then functioned as an expletive, signifying all that was misinformed.[22] It was around this same time, too, that teratology became regarded as an activity which had a past, present and future, as a collective endeavor with its own discernible history.

With these changes in theory, language and scientific practice, monstrosity was finally wrenched from its former niche in the conceptual geography of wonders and irregularities, and resituated in a new context, as a concept of teratology. What came to dominate nineteenth-century thinking was the view that monstrosity was a highly regular phenomenon, subject to systematic laws of embryology and physiology. In fact, the entire project of teratologists can be seen as an attempt to regularize irregularity, for, according to Breschet, "nothing is monstrous in nature,"[23] and to Serres, "the order is in the disorder."[24] For Isidore Geoffroy Saint-Hilaire, monstrosity was "no longer a blind disorder, but another order, equally regular, equally subject to laws,"[25] and equally given to "constant and precise rules."[26] Similarly, in his essay on the fundamental laws of teratology, Dr. A.M. Adam explained that "modern investigations in teratology and recent advances in embryology, have clearly shown that malformations are neither the blunders and failures

of nature, nor yet lusus naturae, her eccentric and inexplicable freaks."[27] For although "various species present many distinct generic characters and great structural diversities, the unity of organic formation which has presided over their development gives rise to many very striking and unexpected analogies."[28] "All organic processes," moreover, "are liable to mutation and disturbance, and all development is subject to mysterious deviations and abnormality," so that even in nature's malformation, "the greatest regularity is observable."[30] For John North, likewise, monstrosity was "not a disorder arising from the blind freaks of nature," but was "governed by constant and precise laws," and "capable of being submitted to a regular and scientific classification."[31] Summarizing various known "anomalous" conditions, North was emphatic in pointing out that the malformations in question were by no means "rare" or "uncommon," but frequently encountered in organisms throughout the animal kingdom.[32] And finally, in an emblematic passage, Adam could argue that the word monster itself was obsolete and therefore ought to be entirely "abolished" from "medical literature" as "indefinite, confusing and unscientific."[33] Once an extraordinary phenomenon, for experts such as these, who were informed by new assumptions about science, nature and life, monstrosity had become above all an objectified matter of scientific interest, a matter of the greatest regularity, and in this sense, no longer "monstrosity" at all.

How, then, is one to characterize this transformation in the study of monsters? Was it a matter of the truth finally emerging after a century of cumulative research and investigation? This,

in any case, is how early nineteenth-century scientists seem to have understood the history of teratology. Isidore Geoffroy Saint-Hilaire, for example, proposed that the history of teratology be divided into three periods: the fabulous (sixteenth and seventeenth centuries), the positive (1700-1750), and the scientific (1750-1832).[34] According to this view, the science of monstrosity remained "arrested" in "infancy" for centuries, hampered by "ridiculous and bizarre explanations," and by the "absurd prejudices" which dominated the superstitious age.[35] Only at the beginning of the eighteenth century was the "importance of observation" appreciated, and many facts, gathered with "care and exactitude," accumulated.[36] Finally, after a "rapid progress towards truth," this "march" culminated in the scientific age, when a true science of monstrosity appeared.[37] Writing about the study of monstrosity a few years later, John North offered a similar version of its history:

> I proceed to give you in the present lecture a brief . . . sketch of the information that we have derived on the subject of monstrosities, within the last few years, from the labours of the French and German writers, especially Meckel, Soemmering, Breschet, Serres, and above all, Geoffroy St. Hilaire. The researches of these distinguished writers have filled up a great blank in medical science. Before their time almost every example of monstrous formation was attributed, not merely by the public, but also by the profession, to a whimsical deviation of Nature from her accustomed laws. Such continued to be the prevailing doctrine until the beginning of the 18th century, when better-founded and more philosophic views began to be established, and were gradually carried to their present comparative state of perfection.[38]

Most subsequent commentary that is available about the history of teratology has been written by scientists, who have included short "sketches" of past researches in teratology in their

otherwise strictly medical works.[39] These "textbook" histories have tended to remain faithful to North's vision of science--an objective, steadily advancing enterprise. Consequently, like North, they have represented the history of teratology as an "inexorable" march to truth. In such narratives, the nineteenth century appears predictably as the golden age of teratological understanding, in contrast to less enlightened eras, which were apparently rife with superstitious credulity, darkness and ridiculous beliefs. Gould and Pyle, for example, in Anomalies and Curiosities of Medicine (1896), explain that "there has been little improvement in the mode of explanation of monstrous births until the present century, while in the middle ages, the superstitions were more ludicrous and observations more ignorant than before the time of Galen."[40]

To account for the origins of teratology, such accounts typically search the past for evidence of teratological theories "in embryo." The history of teratology then reads as though it were a continuous, linear tradition, in which "scientists," from Aristotle to Mendel, participated in a discovery by discovery accumulation of knowledge to bring teratological understanding to its present state. Josef Warkany, a contemporary teratologist, for example, claims that teratology is "a science that can be traced to the earliest times of human history,"[41] a task which he takes up in various articles on the history of teratology. He speaks of the "teratological knowledge of people living in a Stone Age civilization,"[42] and regards Babylonian priests as the "founders of the science of teratology."[43] He describes the teratological knowledge of the Greeks and Romans, claiming that

Aristotle "had a surprising knowledge of teratological facts."[44] He traces the "decline of teratology" in the middle ages and its revival in the seventeenth century.[45] Finally, he arrives at the nineteenth century, which towers as a "peak in the area of teratology."[46]

In obvious ways, narratives such as this misrepresent the concerns of past observers of monstrosity. They assume that past works can be interpreted according to modern concerns and a modern "world view." As Jacques Roger says of the writers of this type of history:

> . . . they were mainly interested in the development of their science, from the past as they studied as historians, to the present that they knew as scientists. That development was of course directed toward the present and so was its history . . . According to that perspective 18th century science was modern science in the cradle and this made it possible to apply modern criteria or modern categories to scientists for whom they did not exist.[47]

The most direct way to question the limitations of such approaches is to consider, as Foucault has done in the case of biology, whether there was, before the nineteenth century, such a discipline or such an activity as "teratology." The word itself was coined by Geoffroy Saint-Hilaire in the 1830's and became increasingly frequent in English usage after that, but it does not appear at all in scientific works on monsters before the nineteenth century. Men who investigated monsters in the eighteenth century did not conceive themselves as "contributors" to a particular discipline, but rather, worked in a scientific landscape in which the distribution of subjects was very different from that of the nineteenth century. Their concerns, moreover, were quite different. In 1741, for example, the Royal Society

published a paper by Daniel deSuperville, in which monsters were discussed within a more general essay on generation. For de-Superville, a major concern was that of squaring what he observed in monsters with what he believed about God. Refusing to believe that God would have created embryos "imperfect," he insisted that monsters could only be caused by mechanical interferences after conception.[48] Certainly, deSuperville did not see the scientific map divided as it was later to be, into specialized disciplines where the embryologist studied "reproduction and development," and the teratologist "anomaly." Rather, he conceived the study of monstrosity according to completely different criteria (God and generation), and, writing in a pre-teratological world, brought a significantly different set of questions and answers to bear on the problem of monsters. Further, when eighteenth-century investigators discussed the problem of monstrosity, it was in a language quite dissimilar from that employed by teratologists. In 1741, after having encountered a case of a foetus born without a brain, William Gregory sent a report of the phenomenon to the Royal Society, describing the foetus as a "monster, resembling a hooded monkey."[49] A hundred years later, such foetuses were designated in strikingly more objective terms, as cases of anencephaly, a designation which suggests an altogether different kind of understanding. Clearly, then, eighteenth-century investigators did not speak as teratologists, and did not define themselves as such, for the reason that nineteenth-century ideas about monstrosity were not a part of their conceptual universe.

Except for the fact that it is directed specifically at the history of teratology, there is nothing new in the preceding

critique. For many recent historians of science, the golden age version of nineteenth-century science has been striking discordantly, as something of a myth. Stephen Gould, though he believes that a "factual reality exists" and that "scientists can learn about it," suggests that science is best understood as a socially embedded activity.[50] A science does not begin "in the nothingness of ignorance," he argues, moving toward truth "by gathering more and more information, constructing theories as facts accumulate." Rather, "sciences work with elaborated contexts for explaining facts from the outset," and often it is extra-scientific considerations which determine how, or even if, a particular problem will be conceptualized.[51] Foucault, too, would argue that science is by no means a culturally detached activity. In his view, it is deeply limited, in fact constituted, by the specific code of knowledge which governs all intellectual activity at a given time. Since all that can be said in any period is limited by this code, scientists, like other intellectuals, can formulate questions and answers only in this most restricted and historically conditioned way. Similarly, Georges Canguilhem, in his study of nineteenth-century investigations into normal and pathological conditions, argues that abnormality is not properly regarded as a fact, but rather as a historically situated judgement. Following from this, he attempts to characterize the epistemological conditions which made it possible for nineteenth-century scientists to conceptualize abnormality in the way they did.

Given this climate of scholarship, it is evident why historical sketches of teratology, like that offered by North, Geoffroy Saint-Hilaire and numerous twentieth century writers, no

longer "resonate." If most historians would now offer a different history of teratology, it is largely because our views of science have changed since the nineteenth century. When we ask (and unlike North, we do ask), "can science make claims to truth?" we can no longer answer unequivocally. In any case, examined this way, the history of how monsters came to be a topic of interest for expert scientists, along with being an episode in the history of science, is also necessarily an episode in the history of ideas and culture.

Between 1750 and 1850, radical change occurred in the study of monsters, and as we have seen, by the 1830's, monsters had become the object of study for theorists of a newly designated scientific discipline. Investigators articulated an altogether new set of teratological laws and theories, they spoke of malformation in an objective and highly medicalized idiom, and they saw themselves as a community of professionals, distinguished from the vulgar by expert modes of speech and understanding. However, it is possible to comprehend the appearance of teratology only if one considers that it was symptomatic of a deeper reorientation in thinking about nature, deviation and the study of living things, a reorientation which gave rise to an entirely new conceptualization of monsters. How otherwise can one explain, for example, that nineteenth-century scientists spoke of malformation as a highly regular, if abnormal, phenomenon, while eighteenth-century authors described monsters as surprising, odd and irregular?

I would argue that early eighteenth-century investigations of monstrosity proceeded upon the tacit belief that monsters were

essentially different from those living things which were regular. They were different kinds of beings. Such a belief was possible because until around 1750 the study of monstrosity belonged to natural history, and was informed by its content, its methods and its encyclopedic representation of Nature as a divinely created order of fixed species, differentiated one from the other by manifest structural similarities and differences. According to the principles of this order, monsters were "monstrous" precisely because by virtue of visible (i.e. structural) irregularities, they appeared to be so.

In contrast, nineteenth-century investigations belonged to a fundamentally different conceptual order, one which made "life" --and not fixed species--the primary object of study, and one which defined malformation accordingly, not as monstrosity, but as biological abnormality. Increasingly after 1750, scientists came to understand external structure as an expression of internal functions and to interest themselves in comprehending these invisible processes of life. By the early 1800's, with what Foucault has characterized as the Cuvier transformation, living beings had become "organisms," dynamic systems governed by an internal plan and by internal laws of organization.

As Geoffroy Saint-Hilaire suggested, it was upon the "great sciences of organisation" that the science of monstrosity was built.[52] Studies in comparative anatomy and physiology suggested that abnormalities occurred regularly throughout the living world, that all organisms were susceptible to malformations and that these accorded with the same invariable rules which underlay all animal life.[53] Similarly, studies in embryology made it

possible to understand malformation in terms of organic history, to explain the principles of abnormality as quantitative deviations in an otherwise normal developmental plan. The whole notion of monsters as freakish deviations in a fixed, divine order was gradually eroded as life became seen as a dynamic and self-regulating process, a process which comprehended both the normal and the pathological within itself.

Informed by such assumptions, it was no longer possible for nineteenth-century scientists to regard monsters as qualitatively different beings. On the contrary, according to the prevailing nineteenth-century view, monsters, qualitatively speaking, were precisely the same as normally formed beings.[54] If monsters appeared to be different, this was only illusory, for despite structural variation, there were deep physiological uniformities in all life. According to George Fisher, a noted nineteenth-century teratologist, " . . . all the structural deviations from the normal type which are called malformations . . . from the slightest to the greatest, constitute a continued series, the difference . . . consisting in the simple matter of quantity and not a difference in kind."[55] Thus, while early eighteenth-century researches into monstrosity were organized upon the principles of structure, of the visible and qualitative difference, teratology was conditioned by a new set of conceptual rules: by organization, development and quantitative deviance. Similarly, if eighteenth-century investigators had posed a dichotomy between regular and irregular productions of nature, nineteenth-century teratologists posed a new dichotomy: all life processes were regular, but insofar as quantitative variation occurred, some

organisms were healthy and some were pathological, some normal and others abnormal.

The nineteenth-century view of life as a regular and self-regulating principle enabled scientists to speak of norms and abnormalities as objective (i.e. biological) facts of life. If physiological norms existed, science could only know them through an investigation into pathological forms, which deviated, in some measurable way, from the norm. Monsters provided just such pathological cases for study. In much the same way as the insane were investigated to elucidate the meaning of sanity, so monsters were studied as a means of comprehending normal life processes. Viewed in the most objective manner, the physically malformed were reduced to biologically diseased specimens, identical to healthy organisms save for quantitative variations.

However, to the extent that they were medicalized in this way, monsters ceased to be monstrous, for above all abnormality was seen as a highly regular and objectively explicable phenomenon. Indeed, by the 1830's, various scientists expressed dissatisfaction with the term, "monster." It was widely felt, with Dr. A. M. Adam, that "monsters" should be described objectively, termed "generically malformations, and individualized under their own proper teratological designations."[56] For Geoffroy Saint-Hilaire, there was only one kind of organism which constituted a monster, and this, not because the organism was irregular or "different," but because it was so quantitatively deviant as to be incompatible with life. At one time a morally charged phenomenon, resulting from the judgements of God, monstrosity became, for Saint-Hilaire and his contemporaries, an objective

matter of arrested organs and impaired functions, in which value had no place. The fact that the designation, "abnormal," constituted an essentially subjective evaluation was henceforth obscured, by a science which claimed to deal only in objective knowledge.

Finally, with these changes in scientific thinking, the rupture between learned and popular conceptions of monstrosity was assured. Scientists could no longer tolerate the popular view of malformed individuals as deviations from the "course of nature," nor could they experience them as intoxicating spectacles of irregularity. According to the scientific point of view, monsters were simply biological deviations and specimens, therefore, of the most objective kind of interest. Refusing common sense impressions in favor of scientific knowledge, teratologists approached monstrosity not in terms of how it appeared to the eye, but in terms of how it was to be comprehended by the mind. Thus, while monsters continued to appeal on the fairgrounds as extraordinary beings, and phenomena of some wonder, they had all but disappeared from the scientific vocabulary, eclipsed by anencephaly, diplogenesis and other disease entities. At bottom, this essay is an attempt to characterize such conceptual changes, and to elucidate this process of "scientization."

In researching this problem, I have drawn on accounts of various investigators who, between 1650 and 1850, interested themselves in the question of monstrosity.[57] At first, many of these accounts were incomprehensible because they embodied forms of language and thought which were quite foreign. In one sense,

therefore, my central problem has been to acquire a foreign language and to discover the internal consistencies of a foreign way of thought. In approaching this problem, I assumed two things: first, that various utterances were informed by particular theoretical positions which were current in scientific thinking about monstrosity and secondly, that these theories belonged in a specific epistemological framework, which governed the kinds of questions asked and the kinds of explanations given. In short, to understand these writings, I have tried to reimagine their theoretical contexts and to determine what kinds of philosophical and epistemological configurations could have supported the diversity of theorizing and thinking about monsters.

As for organization, I have arranged this essay into three chapters. Chapter one considers the study of monstrosity during the period extending roughly from 1650 to 1750, and attempts to show how thinking about monsters was constrained by the epistemological code of natural history and by the central concept of structure. Chapter two is concerned with how scientists during the latter part of the eighteenth century approached the study of monsters, and discusses the transitions which occurred as investigations into monstrosity became dominated by the principle of animal function. Finally, chapter three is about the appearance of teratology in the nineteenth century. It attempts to demonstrate how the science of anomalies was ordered by contemporary concepts of life, organization and development.

Few contemporary historians have addressed the problem of monstrosity.[58] Whether this is, as a recent article suggests, because the subject has seemed "trivial" or "tasteless," or

whether the question simply did not occur in previous historical contexts, the fact remains that the subject has received little serious historical attention.[59] Recently, however, the whole question of pathological behaviors and structures in man has been provoking considerable interest, and there are now several studies, like those of Foucault or Canguilhem, which attempt to explain past thinking about disease, madness, criminality and other pathological phenomena. These works have shown why the problem of abnormality is necessarily an historical problem, for, as Canguilhem says, "a congenital clubfoot, a sexual inversion, a diabetic, a schizophrenic pose innumerable questions" which, in the end, refer to the past, or to "the whole of anatomical, embryological, physiological and psychological research."[60] What such studies suggested to me was that the work of scientists who investigated monstrosity between 1750 and 1850 might provide a concrete case in how a condition of being "different" came to be conceived as "deviant" and understood by scientists, according to their own objective criteria, as "abnormal." Like studies in the history of madness or disease, it seemed that the history of scientific thinking about monstrosity might clarify past conceptions of nature, life and abnormality. At the same time, it seemed that the topic might throw light on many of the more basic questions in the history of scientific thought: how is scientific knowledge generated?, what is the historical relationship between scientific and popular knowledge?, how ought the history of science to be characterized?, is science about the truth?, etc. If the subject of monstrosity has been overlooked in other historical climates, then, it appears to me now in high relief, as an obvious

correlate of problems such as these.

Finally, this study arose from more than just an abstract, academic concern. As Canguilhem suggests, it is in the present that problems provoke reflection, and it is certainly in an attempt to "see" the present that I have tried to see the past. I believe that it is mistaken to think of abnormality as an absolute, to endow it with the status and the authority of a fact. It is not a fact, but a concept in which two forms of knowledge--the subjective and the objective--have been mixed from the outset. If nineteenth-century scientists thought otherwise, it was because they equated the abnormal with the pathological and sought to reduce such phenomena as disease and monstrosity to a matter only of organs and functions. The normal and the abnormal, it was assumed, were organic conditions which could be quantitatively defined and which were therefore authentic facts of science, from which all value had been eliminated. However, implicit in the dichotomy posed between the normal and the abnormal was an ideal of perfection and the judgement that some conditions of life are more perfect than others. Certainly one may argue that this is so, but there is no purely empirical data to support such claims. Still, we live in a world from which the physically malformed have, for the most part, been removed to institutions. Modern science continues to designate these as objective cases of abnormality. Some now see such "specimens" as genetic mistakes which, with scientific intervention, can be erased. These, I think, are concrete and disquieting problems, and they refer to the whole question of how we are to understand abnormality. If abnormality is a problem for science then, it must also be a historical problem. Historical

study permits us to see how past thinking on the subject has been constrained; it suggests to us that modern thought is equally constrained. In short, it provides us with the means, and I think the only available means, of rendering our own thinking about abnormality open to critical reflection.

NOTES TO THE INTRODUCTION

The abbreviation PTRS is used throughout to refer to the Philosophical Transactions of the Royal Society.

[1]William Wordsworth, The Prelude, ed. E. Selincourt (London: Oxford University Press, 1960), vii, p. 124.

[2]Cornelius Pet, "An example of Gods judgement shewn upon two Children," English Book Series, 1475-1640 (Ann Arbor: University Microfilms), Reel 379, 1580.

[3]G. Purslow, "God's Handy-worke in Wonders miraculously shewn upon two women lately delivered of two Monsters, with a most strange and terrible Earth-quake," English Book Series, 1475-1640 (Ann Arbor: University Microfilms), Reel 1067, 1615.

[4]A. Griffith, "A true and certaine relation of a strange birth borne at Stonehouse," English Book Series, 1475-1640 (Ann Arbor: University Microfilms), Reel 1164, 1635.

[5]"Of a Monstrous Birth," The Gentleman's Magazine 18 (December 1748), p. 535.

[6]see for example Ambroise Paré, On Monsters and Marvels (1573), trans. Janis Pallister (Chicago: University of Chicago Press, 1982), p. 4.

[7]Robert Corke, "A Letter from the Right Revd Father in God R. Bishop of Corke, to the Right Hon[ble] John Earl of Egmont, FRS concerning an Extraordinary skeleton," PTRS 41 (1740), p. 812.

[8]see for example Francis Bacon, The Advancement of Learning in The Advancement of Learning and New Atlantis, ed. Arthur Johnston (Oxford: Clarendon Press, 1974), p. 68.

[9]Jacomo Grandi, "Concerning some Anatomical Observations, and two odd Births," PTRS 5 (1670), p. 1189.

[10]Corke, Concerning an Extraordinary skeleton," p. 810.

[11]Joseph deTorres, "An Extraordinary Case of the Heart of a Child turned upside down," PTRS 41 (1740), p. 776.

[12]John North, "A Lecture on Monstrosities," The Lancet 1 (1840), p. 857.

[13]Ibid., p. 918.

[14]W. Cooper, "An Account of an extraordinary acephalous Birth in a Letter to William Hunter," PTRS 65 (1775), p. 319.

[15]North, "On Monstrosities," p. 918.

[16]Ibid., p. 857.

[17]Ibid., p. 913.

[18]Ibid.

[19]Ibid., p. 859.

[20]The word "teratology" was first used in reference to the science of anomalies by Isidore Geoffroy Saint-Hilaire, in Histoire Générale et Particuliére des Anomalies de L'Organisation chez L'Homme et Les Animaux, ou Traité de Tératologie, 3 vols. (Paris: J. Bailliere, 1832-36).

[21]see for example Allen Thomson, "Remarks Upon the Early Condition and Probable Origin of Double Monsters," The London and Edinburgh Monthly Journal of Medical Science iv (June 1844), pp. 479-90; v (July 1844), pp. 567-84; A.M. Adam, "Contributions to Teratology," The London and Edinburgh Monthly Journal of Medical Science xviii (March 1854), pp. 241-49; xix (May 1854), pp. 399-405; George Fisher, "Diploteratology: An Essay in Compound Human Monsters, Comprising the History, Literature, Classification, Description and Embryology of Double and Triple Formation," Transactions of the New York State Medical Society (1865), pp. 232-68; (1866), pp. 207-60.

[22]For this use of the word popular, see Chapter 3, page 159f.

[23]quoted in Adam, "Contributions to Teratology," p. 247.

[24]Ibid., p. 248.

[25]I. Geoffroy Saint-Hilaire, Traité de Tératologie, I, p. 18.

[26]Ibid., p. 21.

[27]Adam, "Contributions to Teratology," p. 399.

[28]Ibid., p. 247.

[29]Ibid.

[30]Ibid., p. 399.

[31]North, "On Monstrosities," pp. 858-59.

[32]In his lecture, North continually refers to the fact that certain malformations recur regularly. For example, he writes:

> . . . Again, we not uncommonly find, as a specimen of monstrosity in the human subject, a cloaca . . . Monstrosity from a fissure in the lips. . . is by no means uncommon. . . We often meet in the human subject with a bifurcation of the glans penis . . . Imperforation of the vulva is not infrequent.

North was apparently concerned to erode the curiosity appeal of monsters.

[33]Adam, "Contributions to Teratology," p. 242.

[34]for Geoffroy Saint-Hilaire's full discussion of the history of teratology, see his Traité de Tératologie, I, pp. 1-27.

[35]Ibid., p. 4.

[36]Ibid., p. 7.

[37]Ibid., p. 8.

[38]North, "On Monstrosities," p. 857.

[39]There are a number of scientific works which include surveys of the history of teratology. From the nineteenth century, see Geoffroy Saint-Hilaire's Traité de Tératologie and George Fisher's "Diploteratology." Historical discussions are also provided in G. Gould and W. Pyle, Anomalies and Curiosities of Medicine (New York: Sydenham Press, 1896); J. W. Ballantyne, "The Teratological Records of Chaldea," Teratologia 1 (1894), pp. 127-43, "Antenatal Pathology in the Hippocratic Writings," Teratologia 2 (1895), pp. 275-87, "Teratogenesis: An Inquiry into the Causes of Monstrosities," Edinburgh Medical Journal XLI (1896), pp. 593-603. From the twentieth century, see Ilva Veith, "Congenital Anomalies in Historical Perspective," Modern Medicine (1963), pp. 253-68; T. Persaud, "Congenital Malformations," West Indian Medical Journal 19 (1970), pp. 240-6; T. Persaud, ed., Problems of Birth Defects, from Hippocrates to Thalidomide (Baltimore: University Park Press, 1977); M. Barrow, "A Brief History of Teratology to the Early Twentieth Century," Teratology 4 (1971), pp. 119-30; M. Lipton, "The History and Superstitions of Birth Defects," Jnl of American Pharm Assoc 2 (1971), pp. 395-99; Joseph Warkany, Congenital Malformations (Chicago: Year Book Medical Press, 1971); Joseph Warkany, "Congenital Malformations Through the Ages," in Drugs and Fetal Development, ed. M. Klingberg (New York: Plenum Press, 1972), pp. 17-30; Joseph Warkany, "Congenital Malformations in the Past," in Problems of Birth Defects, ed. T. Persaud (Baltimore: University Park Press, 1977).

[40]Gould and Pyle, "Anomalies," p. 161.

[41]Warkany, "Congenital Malformations in the Past," p. 5.

[42]Ibid.

[43]Ibid., p. 7.

[44]Ibid., p. 14.

[45]Ibid., p. 15.

[46]Ibid.

[47]Jacques Roger, "The Living World," in The Ferment of Knowledge, ed. G. Rousseau and R. Porter (Cambridge: Cambridge University Press, 1980), p. 256.

[48]Daniel deSuperville, "Some Reflections on Generation and On Monsters, With a Description of some particular monsters," PTRS 34 (1741), pp. 294-307.

[49]William Gregory, "An Account of a Monstrous Foetus, resembling a hooded Monkey," PTRS 32 (1741), p. 764.

[50]Stephen Gould, The Mismeasure of Man (New York: W.W. Norton, 1981), p. 22.

[51]Ibid., p. 321.

[52]Geoffroy Saint-Hilaire, Traité de Tératologie, I, p. 3.

[53]Ibid.

[54]see Canguilhem, On the Normal and the Pathological, Chapter 1.

[55]George Fisher, "Does Maternal Mental Influence Have any Constructive or Destructive Power in the Production of Malformations?" American Journal of Insanity (1870), p. 275.

[56]Adam, "Conbtributions to Teratology," pp. 246-7.

[57]For the most part, I have confined my research to English sources, except in cases where it was clear that English investigators were themselves relying heavily on French authors.

[58]I have found no contemporary historical studies which make the scientization of monsters in late eighteenth-century England their primary focus. However, there are some works which provide interesting and helpful discussions of various aspects of the problem of monstrosity in history. In La Nature et Les Prodiges (Geneva: Librairie Droz, 1977), Jean Céard provides an analysis of the "dialectic" between the Aristotelian tradition and the divination tradition in philosophical speculations of monstrosity through the sixteenth century. Katharine Park and Lorraine Daston in "Unnatural Conceptions: The Study of Monsters in Sixteenth- and Seventeenth-Century France and England," Past and Present 92 (August 1981), pp. 20-54, trace the evolution in attitudes towards monsters until the end of the seventeenth century. In The Shows of London (Cambridge: Harvard University Press, 1978), Richard Altick includes a few chapters on popular attitudes to "freaks" in the eighteenth and nineteenth centuries. Leslie Fieldler's Freaks: Myths and Images of the Secret Self (New York: Simon and Schuster, 1978) comments on the mythological import of freaks in modern culture. For interesting discussions of the problem of monsters in the history of the life sciences, see Georges Canguilhem, On the Normal and the Pathological and La Connaissance de la Vie (Paris: Librairie Philosophiques J. Urin, 1965); Francois Jacob, The Logic of Life; Michel Foucault, The Order of Things. There are

some brief but useful treatments of the teratological writings of particular scientists as well. See Stephen Cross, "John Hunter. . . and Late Eighteenth-Century Physiological Discourse;" Shirley Roe, Matter, Life and Generation (Cambridge: Cambridge University Press, 1981); Stephen Gould, Ontogeny and Phylogeny (Cambridge: Harvard University Press, 1977).

[59]Park and Daston, "Unnatural Conceptions," p. 22.

[60]Canguilhem, On the Normal and the Pathological, p. 7.

CHAPTER ONE

# NATURAL WONDERS AND NATURAL HISTORY: THE STUDY OF MONSTERS IN THE LATE 17TH AND EARLY 18TH CENTURIES

## Part One: Traditional Views of Monstrosity

> Monsters are things that appear outside the course of Nature (and are usually signs of some forthcoming misfortune), such as a child who is born with one arm, another who will have two heads, and additional members over and above the ordinary.
>
> -- Ambroise Paré, 1573[1]

If monstrosity was a topic of great interest among natural historians of the late seventeenth and early eighteenth centuries, these investigators were by no means the first to interest themselves in monstrous phenomena. On the contrary, there had been perennial interest in monsters since very ancient times when Babylonian diviners made extensive inquiries into what various anomalous births might signify. If such births were "read" correctly, they could, it was thought, deliver valuable forecasts of future events. Thus, according to Babylonian records, if an infant were born without ears, there would be mourning in the country; a monster with no fingers signified that the town would have no births; an infant born with the ears of a lion indicated that a powerful king would reign, and so forth.[2] Since that time, all kinds of explanations of monstrosity had been advanced, each based on specific assumptions concerning the nature of reality and each generated in the context of other prevailing beliefs. Throughout the sixteenth and seventeenth centuries, monstrosity continued to excite interest of the most diverse kind, and by the 1650's,

there existed an extensive and varied literature on the subject. To comprehend the investigations of monstrosity which were undertaken between 1650 and 1750, it is helpful first to have some general idea of the kinds of thinking which characterized these earlier periods. Indeed, it is only when the work of later seventeenth-century investigators is viewed retrospectively that the problems which concerned them and the novelty of their approach becomes evident.

From classical times, though specific interpretations were conditioned by their own particular historical contexts, thinking about monsters had been oriented in three main directions. Firstly, in the context of various speculations about divination, monsters were understood primarily as signs. Perhaps the most outstanding classical proponent of this view was Cicero, who included monsters as one of a number of prodigies and portents by which the gods addressed themselves to man, to give warning of future events or impending menace.[3] A major Christian exponent of this notion was Isidore of Seville, who, in his Etymologiae, explained that "portents are also called "signs," "monstrosities," and "prodigies" because they seem to portend and to point out, to demonstrate, and to predict future happenings."[4] Since monsters almost always died at birth, reasoned Isidore, God could not possibly have intended them for any other purpose than to provide mankind with warnings. Derived from the Latin word, "to show," or "to warn," "monster" still embodies residual elements of this line of thinking, whereby monstrous births were to be read as omens of divine purpose.

Secondly, an altogether different accounting of monstrosity was proposed by Aristotle. Though he retained the vocabulary of divination in designating animals that "don't conform to the usual productions of nature" as monsters, he nevertheless divested the term of its supernatural connotations and sought to ground monstrosity firmly in the natural world.[5] Since Nature submits to Necessity, nothing, in his view, was actually contrary to Nature's plan. Monsters therefore were neither terrifying nor shocking; nor were they signs, but rather, facts of nature, necessary, as he explained, "by accident."[6] Just as a grammarian is capable of erring in the production of speech, so nature occasionally failed, due to a deaf resistance of matter, in its striving toward perfect form. As for the teleological implications of monstrous births, Aristotle provided no explicit commentary and restricted his efforts instead to an attempt at classification and an explication of naturalistic, efficient causes.

Finally, according to the canon of the wonder tradition, monsters were not so much specific omens as they were general illustrations of natural or divine power, miraculous events which attested, as in Pliny,[7] to the ingenuity of Nature, or later, as in Augustine,[8] to the power and wisdom of God. For adherents of this view, monsters appealed for the most part as all-humbling wonders, as marvels deserving of man's abiding awe.

During the sixteenth and seventeenth centuries, these three lines of interpretation, or some combination of them, continued to inform both learned and popular conceptions of monstrosity. From the early sixteenth century, discussions of monstrous

births appeared in various kinds of contexts, from pamphlets and tracts intended for religious instruction, to popular ballads, broadsheets and wonderbooks, which were catalogues of strange events and curious lore compiled primarily for entertaining reading. Most prominently, monstrous births figured in theological discussions, where they served a wide variety of rhetorical purposes. In 1523, for example, Luther and Melanchthon jointly published a pamphlet interpreting the appearance of a strange, ass-like monster found floating in the Tiber River to be a message from God, symbolizing ecclesiastical corruption and indicating the doom of the papacy. This pamphlet, translated into French, Dutch and English, was enormously influential as Park and Daston point out in establishing monsters "firmly in the centre of both Catholic and Protestant religious polemic."[9]

In other cases, Christian authors made monsters the object of religious instruction, arguing that they were tokens of divine displeasure over man's iniquity. As such, monsters were hailed as a general warning to all sinners. In 1580, for example, the birth of two monstrous children was proclaimed as "an example of God's Judgement shewn upon two children," clearly intended as divine admonishments. As the author says:

> Dearly beloved brethern like as daily we see the wondrous works of God, to advertise us to the amendment of our sinful, wicked and detestable lives, before he doth plague us, like as always he is good and merciful and doth not punish us according to our defects, but sending us first signes and tokes to admonish us of his ire which we so rightly deserve for our so little regarding and esteeming of his most holy word and gospel. But we daily neglecting and not regarding the same: He therefore hath not only sent hideous Monsters and fearful signes, unto those where they were borne and seen, but also unto us.[10]

Following this, the author proceeded to describe two monsters, one a double monster, half black and half white and the other a monster which did "most wonderfully speak" for three days, advising man to "amend" his ways.

Similarly, a tract published in 1613, providing "Strange news of a prodigious monster," warns that monsters are sent to "signify to us the ugliness of Sin in the Eyes of God:"

> Man at first losing of his Innocence, lost also his place, and contracted a heavy curse both to himselfe, and to his posteritie. The Earth it selfe innocent of his crime was accurst for his sake, for whom it was created and brought forth thorns, briars and stinking weeds, where before it was full of pleasure . . . and so had continued if man had continued in his first creation: Now the earth brought forth monsters and ugly shapes, strange and full of terror. The heavens themselves changed the frame of their beauty, putting forth firey meteors, blazing comets and other prodigious sights, breeding wonder and amazement.[11]

"Sin and wickedness," the author continues, "causeth the earth to bring forth prodigious monsters, so far from the fare frame of Nature, that they make Nature herself afraid to look upon them."

Though the prevailing message in such religious works was God's ire, there were some variations on this theme. According to a pamphlet written in 1635, presenting a "true and certaine relation of a strange birth," monsters are not so much illustrations of God's displeasure, but demonstrations of his great power and mercy.[12] God, it was suggested, makes monsters for our instruction ("as the word of God, so the Works of God are for our Doctrine and Instruction"). Monsters are "works of wonder" which evidence God's mercy and remind us of his presence ("He hath made his wonderful works to be remembered"). God usually creates perfect beings, but man, in his ingratitude, takes such perfection

for granted. God is then moved to change the "course of things" and brings forth monsters to demonstrate all that he is potentially capable of. These productions, reasons the author, serve to illustrate that the usual perfect state of things is due directly to God's mercy, and worthy, therefore, of human gratitude.

After 1650, speculations about monstrosity became increasingly naturalistic and secularized, but the notion of monsters as signs of divine will endured in the popular imagination. As late as 1748, one could read in The Gentleman's Magazine of a "surprising" monstrous child, which according to the author was "a remarkable display of divine almighty power and undoubtedly visible proof of God's displeasure against Sin," for "contrary to the established laws of nature, He sometimes permits lusus naturae to exist among the human species," harmony and beauty being the usual "beauty of all his works."[13] (The parent of this monster, the author noted, had been "remarkably vile.")

If much of the interest in monstrosity during the sixteenth and seventeenth centuries was religious in nature, monsters also aroused curiosity of a more secular kind. From the early 1500's, there are references to monsters being exhibited for profit, as curious spectacles of natural wonder. By 1600, such "freaks of nature" were a prominent attraction at fairs and taverns where they could be seen for a fee. In addition, by the later sixteenth century, the subject of monstrosity was a major feature in wonder books. There, monsters appeared amongst a wide assortment of curious marvels and strange phenomena, presented as intrinsically interesting wonders "more to surprise and entertain the reader than to acquaint him with imminent apocalypse or judgement."[14]

Perhaps the most famous monster book of the period was Des Monstres et prodiges, published in 1573 by the French surgeon, Ambroise Paré. In it, Paré provided a complete compendium of the latest information about monsters, drawn from the testimony of a wide range of ancient sources (the Bible, Hippocrates, Aristotle, St. Augustine, etc.) as well as from more current observations and popular reports. Interested in the diverse architecture of nature, Paré presented assorted illustrations of the varied shapes, sizes, structures and resemblances reported to have occurred in monstrous productions, including examples of those "marvellous creatures" arising from supernatural agents alongside those strange configurations produced from more naturalistic factors.

Something of a visual extravaganza, Paré's book proved enormously popular for both French and English audiences. It was still widely known, in fact, in the nineteenth century, though in the hands of nineteenth-century teratologists, it came to serve a purpose far different from that intended by Paré (or "worthy old Ambroise Paré" as one nineteenth-century doctor described him).[15] For teratologists, Des Monstres et prodiges constituted a convenient polemical tool, commonly cited as a telling example of the absurdities which could prevail in a world without the benefit of scientific truth. Discussing the monster book genre in 1865, for example, George Fisher argued that many of the figures in such works were "made from mere descriptions by different writers, who made up their account from popular report and traditions, in which fanciful resemblances to imps, demons and other phantoms of their brains were freely indulged in, and glowingly portrayed." Such stories, Fisher continued,

"having passed through several editions, at last gained credence and were regarded as authentic."[16]

What is most noteworthy about the various sixteenth and seventeenth-century compilations of monsters, like that of Paré, is that they freely incorporated both popular and learned notions of monstrosity. Apparently, no strict division was drawn between the two forms of knowledge. Typically, wonder books portrayed a diverse assortment of the most fabulous sorts of beings (beings which we would automatically deem impossible or purely imaginary) along with other cases of what we would acknowledge as real or possible malformations. For example, in Paré's book, one finds a monster with the form of a dog and the head of a fowl, a man with the hands and feet of an ox, a hybrid monster, half man and half swine, a child with a frog's face, a headless child with eyes on its chest and all other conceivable combinations. In considering the causes of such extraordinary beings, Paré drew heavily on popular thought, and suggested several forces, both natural and supernatural, which operated in the production of monsters:

> The first is the glory of God. The second, his wrath. The third, too great a quantity of seed. The fourth, too little a quantity. The fifth, the imagination [maternal]. The sixth, the narrowness or smallness of the womb. The seventh, the indecent posture of the mother, as when, being pregnant, she has sat too long with her legs crossed, or pressed against her womb. . . The eighth, through a fall, or blows struck against her womb . . . The ninth, through hereditary or accidental illnesses. The tenth, through rotten or corrupt seed. The eleventh, through mixture or mingling of seed [hybridization]. The twelfth, through the artifice of wicked spital beggars [impostures]. The thirteenth, through Demons and Devils.[17]

Paré differentiated between various kinds of monstrosity on the basis of what had caused them, for their "conformations" were seen to correspond directly and often visibly with the particular factor which had caused the irregularity. Thus, if a monster had too many parts, it was ranked with all similarly excessive productions arising from too great a quantity of seed. Too few parts resulted from too little seed; forms which were completely "against nature" (those born with the form of a dog and the head of a fowl, for example) derived obviously from the wrath of God; and behind those mixed productions with parts half man and half beast was the "abominable" factor of hybridization (or "unnatural" coition between two different species).

Clearly, there was no sense in the sixteenth century that monstrous formations were limited by anything remotely like biological law, for almost any combination of parts was possible. Monsters were not seen to conform with any necessary laws of "life," but rather were limited only by the limits of the human imagination. Nor was there any sense that the study of monsters should be restricted to empirical investigations. Any information--including all that had ever been written or told--was seen as a significant part of the monsters' "history," useful in ascertaining the "meaning" of the birth. Indeed, the distinction between real and imaginary monsters was not apparently an important one at all, and this because in a study which was not yet "scientized," writers did not limit their interest to monsters as facts of nature, but, like Paré, considered them also as signs, deriving ultimately from the forces of divine imagination.

Often to explain various monstrous productions, writers re-

sorted each time to the action of God, since according to the prevailing metaphysic, the entire natural world, and all its component parts, was the result of a direct creation, a direct supervention on the part of God. According to Paré, for example, "it is certain that" . . . completely abhorrent configurations "proceed from the judgement of God, who permits fathers and mothers to produce such abominations from the disorder that they make in copulation, like brutish beasts, in which their appetite guides them, without respecting the time, or other laws ordained by God and Nature."[18] Thus, for Paré, nature was the expressed word of God, an immense text of multiple and mutually corresponding marks and signs, which, if correctly deciphered, could deliver knowledge of God's universal design. Given this theocentric universe of signs and analogies, it is apparent why almost any monster was possible, and why the central question to be asked of monstrous births was what they signified. For, in creating monsters, God was clearly saying something.

## Part Two: Studies of Monstrosity from 1650 to 1750

> . . . either Fiction, or want of Observation has made more Monsters than Nature ever produced.
>
> -- John Floyer, 1699[19]

In 1699, Sir John Floyer, a well known English physician, submitted an account of "two Monstrous Pigs" to the Royal Society. In it, he undertook to demonstrate that "Pigs with a Man's Head," "Pigs with Dogs Heads," "a Monster half Man and the lower parts like a Dog," and many of the creatures mentioned by sixteenth-century authors, were simply impossible combinations, incompatible with "new Discoveries" concerning animal generation.[20] For Floyer, as for many of his learned contemporaries, traditional lines of reasoning about monstrosity had lost their force. What was needed, Floyer suggested, was a more reliable study of monsters, based on scientific reasoning, and above all, on careful empirical observations, for as he said, "either Fiction, or want of Observation has made more Monsters than Nature ever produced."

By the 1650's, men of science had begun to challenge the authority of the ancients, of hearsay evidence and of tradition, choosing to rely instead upon the clear light of their own experience. Like Floyer, they suspected the authenticity of popular superstition and of those fabulous reports from the past; so too did they question the appropriateness of teleological speculations in studies of the natural world. For many empirically-minded investigators of the time, the problem of

ascertaining God's will or his purposes was deemed outside the scope of "science." According to Francis Bacon, for example, the scientific study of nature ought not to incorporate speculations about primary causes at all, for these, he argued, could not be definitively known. Instead, investigators were advised to concentrate on penetrating the world of nature itself, insofar as it was given to the senses and accessible to man's limited understanding. As men of science, they were to restrict their efforts to a direct observation of natural phenomena in order to discover the immediate principles which governed them.

Not surprisingly, such suggestions were not universally heeded, and throughout the eighteenth century, reports of monstrous phenomena continued to encompass many supernatural and popular notions. From the 1650's, however, there were a growing number of investigators who sought to make the study of monsters more empirical and to treat those "singular" existences strictly as facts of nature. Indeed, for natural historians between 1650 and 1750, a central concern was to sever the subject of monstrosity from its supernatural foundation, to empty it of its fabulous associations with ancient legend and popular lore. To facilitate this aim, such investigators attempted to limit their studies of monstrous phenomena to three main tasks: accumulating extensive collections of monstrous specimens, compiling accurate accounts of any strange births reported, and describing all cases of monstrosity as exactly as possible, including only such information as was given by observation. Such a project, it was hoped, would result in a truly representational catalogue of all of Nature's monstrosities.

In undertaking this project, investigators were responding to a model of scientific activity endorsed by the Royal Society and inspired by the Baconian program of studying monsters as a distinct topic within natural history, about which information was to be accumulated in a systematic, inductive manner.[21] In his Novum Organum, Bacon had counselled scientists to gather reliable information about monsters, urging that "a compilation, or particular natural history, must be made of all monsters and prodigious births of nature; of everything, in short, which is new, rare, and unusual in nature."[22] In part, Bacon's program was concerned with displacing what he reviled as vulgar curiosity, in favor of more reasoned brands of interest, for as he said, "Neither can any man marvel at the play of puppets, that goeth behind the curtain, and adviseth well of the motion."[23] To this end, he advised that the study of monsters be well-purged of the mass of unfounded belief which had encumbered it since ancient times. We have, as he said:

> A number of books of fabulous experiments and secrets, and frivolous impostures for pleasure and strangeness; but a substantial and severe collection of the heteroclites or irregulars of nature, well examined and described, I find not: specially not with due rejection of fables and popular errors. For as things are now, if an untruth in nature be once on foot, what by reason of the neglect of examination, and countenance of antiquity, and what by reason of the use of the opinion in similitudes and ornaments of speech, it is never called down.[24]

What was required, he argued, was a compilation of dependable accounts, gathered "with a rigorous selection, so as to be worthy of credit."[25] Furthermore:

> Those are most to be suspected which depend upon superstition, as the prodigies of Livy, and those perhaps, but little less, which are found in the works of

> writers on natural magic, or even alchymy, and the like; for such men, as it were, are the very suitors and lovers of fables; but our instances should be derived from some grave and credible history, and faithful narration.[26]

Besides recommending that the study of monsters be emptied of fable and error, Bacon advised a clear division between studies in natural history and those in theology. Investigations of natural causes belonged properly to natural history; researches into the supernatural origins of things were more properly confined to theology. As far as natural historians were concerned, the study of monsters was to be focussed exclusively on naturalistic questions, for "the narrations touching the prodigies and miracles of religions," being "either not true, or not natural," were in Bacon's view "impertinent for the story of nature."[27]

Still, though Bacon called for the incorporation of monsters into the study of natural history, he nevertheless located them in a special category, distinct from the more mainstream researches into nature. Moreover, this segregation was not arbitrary, but one which Bacon understood as corresponding accurately with the reality of things. For nature herself worked in different modes, and well into the eighteenth century, was understood according to a distinct conceptual dichotomy. On the one hand, there were regular phenomena of nature, that is, phenomena resulting from nature proceeding freely, and without "molestation," "in course."[28] These were continuous and capable of being grouped into fixed species. On the other hand, there were curious or irregular productions, which, though not contrary to nature, were, thanks to error, obstruction, or chance, contrary to the usual course of

nature. Because they exhibited apparent structural irregularities, such deviations, whether they occurred amongst animals, vegetables or crystals, were known collectively as monstrosities. In contrast to regular life forms, these were incapable of being classified into species. They not only deviated from the structural mold of their parent species, but they were unable to propagate their own kind in a lineage of identically formed individuals. Arising from the play of random and indeterminate forces--from "digressions and deflexions"--it was a matter of mere chance whether such beings would be sufficiently equipped to survive the given physical world at all. Each monster represented an eccentric and discontinuous production, occurring against the ongoing output of regular creatures, only marginally included in the natural order, as a failed species or a singular individual. (Hence the eighteenth-century designation of monsters as "singularities.") Structurally, visibly and hence qualitatively distinct from all other creatures, such oddities clearly did not belong in the same category with the regular productions of nature and were consequently segregated in a separate category of natural curiosities, where they stayed for a good part of the eighteenth century.

Inspired by Bacon's program for the advancement of learning, and in keeping with his advice about monsters, the Royal Society took up the task of acting as the central repository for monster data. Bacon's call for reliable information about monsters was echoed in many of the early publications of the Royal Society. In 1693, for example, Sir Hans Sloane, in his capacity as Secretary to the Society, issued a routine circular to various

men of science, both in England and abroad, requesting any information of scientific interest. "The Royal Society," he wrote, "are resolved to prosecute vigorously the whole design of their institution and accordingly, they desire you will be pleased to give them an account of what you meet with or hear of that is curious in nature, or in any way tending to the advancement of natural knowledge."[29]

Complying with such requests, learned correspondents from all over Europe endeavoured to inquire into any monstrous phenomena that occurred, in order to furnish the scientific community with an account of the monster, and ideally with a drawing or specimens as well. Thus, by the 1660's, monsters were being described, dissected, drawn and pickled in the interests of natural history. In 1665, for example, Mr. David Thomas wrote to Robert Boyle, offering information gathered "Upon the strictest inquiry," concerning a "Monstrous Calf," a part of which, he continued, he had "begg'd of Dr. Haughten for you."[30] From Italy, Jacomo Grandi, "Publick Anatomist of Venice," wrote to inform the Society that he "met with nothing curious" in his "Anatomical Dissections of the first Year," but in 1669 "lighted upon two odd Births," worthy of the Society's attention.[31] In 1685, the Society received a detailed discourse and diagrams upon "the Dissection of a Monstrous Double Catt," provided by the prominent Irish anatomist, Dr. Allan Mullen, who would have given "an account before this time of the Monstrous Catling that I lately Dissected, but that my busyness would not give me leave to put it in writing till now."[32] From Dublin, George Ash (secretary of the Dublin Society) wrote apologetically in the same year, explaining that "The Account I

here send of the Horny Girl is, much more imperfect than I hoped it would have been, both because its parents or friends, who might give some information of the beginning and occasion of the growing out of these Horns, are not to be found, and that the owner of this Monster would not be perswaded to let us take the figure thereof, which we design'd to present you."[33] In 1696, Dr. Cyprianus submitted an account of a monstrous infant, born with a wound in its breast, occasioned by the "force of Imagination." "Amongst some other Extraordinary Accidents which have offered themselves to me, since my coming home, there is one," he notes, "worth your knowing."[34] Similarly, having encountered a strange production born of a woman under sentence of Transportation, Dr. Timothy Sheldrake reported it to Hans Sloane in 1739, writing, "I Herewith send you both a Draught and Description of a monstrous Birth, which I believe the Royal Society have had as yet no Account of; which gives me Hopes, that what I here send will prove the more acceptable to you."[35] So, too did Reverand Derham, FRS and renowned devotee of natural history (and theology) respond to the Society, giving in 1708 an "Account of some Inundations; Monstrous Births," and "Appearances in the Heavens," all "Observables" which he deemed worthy of the Society's notice.[36] As he explains:

> I Received some time since a Letter from Maghrafelt in the North of Ireland, from a very Intelligent Person there, and great Well-wisher to our Royal Society, one Mr. Neve; who out of his own good Will had collected some of the Lough-Neagh Petrifications, Pieces of the Giants-Causway, and other Curiosities, and sent them, he tells me, as far as Bristol: But hearing the Society had of them already in their Repository, he took no further care of them . . . But there are some other Matters related by him, that I believe will not be unacceptable.[37]

After this introduction, Derham goes on to describe a "prodigious Flood (the like not in the Memory of man)," "some Monstrous births," and one "last Curiosity," a very "strange Light in the North."

Amongst late seventeenth- and early eighteenth-century men of science, monsters appealed very much as curiosities of nature, to be observed and collected as such. Indeed, at first glance, the work of such investigators looks like little more than an encyclopedic project of curiosity collecting. Along with an almost staggering range of other irregular phenomena, such as rare fossil bones, strange rock formations or unusual plant and animal specimens, monsters were gathered, dissected, preserved and displayed in various private collections or museums throughout England. A highly fashionable activity, many gentlemen kept monster collections of their own: M. Bussière, a French correspondent with the Society, after providing an account of a child born without a brain (1698), advised readers that he keeps "the Bones of that Skull in [his] House, where any Body may have a view of it, to satisfy their Curiosity, when they please."[38]

Hans Sloane, too was an enthusiastic collector of natural specimens, both "curious" and otherwise. According to Walpole's description of Sloane's private collection, besides plenty of "foetuses in spirits," there were embryos, cockleshells, hippopotamuses, sharks with one ear and spiders as big as geese."(1753)[39] From all appearances, Sloane's vision of the Royal Society seems to have been that it would become an orderly reservoir for such facts of nature, each fact published, or else classified, labelled and preserved for easy discussion and observation. Describing

the Royal Society repository in 1700, Ned Ward characterized it as a Warehouse of Aegyptian Mummies, Old Musty Skeletons, and other Antiquated Trumpery: magnets, a parcel of Shell-Flies almost as big as Lobsters, an Aviary of Dead Birds, sundry sort of Serpents, Skeletons of Men, Women and Monkeys, Birds, Beasts and Fishes, Abortives put up in Pickle, and abundance of other Memorandums of Mortality.[40]

As for living monsters, they were exhibited in fairs, taverns or private houses, providing gentlemen with the eagerly sought opportunity of inspecting these curiosities in the flesh. Whenever they happened upon monstrous births or live exhibitions, the scientifically minded usually took it upon themselves to write up a descriptive account, to be circulated amongst other devotees of natural history, or, as in the preceding examples, submitted to the Royal Society for publication. Often in such reports, authors included one or two laudatory lines in reference to the novelty or exceptional nature of their particular case, thereby justifying it as a deserving addition to the ever-increasing stock of knowledge about natural history, and legitimizing it as a novel and therefore worthy curiosity. In 1736, for example, Joseph de Torres, a Spanish physician, happened upon an "uncommon Observation," an "extraordinary Case" in which the heart of an infant was turned upside down.[41] De Torres wrote of it to the Society, expressing himself in hopes that the Society would not "be displeased with an Account of a new and surprising Prodigy concerning the Heart, the like of which," he adds, "was never hitherto observed, till I saw it on the 29th of December 1736, in a new-born Female Infant of the Town of Almoyna, and faithfully delineated it." However else

these learned investigators understood monstrosity, monsters were securely located within the conceptual category of "curiosities" and it was as curiosities that they were so rigorously collected.

To modern readers, the eighteenth-century penchant for monsters--and monster collecting--may appear as a rather "unscientific" preoccupation with novelty, especially since accounts commonly include tributes to the monsters' great singularity and references to the surprise and astonishment of curious observers. Certainly to nineteenth-century teratologists, such treatments seemed frivolous, and indicative of a "vulgar" and overly subjective style of thought. Partly this was because, by the nineteenth century, the very category of natural curiosities had disappeared. By then, nature was seen as a monolithic force, operating in only one mode, and incapable of "deviating" from her path to produce a separate class of odd or irregular phenomena. Apparent disorder was understood as part of a deeper, underlying order, and while certain natural functions remained curious, no phenomenon of nature could be construed, by virtue of its visible irregularity, as a "curiosity."

However, the eighteenth-century view of nature and of what constituted a scientific interest in nature, was very different. To speak of curiosities, and to speak of them expressively, was not necessarily unscientific, nor was it by any means "idle" to expend endless energy collecting such specimens. There are three reasons that this was so. Firstly, according to eighteenth-century scientists, order was not <u>in</u> disorder; order was <u>opposed</u> to disorder. In other words, nature, a heterogenous force, <u>did</u> produce

curiosities, and from all appearances, they were strangely discordant with the ordinary course of natural events. This meant that, while engaging in a serious naturalistic study, it was nevertheless quite possible for eighteenth-century investigators to experience monsters as curious spectacles of the most astonishing kind, deserving of awe and surprise. For while monsters were "of nature," they were at the same time "curiosities," visibly differentiated from nature's regular productions.

Secondly, according to the standard procedural tenets of natural history, it was precisely through a collection of such phenomena that scientific knowledge would be advanced. For natural historians of the time, nature was an immense tableau of fixed and continuous species, each living thing preformed originally by God, in keeping with a harmonious plan. One of the primary goals of early eighteenth-century natural history was to bring all of nature, including her irregular and accidental variations, within the scope of man's vision. To know nature, it was necessary to represent the full panorama of her creatures, arranged side by side, according to the plan which was existent in nature. And, to understand the order, it was useful to observe the disorder, for as Bacon said, "he who is acquainted with the paths of nature, will more readily observe her deviations; and vice versâ, he who has learnt her deviations, will be able more accurately to describe her paths."[42]

Collection, of course, was an integral component of this program, not as an end in itself, but as a necessary means for furthering man's understanding of the actual principles and relationships operating in nature. Arguing repeatedly for a step by

step amassing of data, Bacon had regarded such inductive activity as a preliminary means of achieving accurate generalizations about the natural world. As he explained in the "Distributio Operis:"

> In our method axioms are raised up in gradual succession and step by step, so that we do not arrive at the most general statement until the last stage, and these general statements come out, not notional, but well-defined and such as nature may acknowledge to be really well-known to her, and which shall cleave to the very marrow of things.[43]

If part of the vision of Bacon's New Atlantis was, as Philip Ritterbush suggests, "an army of collectors ranging the earth, seeking specimens for the cabinet of a central repository where they could be sorted and arranged," the other part of his vision was that, through such activity, true statements about nature would accrue.[44]

Thirdly, if the eighteenth-century study of monstrosity struck later scientists as "unscientific," this was also because, throughout most of the eighteenth century, the lines between professional and amateur, scientific and popular were relatively obscure. There was, in fact, a continual crossover in investigations of monstrous births between what later professionals would regard as scientific "interest" and popular "curiosity." Traditional themes of hybridization, maternal imagination, and Godly wrath persisted in the popular imagination, and whether such views were endorsed or discredited by more learned investigators, they nevertheless continued to enter into scientific speculations, if only in determining the kinds of questions which were asked. Certainly it is quite clear that the learned founders of the Royal Society undertook the study of monsters for largely scientific reasons--to enhance natural knowledge. Thus, on the one hand, monsters

were to be described according to particular methodological rules and with due gravity, as facts of nature. But at the same time, such oddities enjoyed tremendous appeal, as astonishing curiosities and scientific novelties. Besides the Royal Society collection and private collections like that of Hans Sloane, where admission was usually restricted to medical people, scientists or highly placed laymen, there were a host of exhibitions of human monsters, both living and dead, in the fairs, taverns and streets of London. Such popular exhibits appealed to the learned and the unlearned alike, and well into the nineteenth century, provide a rather striking counterpoint to the concurrent "empirical" examinations of monsters which were taking place in scientific circles. Most of the "freaks" shown publicly in London between 1700 and 1800 were treated in the Philosophical Transactions, and in their search for information, the Society's members moved freely from one milieu to the other, with no apparent sense of incongruity. Investigators expressed no scorn for the popular wonder which monstrous births generated, but regarded "tumultous concourses of gazing people" as a matter of course.[45]

Since the scientific community drew no rigid distinctions between amateur and professional investigators of natural history, the Royal Society accepted all manner of accounts for publication--from the extremely precise and learned anatomical descriptions of Dr. Mullen to the more intuitively sketched descriptions offered by Reverend Derham. Indeed, during the late seventeenth and early eighteenth centuries, a striking variety of people contributed accounts of monstrosity to the Royal Society. Some contributors identified themselves as doctors or physicians or local surgeons;

some were anatomists, others clergymen, and still others were described simply as noble persons, as Intelligent people, or as people of learning and curiosity. One was an ingenious student in physick, one a vicar, one a professor of mathematics, and many described themselves only as fellows of the Royal Society.

A great majority of the people who studied monsters may be described as amateur scientists, people with a commitment to empirical observation and experiment, pursuing a general rather than a professional interest in the study of natural history. They did not have specialized knowledge of monstrosity, nor did they investigate monstrosity exclusively, but rather wrote about it whenever they came across an example of a strange birth in their practice or when news of a monstrous exhibit attracted them to a viewing of the curiosity. There seems to have been no clear demarcation between men of science and men of learning in general, but rather an exchange of information took place amongst a very divergent group of interested and curious amateurs.

What makes it problematic to describe the eighteenth-century interest in monstrosity is that there seems to have been a substantial amount of curiosity seeking on the part of such amateurs. Though purportedly pursuing a scientific interest, many manifested attitudes towards monsters which verged on the more popular displays of curiosity mania. Some investigators, particularly churchmen, had little specialized anatomical knowledge and were primarily concerned with arousing the contemporary appetite for natural (and thereby divine) wonder. Writing in 1738 of a man who was "one intire Bone from the Top of his Head to his Knees," Bishop Robert Corke expounded at length about the astonishing appearance of the

man's skeleton, which among other novel formations, featured bones "like the Spurs of a Cock," and "Ramifications" like "Shoots of white Coral."[46] One of the most "extraordinary things" he "ever saw," the Bishop could not "forbear" letting the scientific community partake with him in "the Amusement," even though providing an account would be "very difficult." For as he explained, It is "many Years since I have seen any thing of Anatomy, and of Consequence have forgotten the Names of the Bones belonging to the various Parts of the human Body." Similarly, when Reverend Edmund Almond wrote to one of the Society's fellows in 1744, he provided little anatomical information about the "Gigantic Boy at Willingham," but proclaimed him of great interest as an extraordinary "Prodigy in Nature," bringing "People far and near to see him."[47] A few months later, the surgeon, Thomas Dawkes, furnished the Society with a more "exact description of the giant, measured with utmost Accuracy." Having engaged "the Attention of the Curious in this Neighbourhood," Dawkes felt that the "prodigy" also demanded the attention of the "Learned."[48] When such investigators proclaimed their suprise or astonishment over monstrous births, they did so intuitively, not as objective specialists confronted by specimens of pathology, but as spectators confronted by what, from all appearances, was extraordinarily different. Such expressive and subjective responses would not become stigmatized as unscientific until the nineteenth century, when professional knowledge required more professional restraint.

Given these considerations--the eighteenth-century view of nature as a heterogenous order, the primary reliance upon collection as a means of studying nature, and the relatively open

exchange between scientific and popular knowledge--the apparent craze for monster collecting among eighteenth-century investigators appears not so unequivocally as later scientists were to dismiss it, as an indiscriminate weakness for novelty. Rather, it was part of what was considered a concerted scientific enterprise, directed toward increasing natural knowledge and fuelled by legitimate scientific curiosity. If the Royal Society published some accounts which did not meet with these higher aims, it was because the distinction between scientific interest, idle curiosity and wonder were somewhat blurred in a scientific community yet to be professionalized.

Among those late seventeenth- and early eighteenth-century investigators who considered themselves men of science, Bacon's program for cleansing the study of monsters of traditional error was for the most part well-heeded. In collecting "credible" data and writing "grave" reports, scientific investigators observed a number of methodological guidelines, aimed at extracting the true facts about monsters from the layers of falsehood which engulfed the subject. Firstly, in describing cases, they concerned themselves with the natural features of the monster in question, depending either upon direct observation of the case or upon the testimony of purportedly reliable witnesses for information. Generally, authors were careful to record the circumstances surrounding monstrous births, noting times, places, witnesses, attendant physicians or surgeons, and supplying faithful narrations of their personal involvement. Further, in an effort to establish the reliability of accounts, they often listed their own credentials or the credentials of witnesses.

M. Gaillard, for example, describing the birth of an infant born with two heads in Toulouse in 1697 writes:

> There was seen there, Twelve Years ago, an Infant who had Two Heads . . . Master Peter, sworn Chyrurgeon, opened it in Presence of Mr. Bayle, Doctor of Physick, and Master of Arts, and Master Carboneau, sworn Chyrurgeon.[49]

As for his own credentials, Gaillard identifies himself as a Doctor of Physick of the Faculty of Toulouse. Similarly, in an account of a monstrous double birth in Lorraine (1722), the author begins in characteristic style, with a reference to his qualifications:

> I the Underwritten, Surgeon in Ordinary to his Royal Highness the Duke of Lorrain, certify, that on the last of December, 1722, I went by his Orders to Domp Remy la Pucelle, to see there Sebastiana Camus, aged 44 Years, delivered on the 24th of the said Month, being Christmas Eve, about eight o'Clock in the Evening, of two Children, or Twins, joined together in the Manner as appears by the Draughts. . . [50]

Manifesting the same concern to prove the authenticity of his account, William Gregory ended his report of a monstrous foetus by averring the "above Case to be strictly true, to the best of my knowledge, as witness my Hand this 30th Day of April, 1733."[51]

In gathering information, investigators frequently weighed the testimony of witnesses for reliability, as did M. Bussiere in 1698 in his investigation into the case of a child born without a brain. "The Midwife," he reported, "said the Child came alive out of the Uterus; but tho' we cannot trust such Report, yet, tis certain, the Mother assureth, that she felt him stirring very often," and the husband, "keeping his Hands fast upon her Belly . . . affirmeth he felt plainly the Child's motions . . . [which is] sufficient to prove, that he was alive in the Belly of his Mother."[52]

Representational descriptions of the monster, first of how it appeared externally and then frequently in dissection were given, and often a drawing, rendered in realistic detail, was appended. If possible, investigators endeavoured to preserve the monster. In 1665, for example, an author describes Robert Boyle's efforts to preserve the head of a monstrous colt. Boyle, he explains:

> went into the Stable . . . and got the Head hastily and rudely cut off . . . Afterwards he caused it to be put into a Vessel, and covered with Spirit of Wine, thereby chiefly intending, to give good example, together with a proof, that by the help of the said spirit. . . the parts of Animals, and even Monsters, may in Summer itself be preserved long enough, to afford Anatomists the opportunities of examining them.[53]

Finally, any references to supernatural causes, fable or unfounded belief was avoided except in cases where the author was concerned to discredit such views. In the introduction to his Mechanical and Critical Inquiry into the Nature of Hermaphrodites (1741), for example, James Parsons clearly expressed his aversion to superstitious "mysteries" in treatments of natural history:

> I do not promise methodological and finished Treatises, but only some short Hints on Natural History, and rude Strokes of Reasoning, yet I have this for my Plea; that the Expulsion of Superstitious Mysteries and Errors, Occult Causes, and in fine, the Promotion of Truth are my sole Intentions.[54]

Most accounts submitted to the Royal Society between 1665 and 1750 followed a similar format, in which the author first presented general commentary concerning the times, dates and circumstances surrounding the birth, and then proceeded to the main point of the exercise, which was to present an anatomical description of the case. Though numerous examples could be cited to illustrate this pattern, William Durston's portrayal of a double monster,

submitted to the Royal Society in 1670, is a typical illustration. After narrating the events of the birth, Durston goes on to present his description, first focussing on the external features of the monster. As he reports:

> This Birth, as you see, had two Heads, and two Necks; as also the Eyes, Mouths and Ears, sutably double. Four Arms with Hands, and as many Leggs and Feet. There was to both but one Trunk; but two Backbones, from the Clavicles to the Hypogastrium, and from the shoulders down to the bottom of the Loins they were not distinct, but cemented and concorporated, after this manner: The right Clavicle or Channel bone of the Right-hand-Child (being long) joyned with the left Clavicle of the Left-hand-Child. The Ribbs on the face side of both of them, by the Cartilages or Gristles were united. . . [55]

Following this, the author provides a sketch of the interior view of the monster. Upon dissection, they found:

> one Navil-vein, and one Liver, but that was very large, with the Bladder of Gall seated in its usual place: but there were two Urinary Bladders, two Wombs, four Kidneys, and one Stomach, with the Oesophagus or Gullet perforate and open from the Mouth of the left head . . .

What is most striking about Durston's account and highly typical of all such late seventeenth-century accounts is that the author did not venture beyond description to offer any theoretical conjectures as to the causes of the monster in question. On the contrary, though the style, length and anatomical precision of descriptions varied, most English authors, like Durston, were content merely to describe what was seen.

This reliance upon description (as opposed to theoretical speculation) may be counted as a characteristic methodological feature of the late seventeenth-and early eighteenth-century study of monstrosity and one which, like the compilation of accounts and the collection of specimens, accorded exactly with the prevailing notion of what a natural history ought to be.

As Jacques Roger says:

> The history of the word history itself would deserve an accurate study. In the 1670's, it often means a plain description of a natural phenomenon. In that sense, and even in physics, a history of nature is opposed to a natural philosophy which is a search for the causes of the phenomenon. According to many scientists of the time, one should first write an ample history of nature before thinking of building a philosophy of it.[56]

According to Michel Foucault, inasmuch as natural history concerned itself with the problems of classification and representation, it was necessarily a project limited largely to the description of living beings. As we have seen, natural historians tended to view nature as an immense order of fixed, divinely created species. From the simplest to the most complex, each species of animal occupied a place in the graduated chain of being, and each was differentiated from the next by manifest structural similarities and differences between them. Natural history sought to "re-present" this visible order, to construct a classificatory scheme which would exactly represent that which God had established in nature. In order that they might be properly sorted and arranged, therefore, all of nature's creatures had first to be described. They had, moreover, to be described in a particular way--in terms, that is, of their external structural characteristics.

It was precisely in this representational manner that natural historians, like Durston, described cases of monstrosity. Monstrous double births, hermaphrodites, monsters with multiple structural deficiencies or imperfections--all of these were portrayed, not as integrated organisms, but as strange structural assemblies, with no reference to any underlying organic method

operating beneath the apparent structural madness. In composing such sketches, authors described each unnatural part simply as it appeared to the eye. How such parts were correlated with others, how they affected the animal as a whole, how the organism compensated for deficiencies--such "organic" questions were not raised, and this because monsters were not understood as organic systems. They were structurally, and not functionally, imperfect productions.

Given this primary reference to "structure" and "appearance" in the study of living things, the eighteenth-century conceptualization of monsters as curious and singular irregularities, as qualitatively differentiated beings, becomes much more comprehensible. For, as long as structure served as the key criterion in differentiating creatures into species, it meant that monsters would be identified as beings of a profoundly different nature from all those living things which were regular. Firstly, because any two individual living things, if they differed in structure, were considered to differ in essential character as well and to belong in two separate species. Secondly, because each monstrosity represented a discontinuous singularity, an individual which resembled no other individual and a being, therefore, which belonged definitively to no one species. Monsters were monstrous precisely because they were structurally, that is visibly, deviant. In being so, they blurred the categorical distinctions between one species and another, challenging apparently fixed boundaries, such as that which separated man from beast.[57]

To the extent that it was incorporated into natural history and subject to such methodological rules, the study of monsters

became much more "natural" than it had been in previous periods, in keeping with Bacon's injunctions against mixing supernatural conjecture with studies of nature. However, though the divisions between theological, philosophical and scientific knowledge were acknowledged among eighteenth-century investigators, the boundaries between these fields of knowledge were not drawn along the same lines as they were to be in the nineteenth century. At the time, all of nature was understood as God's original creation. Studies of the natural world were undertaken in the knowledge that they referred ultimately to God, to demonstrate the glory and wisdom of the master designer of the natural order. For Bacon, a knowledge of natural facts would provide a "rich storehouse for the glory of the Creator,"[58] and similarly, Hans Sloane described his great collection of natural history not only as contributing to the "use and improvement of physic and other arts and sciences, and benefit of mankind," but, most important, as "tending many ways to the manifestation of the Glory of God [and] the confutation of atheism and its consequences."[59] With such clear lines connecting natural theology with natural history, religious considerations entered readily into early eighteenth-century speculations of the natural world and predictably, figured prominently in discussions of monstrosity as well. Some investigators, for example, provided incidental commentary about such issues as whether monsters had "humane souls," whether they had "received baptism," and whether the parents of monstrous infants were of good or bad repute.[60]

Moreover, throughout the eighteenth century, the whole question of the <u>origin</u> of monsters was ultimately inseparable

from theology. Indeed, one of the underlying issues conditioning philosophical speculations into the causes of monstrosity was whether God would or would not have included such apparently marginal creatures in His original plan of creation. According to the theory of preformation, which was the most widely held view of animal generation between 1700 and 1750, all living creatures began as pre-existing embryos, created by God at the beginning of creation. Each embryo was a miniature version of the particular animal it was destined to become, with all the necessary parts of the animal intact and awaiting only animation to stimulate the process of growth.[61] Whether the embryo pre-existed in the female egg or in the male sperm was a contentious issue and one which divided preformationists into two opposed camps. On the one hand, the ovists argued that "the Image, the Type, the Picture of the Embryo," was contained in the "Eggs of the Females."[62] Animalculists, on the other hand, held that the embryo was contained in the male semen, which was a "Liquid full of small Worms," or animalcula, each of which constituted a "true Embryo."[63] The appeal of the animalculist position was that the existence of the animalcula could purportedly be demonstrated through actual observation, for with the aid of a microscope, it was possible for scientists to see the "embryo" in the male semen. Informed by this theory, some claimed to have actually seen tiny monstrous embryos, preformed animalcula with "unnatural" parts, though how much credibility was afforded such claims, is unclear.

For those concerned with the causes of monstrosity, the main question to be decided was whether monsters were original, that

is, preformed by God and thus, part of His original plan, or whether they arose only accidentally, through mechanical injuries inflicted upon an otherwise perfectly formed embryo. By the 1720's, this question had surfaced in the European scientific community in the form of a debate (and often an explicitly theological debate) between "originalists" and "accidentalists."[64] Or, in the words of Daniel deSuperville, whose paper about generation and monstrosity was published by the Royal Society in 1740:

> The Opinions of Most of the Natural Philosophers on this head may, upon the main, be reduced to these two Hypotheses: 1. That Monsters are original, that is to say, that even in Conception the Monster is conceived. 2. That they are not produced but by Accident.[65]

DeSuperville himself entered this debate squarely on the side of the accidentalists, for as he says, "supposing every Animalculum to be an Embryo created, I cannot imagine them to be created imperfect!" Whatever they be, therefore, he believes monsters "rigorously speaking," to be accidental:

> To how many Accidents are they not subject afterwards in the Venter of the Females? A Fall of the Mother, a strong Pressure, a Contusion, etc. may disorder the nice and tender Structure of that little Creature so far, that a great many of its Parts do not unfold themselves any longer, are destroyed, or have their Order and natural Situation intirely changed. . . The disturbed and disordered Imagination of the Females ought also to be ranged among the accidental Causes of Monsters.[66]

In a similar mechanistic fashion does deSuperville account for <u>double</u> monstrosities ("Siamese" twins):

> The Production of all these Monsters that are double, or have superfluous Members, may very well be occasioned by two Animalcula entring into the same Egg; they touch, they close, they unite, they crowd each other: The Parts of the weakest, being too much crowded, cannot extend nor display themselves; so they vanish, as it were, so much the easier as they are extremely tender, and without any sensible Consistency.[67]

James Parsons, too, in his speculations into the nature of hermaphrodites, insists that such monsters can only be explained as accidents or injuries in the womb. God could not possibly have intended them, for the reason that such productions, unable to procreate, are contrary to the survival of the species, and contrary therefore to God's plan of continuity.[68]

Obviously, much besides "science" was entangled in such discussions. At issue were the very basic problems of God's role in the universe and the existence of order in nature. For accidentalists, such as Parsons and deSuperville, it was impossible to conceive that an intelligent God would purposefully create beings that so obviously departed from the harmonious order of regular and continuous species. The logical alternative was to appeal to more mechanistic theories of accidental interference. God, they reasoned, creates all embryos perfect, with all the mechanisms necessary for their survival, and according to a harmonious plan. But in the course of their unfolding, such embryos are susceptible to any number of accidents which act directly upon the parts of the embryo to alter its formation.

For others, such reasoning was full of disquieting implications. At bottom, it meant that the natural order, once set in motion, was no longer subject to God's guidance. Such a scheme, it was felt, left too much to blind chance, thus threatening the existence of an ordered, God-governed universe. To overcome such difficulties, originalists (notably Albrecht von Haller) advanced the argument that monsters were not accidental at all, but that monstrous structures were preformed, just like all others, in the first rudiments of the foetus. According to

originalist logic, monsters were not real inconsistencies in Nature, but only appeared to be so to man, who was incapable of penetrating God's larger design. All through the eighteenth century (until preformation was abandoned in favor of epigenesis), the debate over the origins of monsters--largely theological in nature--was a major preoccupation of those "philosophers" who attempted to square the problem of monstrosity with their notions of God and generation.

Though most English investigators confined themselves to the task of describing whatever monstrosity they happened across, some did engage, in deSuperville's terms, in the business of explaining the underlying principles of monstrosity. A great variety of explanations were advanced. Bacon, for example, spoke only in the most general terms, suggesting that monsters arose from error or chance, from digressions in the ordinary course of nature's production. For others, the principle behind monstrosity was not error, but sport, and it was primarily for her own amusement that nature made monsters. In his description of the "extraordinary skeleton" published in 1738, Robert Corke reports that "in the fleshy Part of his Thighs and Buttocks Nature seems to have sported herself, in sending out various Ramifications of Bones from his Coxendix and Thigh-bones, not unlike the Shoots of white Coral, but infinitely more irregular."[69]

For the most part, English investigators favored accidentalist (as opposed to preformationist) theories of monstrosity. Until the middle of the century, if they speculated about the efficient causes of monstrosity at all (which was rarely), the majority of authors resorted to mechanical factors such as falls, blows,

overcrowding in the womb or maternal imagination. In his account of "Two Monstrous Pigs" (1699), for example, Dr. Floyer designed to prove that "the Distortion of the parts of a Foetus, may occasion it to represent the Figure of different Animals, without any real Coition betwixt the two Species."[70] Refuting the theory of hybridization, Floyer was "convinced" that a monstrous pig which he encountered "was not from the Conjunction of both Kinds; but only occasioned by the pervertion of the compression of the Womb," a phenomenon which he considered "very frequent" in the production of monsters.

Like Floyer, most eighteenth-century investigators rejected the theory of hybridization, considering it impossible for humans to produce offspring of a non-human species. However, the fact that monstrous animals often resembled humans, and vice versa, continued to be a great mystery. In popular thought, hybridization--along with maternal imagination--provided satisfactory explanations for such resemblances; both explanations rested on the evidence of visual analogy. The persistence of these beliefs is well illustrated in the particularly bizarre case of Mary Toft, who, in 1726, gathered great notoriety from her claims that she had given birth to over fifteen rabbit-like offspring. Dubbed "the rabbit breeder," this woman, by introducing parts of rabbits into her vagina and feigning "delivery," had convinced a local surgeon that she was actually giving birth to rabbits.[71] The reason for this unnatural occurrence was, Mrs. Toft claimed, that she had on several occasions seen rabbits running in the field and had "longed" to make a meal of them. When additional medical men were called in to examine the case, the fraud was found out,

not, however, without generating a great deal of excitement in the local population around Godlyman. In her "confession," Mary Toft admitted that she had concocted the scheme in an attempt to make money from curiosity seekers, apparently assured that there would be plenty of interested viewers. Whatever else this episode illustrates, it certainly suggests that the processes of generation were still far from clear in popular culture. Given this lack of understanding, it is not surprising that "common sense" explanations for monstrosity were to persist throughout the eighteenth century.

Though some learned observers considered the belief contrary to reason, the most commonly cited cause of monstrosity in the early eighteenth century--both in popular and learned accounts--was maternal imagination. There were two main variations in this accidentalist theory. Some believed that a mental impression of the mother at the time of conception or during pregnancy influenced the formation of the child by producing a kind of direct "photographic" effect on the offspring. Others suggested that maternal fright, worries, stress or shock could produce malformations in the child in a more non-specific way, so that the exciting factor bore no direct relationship to the nature of the defect. Until the later eighteenth century, it was the first of these views which predominated, and though they did not attempt to explain the exact mechanics of the process, many investigators noted that foetuses acquired characteristics which corresponded directly to a particular sight or event which had impressed the mother.

Writing in 1739, for example, William Gregory explained the birth of a child resembling a hooded monkey as the result of

the mother's encounter with some travelling entertainers:

> Soon after Conception, some Fellows who travel the Country, with a Bear and a Monkey, placed themselves before the Woman's Door, in order to make Diversion for the Populace. The Monkey had a Hood on, which reached to his Shoulders, of which the Woman took prodigious notice; and all the time the Monkey was playing his Tricks, in turning over a Stick, etc. the Woman could not keep her Eyes off from him. Some small time after, the Woman met a Man of a thin, pale, dismal Aspect, upon whom she looked very earnestly, and thought his Face to be. . . like the Monkey's Face. When the Woman was quick with Child, and the Foetus began to move, the Woman felt it turn over and over . . . just as the Monkey turned over the Stick . . . I need not here mention the exact Resemblance of [this] Foetus to a hooded Monkey . . . [72]

Similarly, Daniel deSuperville defended the theory of maternal imagination on the grounds that it was supported by "Hundreds of instances" deriving from observation. As he explains:

> . . . some twenty Years ago, a Cloth-shearer in Holland had the Misfortune to fall into the Hands of some drunken young Fellows, who murdered him, and stabbed him with more than twenty Wounds with their Swords. He was to be married that very Week: His Sweetheart saw his Corpse naked with all those Wounds, and was two Days after delivered of a dead Child, which had the Marks of the Wounds in the same Places of its Body, where the Mother had observed them on her dead Lover.[73]

Anticipating skepticism, deSuperville continues:

> I very well know, that these sorts of Instances, of which one might alledge some Hundreds, will not go down with certain People, who deny the Effects of the Mother's Imagination on the Foetus. . . [However] daily Observations demonstrate to us, that the disordered and disturbed Imagination of Women often hurts the Infants.

Among the other accidental causes of monstrosity, eighteenth-century investigators also cited a wide variety of mechanical pressures or interferences. In explaining a case of double monstrosity, for example, James Parsons offered the following explanation:

> From hence it will be easy to account for the preternatural Adhesion of these two Children . . . and from hence also we shall be able to account for every other Monstrosity that can attend Animals and Vegetables. We have observed before, that each Seed and Ovum contains the Animal and Vegetable proper to its species. Now, when two or more of these animal Ova are fecundated, and come into the Uterus, the Sides of the Ova . . . must inevitably come into Contact; and if the Membranes of each continue in a good State, the Foetus's will be free in their several Apartments, and grow proportionably; but if the Parts of the Membranes, which are close together, by being thin or weak, or by any irregular Resistance, or Friction, come to be dissolved or broken, then the Fluids of both unite, and the two little Organizations, having no longer a Partition between them, come together, adhere, and intwine into each other. . . and at length the Whole becomes irregular and monstrous.[74]

Whatever the particular theory they advanced to explain monstrosity, however, whether they were explained as original debilitations of the embryo, as products of maternal imagination, overcrowding in the womb, falls, contusions, as jokes of nature or chance digressions, eighteenth-century investigators did not think of monstrosity as a phenomenon dependent upon or limited by "organic" laws. In fact, monstrosity was not strictly an organic matter at all, since such structural deviations were seen to occur in both living things and in crystals, and according to the same general principles in both cases. In accounting for the origins of living monsters, it was necessary to resort to forces outside the organism itself--either accidental interferences or providential design.

According to accidentalist theories, to explain a given deviation, one had first to understand the nature of the accidents which caused the injury, for depending upon the kind of interference (an in the case of maternal imagination, upon what the mother had seen), the monster's structure would be affected dif-

ferently. Since an indeterminate variety of accidents could occur, the possible range of structural malformations was virtually endless. This is not to say that eighteenth-century investigators regarded any combination of parts as being possible. With the general rejection of the hybridization theory in favor of preformation, most of the fantastic hybrids of the sixteenth century had been relegated to the realm of the imaginary. It was clearly recognized that monsters could not deviate entirely from the known processes of generation. However, until the nineteenth century, it was impossible to determine what kinds of structural irregularities might occur, since external forces were seen to act directly upon the parts of the embryo, which responded in a mechanical as opposed to an organic fashion to such interferences.

Similarly, for those who subscribed to originalist theories, monstrosity was not a predictable biological deviation, but rather an act of providence, the meaning of which was unavailable to man. Such theories precluded the possibility of establishing a scientific classification of monsters. Investigators of the time did recognize certain broad categories of monstrosity, discriminating between double monsters, hermaphrodites and monsters with generally odd conformations, but within these larger classes, great variety was possible. In the final analysis, each monster was a unique and uniquely irregular production, arising from chance, accident or providence.

Like eighteenth-century science in general, investigations into monstrosity from 1650 to 1750 appear extremely "diverse" and "complex," and particularly opaque to modern understanding.[75] There are many reasons why this might be so, but I think Karl Figlio's

argument--that eighteenth-century science does not square easily with the specialized and fragmented character of the modern scientific mentality--is most fruitful.[76] According to Figlio, people in this century have become used to thinking of science as a highly professionalized endeavour, with a "specialized factual content," and clear demarcations, not only "between the sciences," but between "science and other forms of human activity." This compartmentalized kind of thinking "encourages us to write histories of the emergence and development of discrete sciences" in which the "discipline boundaries have been drawn up by an apparently natural logic." What has become increasingly apparent, however, is that, in the eighteenth century, there simply were no discrete sciences, at least not in the modern sense. Investigators of the time interested themselves in a wide range of topics, and in their studies of nature, drew on diverse kinds of knowledge. Consequently, the old "space" of natural history is, in Foucault's terms, "definitively blurred for modern eyes."[77]

In many senses, the study of monsters during this period was, or certainly appears from a modern perspective, highly paradoxical. It was naturalistic, and yet heavily influenced by theological considerations; monsters were grave facts of nature, and at the same time curious and sometimes amusing spectacles of entertainment, attesting to the powers of Nature. Accounts were intended to be empirical, but were often full of expressive and subjective commentary. Further, the scientific community itself was not clearly defined, with the lines between professional and amateur being blurred.

What we see in the eighteenth century, in fact, is an interest

in monsters which was divided along parallel lines of popular as opposed to learned curiosity, with a fair amount of intermingling and overlapping between the two. A diverse assortment of doctors, interested gentlemen, and churchmen, all claiming to be engaged in a scientific study of nature, offered accounts for publication to the Royal Society's Transactions. There, monsters appeared in various kinds of discussions, in purely descriptive accounts of natural history, in treatments on generation and in accounts designed primarily to please the curious or inspire the devout. And finally, if the eighteenth-century study of monsters appears confused, it is also partly because investigators of the period were themselves uncertain of how to grapple with this "strange" phenomenon, and often felt themselves, in deSuperville's terms, to be "groping in darkness" for answers.[78]

Such diversity notwithstanding, it is possible to offer some general conclusions about the investigations of monstrosity during this period. Firstly, in England, the study of monstrosity was largely an empirical project of compilation, collection and description. When called upon to research cases of monstrosity, investigators weighed, measured, dissected, drew, pickled, recorded dates, times and circumstances, providing descriptive rather than theoretical accounts. (Of the more than forty authors who corresponded with the Royal Society, only eight offered speculations about the causes of monstrosity.) Most of the theorizing that occurred about monstrosity during this period was carried on in France and Germany, and communicated to English audiences through the exchange of letters and reports. Influenced primarily by Bacon's inductive program of researching monsters as

a part of natural history, English investigators were satisfied to describe. When they did engage in theoretical speculations, they relied mainly upon mechanistic causes, such as falls, blows or maternal imagination.

Secondly, conceptually monsters were understood as irregularities of nature and this because the predominant principles which conditioned thinking about monsters were "structure" and "appearance." In other words, monsters were monstrous because they were structurally distinct; it was on this basis that they were segregated in a separate class of irregularities, which belonged on the fringe of the natural order. Thus, monsters in the early eighteenth century were not generally seen as part of the planned order, but as chance digressions, failed species in fundamental opposition to an order which was fixed, regular and continuous.

Thirdly, from this it is apparent that when we think of the eighteenth-century study of monsters, we can think of it as in some senses scientific, because eighteenth-century investigators considered it to be so. We cannot, however, think of it as teratology or proto-teratology. Not only was the word teratology not used by eighteenth-century scientists, but the conception of malformation as biological abnormality did not exist. Such a conception was incompatible with eighteenth-century assumptions about living things, and incompatible too with the prevailing view of nature as a heterogenous force.

Finally, in attempting to characterize the early eighteenth-century study of monsters, I have relied on certain central ideas: natural history, structure, appearance, irregularity of nature, fixed species, divine creation, discontinuity, qualitative dif-

ferentiation and empiricism. These, I think, constituted the principal set of ideas, perceptions and methods around which the study of monstrosity was organized until around 1750. When considered in light of these organizing principles, the various modes of investigating, theorizing and talking about monsters appears, if no less complex and diverse, at least more comprehensible.

## NOTES TO CHAPTER ONE

### Part One

[1]Paré, On Monsters, p. 3

[2]quoted in Warkany, Congenital Malformations, p. 8. See also Ballantyne, "Teratological Records of Chaldea," pp. 127-42.

[3]Cicero, De Natura Deorum, trans. H. Rackham (Cambridge: Harvard University Press, 1951), p. 129.

[4]Isidore of Seville, "The Medical Writings," trans. William Sharpe, Transactions of the American Philosophical Society, n.s. 54, Part 2 (1964), p. 51.

[5]Aristotle, Generation of Animals, trans. A. Peck (London: Heinemar, 1953), p. 425.

[6]Ibid., p. 403.

[7]Pliny, The Natural History of Pliny, ed. John Bostock and H. Rely (London: Henry Bohn, 1855) II, p. 135. Describing various monstrous races supposed to exist in foreign lands, Pliny says:

> Nature, in her ingenuity, has created all these marvels in the human race, with others of a similar nature, as so many amusements to herself, though they appear miraculous to us... ..As a striking evidence of her power, let it be sufficient for me to have cited whole nations in the list of her prodigies.

[8]St. Augustine, Concerning the City of God against the Pagans, trans. H. Bettenson (London: Cox and Wyman, 1972), p. 661.

[9]Park and Daston, "Unnatural Conceptions," p. 26.

[10]Cornelius Pet, "An example of Gods judgement," English Book Series, Reel 379, 1580.

[11]"Strange news of a prodigious monster, English Book Series, Reel 584, 1613.

[12]A. Griffith, "A true and certaine relation," English Book Series, Reel 1164, 1635.

[13]"Of a Monstrous Birth," The Gentleman's Magazine, p. 535.

[14]Park and Daston, "Unnatural Conceptions," p. 36.

[15]Adam, "Contributions to Teratology," p. 243.

[16]Fisher, "Diploteratology," (1865), p. 241.

[17]Paré, On Monsters, pp. 3-4.

[18]Ibid., p. 5.

Part Two

[19]John Floyer, "A Relation of two Monstrous Pigs," PTRS 21 (1699), p. 434.

[20]Ibid., p. 433.

[21]The Royal Society published the accounts of over forty authors during this period.

[22]Francis Bacon, Novum Organum in The Physical and Metaphysical Works of Lord Bacon, ed. J. Devey (London: G. Bell and Sons, 1898), p. 496.

[23]Francis Bacon, The Advancement of Learning in The Advancement of Learning and New Atlantis, ed. Arthur Johnston (Oxford: Cambridge University Press, 1974), p. 55.

[24]Ibid., p. 69.

[25]Bacon, Novum Organum, p. 496.

[26]Ibid.

[27]Bacon, The Advancement of Learning, p. 70. Here Bacon further comments that "these narrations, which have mixture with superstition," should be "sorted by themselves, and not . . . mingled with the narrations which are merely and sincerely natural."

[28]Bacon, The Advancement of Learning, pp. 68-9.

[29]quoted in G.R. deBeer, Sir Hans Sloane (London: Oxford University Press, 1953), p. 84.

[30]David Thomas, "An Observation touching some particulars further considerable in the Monster mentioned in the first Papers of these Philosophical Transactions," PTRS 2 (1665), pp. 20-1.

[31]Grandi, "Concerning some Anatomical Observations," p. 1188.

[32]Allan Mullen, "A discourse on the Dissection of a Monstrous Double Catt," PTRS 15 (1685), p. 1135.

[33]George Ash, "Concerning a Girl in Ireland, who has several Horns growing on her Body," PTRS 13 (1685), p. 1202.

[34]Dr. Cyprianus, "An Account of a Child born with a large Wound in the Breast," PTRS 19 (1696), p. 291.

[35]Timothy Sheldrake, "Concerning a Monstrous Child born of a Woman under Sentence of Transportation," PTRS 41 (1739), p. 341.

[36]William Derham, "An Account of Some Inundations, Monstrous Births, Appearances in the Heavens, and other Observables," PTRS 26 (1709), pp. 308-10.

[37]Ibid., p. 310.

[38]M. Bussière, "An Anatomical Account of a Child's Head, Born Without a Brain," PTRS 21 (1698), p. 144.

[39]quoted in Altick, The Shows of London, p. 25.

[40]Ibid., p. 14.

[41]deTorres, "An Extraordinary Case," p. 776.

[42]Bacon, Novum Organum, p. 496.

[43]quoted in Philip Ritterbush, Overtures to Biology (New Haven: Yale University Press, 1964), p. 61.

[44]Ibid., p. 61.

[45]William Durston, "A Narrative of a Monstrous Birth in Plymouth," PTRS 5 (1670), p. 2098.

[46]Corke, "An Extraordinary Skeleton," pp. 810-12.

[47]Edmund Almond, "Some Account of the Gigantic Boy at Willingham," PTRS 43 (1745), p. 250.

[48]Thomas Dawkes, "A Letter Concerning the same Child," PTRS 43 (1745), p. 251.

[49]M. Gaillard, "Particular Observations upon different Maladies," PTRS 19 (1697), p. 717.

[50]Colin MacLaurin, "An Account of a monstrous double Birth in Lorraine," PTRS 32 (1723), p. 34.

[51]Gregory, "An Account of a Monstrous Feotus," p. 764.

[52]Bussière,"An Anatomical Account," p. 141.

[53]"Observables Upon a Monstrous Head," PTRS 1 (1665), p. 85.

[54]James Parsons, Mechanical and Critical Inquiry into the Nature of Hermaphrodites (London: J. Walthoe, 1741). p. iv.

[55]Durston, "A Narrative," pp. 2096-7.

[56]Roger, "The Living World," p. 264. This reliance upon description meant that investigators required no specialized scientific knowledge to engage in acceptable writing, for with a minimum of anatomical knowledge, it was possible to provide a valid empirical account of a monstrous birth. It was partly for this reason that the study of monsters was so widely accessible to amateurs and natural theologians, who would eventually be barred from participating in expert scientific discourse.

[57]For an interesting contemporary critique of the prevailing classificatory scheme in the late seventeenth century, see John Locke, Essay Concerning Human Understanding, ed. A. Fraser (Oxford: Clarendon Press, 1894), pp. 240-2. Locke was highly critical of the "ordinary way of reasoning" in the matter of classification, arguing that taxonomists should not lay the "whole stress on the figure, and resolve the whole essence of the species of man . . . into the outward shape." The existence of monsters, according to Locke, demonstrated the weakness of this reliance upon structure in differentiating one species from another. In keeping with such a scheme, Locke pointed out, monsters inevitably must be classed as something neither man nor beast, but partaking somewhat of either, a proposition which he saw as absurd. For Locke, monsters provided proof that species and essences were nothing but man's abstract ideas with names annexed to them, and not necessarily representative of the reality of things.

[58]Bacon, Advancement of Learning, p. 36.

[59]quoted in Altick, The Shows of London, p. 229.

[60]The question of whether monsters had human souls (i.e. whether they were essentially human) was problematic to eighteenth-century investigators. Their concern over this issue is instructive. It was, I think, only because of the priority attached to structure and visible appearance in the study of living things that such a question could be raised. Certainly it was not an issue which was discussed by nineteenth-century scientists, for they recognized that great structural variety occurred within species without altering the essential character of the animal. For eighteenth-century investigators, structure was a key consideration in differentiating one species from another, so that if a monster exhibited "non-human" structures, or those that were analagous to some non-human formations, it automatically provoked the question of whether the monster was essentially human or not. This became particularly difficult in cases of anencephaly, where the child had no brain. For nineteenth-century scientists, such speculations were outside the scope of science. Monsters by then were specimens of human pathology. If they were grossly deformed, they were characterized as non-viable, but not as non-human.

[61]The preformation theory was first advanced in the 1670's by Malebranche, Malpighi and Jan Swammerdam. According to Shirley Roe, it arose in direct response to the mechanistic embryology of

the Cartesians. For preformationists, a mechanical process based on matter and motion alone was inadequate in explaining the complexities of embryology. Such complexity seemed to indicate the intelligence of a divine creator. After the 1670's, preformation won wide acceptance and served as the main theory of generation until the later eighteenth century, when the theory of epigenesis gained more general credence.

[62]deSuperville, "Some Reflections on Generation," p. 296.

[63]Ibid.

[64]Between 1706 and 1743, there was a heated discussion of this question in the Académie des Sciences, carried on by Lémery (accidentalist) and Winslow (originalist). In 1739, Albrecht von Haller published a treatise on monstrous births opposing the accidentalist view. Until the latter part of the century, most English investigators did not enter this debate on either side, but confined their researches to purely empirical observations. Of those who did speculate about the cause of monstrosity in England, the accidentalist view prevailed. Originalist theories became more widely accepted after the 1750's.

[65]deSuperville, "Some Reflections on Generation," p. 305.

[66]Ibid., pp. 305-6.

[67]Ibid., p. 302.

[68]Parsons, A Mechanical and Critical Inquiry, pp. 75-6. According to Parsons, "we must not assent to the Saint [Augustine] in imagining God to be the immediate Author of any Form in those poor Children (commonly call'd monstrous) that might be painful or disadvantageous to their well-being and Preservation . . . Tho' the first semina of any species of Animals are planted by the Ordination of the Almighty, in an absolute Manner in the Beginning, from which they cannot digress in their successive Generations; yet a Woman . . . may bring forth a Child deformed in every member; which can reasonably be accounted no other than one accidentally injured in the Uterus." Further, he believes, "Every species of Animals are the same now that they ever were, and we must . . . expect no other while time subsists."

[69]Corke, "An Extraordinary Skeleton," p. 812.

[70]Floyer, "A Relation of two Monstrous Pigs," pp. 431-2.

[71]For a full account of Mary Toft, see S. Seligman,"Mary Toft--The Rabbit Breeder," Medical History 5 (1961), pp. 349-60. That hybridization persisted in popular thought into the eighteenth century is evidenced in Timothy Sheldrake's report of a monstrous child born of a woman under sentence of transportation. Sheldrake suggests that some observers regarded the monster to have arisen from hybridization, or from some "Practices both unnatural and unlawful" that the mother was accused of having engaged in.

[72]Gregory, "An Account of a Monstrous Foetus," pp.764-5.

[73]deSuperville, "Some Reflections on Generation," pp.306-7.

[74]James Parson, "An Account of a preternatural Conjunction of two Female Children," PTRS 25 (1748), pp. 535-6.

[75]In his introduction to Ferment of Knowledge, R. Porter characterizes eighteenth-century science as "diverse" and "complex," noting that "all attempts to totalize it have been wrecked upon the reefs of diversity and complexity." (p. 4).

[76]Figlio, "The Metaphor of Organization," pp.17-18.

[77]Foucault, The Order of Things, p. 162.

[78]deSuperville, "Some Reflections on Generation," p. 295.

CHAPTER TWO

## MONSTROSITY AND THE CONCEPT OF FUNCTION, 1750 - 1800

> Monsters . . . seem peculiarly likely to assist us in the prosecution of physiological researches. . . . If we were never to see an animal except in its perfect state, we could form no just idea of the comparative necessity of different parts.
>
> -- John Clarke, 1793[1]

From around the middle of the eighteenth century, various scientists began to formulate the problem of monstrosity in a new way, and with a new series of questions in mind. When early eighteenth-century investigators had speculated about monstrous births, it was, as we have seen, primarily in the context of their researches into natural history, and according to a view of nature as an immutable order of species, each endowed by God with the precise organs and parts necessary for existence. During the second half of the century, however, while it retained certain ties with natural history, the study of monstrosity was increasingly absorbed into the sciences of physiology and pathology, and ordered by a revised set of considerations about vital function and the conditions of animal life.

By the 1770's, research into monstrous phenomena was reoriented around one central and essentially novel idea. This was that monsters constituted not blind eccentricities of nature, but cases of pathology, which, when compared with healthy beings, could serve to elucidate the laws of physiology and ultimately, the very nature of life. For late eighteenth-century scientists, in fact, monsters, along with other diseased specimens, came to occupy a central place in the scientific examina-

tion of life. For, as John Hunter remarked, "just as the 'weight' in a clock might explain the use of the 'spring' in a watch," so monstrous structures may explain "something in the physiology of the more perfect animals," thereby throwing light upon "the principle of animal life."[2]

This pattern of change in the study of monstrosity is evident in the work of many later eighteenth-century scientists, but it is perhaps most clearly manifest in the works of John Hunter (1728 - 1793), the famous surgeon and comparative anatomist of London. Though his researches into monstrosity were of an unprecedented rigour, Hunter's interests were by no means restricted to the subject of monsters. On the contrary, he undertook an exceptionally diverse range of studies in anatomy, physiology, and pathology while at the same time pursuing a multifaceted career in medicine. Besides maintaining a surgical practice and a school of anatomy, Hunter performed an enormous number of physiological experiments and wrote prolifically of his scientific findings. During his lifetime, he published treatises on a wide assortment of topics, from the natural history of bees, the organ of hearing in fish, the lymphatic system and animal heat, to the effects of gun shot wounds, the nature of digestion and fossils. In addition, he wrote two papers on monstrosity, "An Account of an Extraordinary Pheasant" and "An Account of a Free Martin," both contained in his Observations on Certain Parts of the Animal Oeconomy, a collection of papers he compiled in 1786. Many of Hunter's notes were left unpublished till after his death, and it was not until the nineteenth century that two compilations were undertaken. These, The Works of John Hunter

(1837) and Essays and Observations (1861) contained, along with an enormous number of observations on animal life, his basic views concerning monstrosity.

Hunter's surgical skill, his teaching and his writing brought him great acclaim in the English scientific community. But it was for his work in comparative anatomy that he was most widely recognized. According to Everard Home (his brother-in-law and biographer), there was literally no new animal brought to England which was not shown to Hunter. Perhaps the most enthusiastic collector of animal specimens of his age, his energies were engaged, from 1765 until his death, in the building up of a comprehensive anatomical museum, which, for Hunter would constitute the "true book of nature." In 1799, when the museum was handed over to the College of Surgeons, it contained 13,682 specimens, representing over 500 species of animals, all arranged to illustrate the principles of anatomy, physiology and pathology as they occurred in the living world.

By modern standards, Hunter's scientific interests appear overwhelmingly wide-ranging. For him, however, surgery, physiology, comparative anatomy and pathology were all components of a single mode of investigation. "All his labours," according to his biographer, James Palmer, "were directed to the elucidation of the laws of life;" both his writing and his collection may be regarded as forming necessary parts of that general undertaking, the "writing forming the text to his museum;--his museum the appropriate illustration of his writings."[3] It was, then, in the context of this larger attempt to ascertain the principles of animal life that Hunter undertook several researches into

monstrosity, a subject for which he maintained an abiding interest. Through his work, he conveyed many novel views to a wide audience of students and scientists and, in many senses, set the tone of English research into monstrosity until the early nineteenth century.

At first glance, Hunter's interest in monsters appears little different from the curiosity collecting of earlier amateurs. Indeed, as Stephen Cross points out, "the story of Hunter's animal collecting . . . is one of the most picturesque of the period."[4] From 1765, when he built a residence to accommodate his anatomical researches, he seems to have spared no expense or energy to secure specimens--including monstrosities--for dissection, experimentation and display. He patronized cabinet sales, hounded animal dealers for skeletons and maintained contacts all over Europe with traders, ex-pupils, or scientists who supplied him with a steady series of specimens. Many of the monstrous skeletons displayed in his museum were those which he had begged, borrowed or bought from various side-show exhibitors. So assiduous was Hunter in surveying the fairgrounds for potential specimens, in fact, that he apparently gained something of a ghoulish reputation among "the freaks" who were understandably unsettled at the prospect of their bones ending in his museum.[5] In any case, through all his various contacts and activities, he managed to amass an impressive collection of monstrous specimens. By the 1790's, his museum contained over 300 examples of monstrosity, representing cases of malformation in a wide range of animal species. In keeping with the four categories of monstrosity which Hunter recognized, these specimens were arranged

in four separate exhibits: preternatural situation of parts, addition of parts, deficiency of parts and hermaphroditical malformation. Two categories (addition of parts and deficiency of parts) were further broken down into sub-classes on the basis of which organs--those of circulation, digestion, generation or the nervous system--were affected.

If Hunter's monster collecting resembles the curiosity mania of the early eighteenth century, his interest in monstrosity was, in fact, part of a larger study in comparative anatomy, a study quite different from earlier investigations in natural history. In the first place, Hunter's major concern in investigating animals was not with structure and classification, but rather with function. Describing his style of investigation, John Abernethy, a one-time student and later exponent of Hunter's views, recalled:

> When he met an animal he had never dissected, he cared little by what name it was called and to what family it belonged . . . He wished to know how its food was digested, how its blood circulated, how it secured and defended itself from injury . . . how the multiplication of its species was effected and insured . . . [6]

Further, in arranging his museum, Hunter's objective was not to reveal the structural relationships between species. On the contrary, according to Palmer, Hunter's original design in the formation of his museum "was to furnish an ample illustration of the phenomena of life exhibited throughout the vast chain of organized beings, by a display of the various structures in which the functions of life are carried on."[7] "Strictly physiological in its character" and "devoted to the illustration of the science of life," Palmer continued, the museum:

> consists of dissections of plants and animals, in which the structures subservient to the different functions

> are . . . displayed. These structures are taken from every class of organized matter, and are arranged in series, according to the function [locomotion, digestion, respiration, senses, reproduction] in order of their complexity, beginning with the simplest form, and exhibiting the successive gradations of organization to the most complex.[8]

To the extent that Hunter saw structure as subservient to function, so, in his view, was anatomy to be the servant of physiology. In fact, the study of structure was, for him, inherently linked to the study of function; he believed, as William Coleman points out, that "without a knowledge of function or the purpose for which a given organ was designed there could be no satisfactory understanding of structure itself."[9] It was in establishing this close relation between comparative anatomy and physiology that Hunter broke with the earlier tradition of natural history, in which structure and classification had been the primary considerations.

Most importantly, just as Hunter recognized comparative anatomy and physiology as correlative parts of the larger investigation of life, so too did he unite the study of physiology with his investigation into pathology, or the "physiology of disease," as he labelled it. In his yearly course on the principles of surgery, he characteristically began by introducing his students to the "physiology of the animal oeconomy in its natural or healthy state," and then proceeded to pathology, which, he explained, "may be called the perversion of the natural actions of the animal oeconomy."[10]

Rejecting the current ontological theory of disease, Hunter defined disease not as an invasive entity, visiting the sick body, but rather, in strictly physiological terms, as a deviation from

the body's normal functions. To understand disease, he believed, physicians must comprehend normal, healthy functions. Thus, before he treated "of the diseases of the animal body" in his lectures, he regarded it as necessary "to give such general ideas of physiology, and to lay down such axioms and propositions," as would enable his students to follow him "through all the necessary descriptions of preternatural actions of the machine."[11] And, the reverse also being true, he argued that an understanding of healthy functions was facilitated by an investigation into the pathological. In locating the study of disease within the science of vital function, Hunter constituted a new relation between the physiological and the pathological, defining both as vital phenomena, subject to the same laws, and both as necessary components of the same inquiry into the nature of life.

Monsters, according to Hunter, provided a particularly valuable resource in this comparative investigation of the normal and the pathological. As he explained:

> Besides having recourse to many of the inferior orders of animals for the elucidation of some of the phenomena of the more complicated orders, we are also obliged to Disease for many of our hints on the animal oeconomy, or for explaining the actions of parts, for the wrong action of a part often points out what the natural action was, and itself gives an idea of life. Disease often corrects our imaginations and opinions, and shows us that such and such parts cannot have the uses commonly attributed to them, and therefore brings us a step towards the knowledge of the true use. Monstrosities contribute to rectify our opinions in the same if not a more intelligible manner. A monster is either from a deficiency of parts . . . or else from a modification caused by a wrong arrangement or construction of parts, which will produce an unnatural action, by which means the natural action may be known.[12]

Among Hunter's contemporaries, and increasingly from the 1770's, the study of monstrosity was predominantly influenced by such considerations of vital function. To Dr. James Johnston, for example, writing to the Royal Society in 1767, monsters demonstrated "more consequentially than experiments" how parts function and which functions are necessary to life.[13] As such, these "singular existences" afforded useful inferences in the scientific investigation of life. Similarly, Dr. John Clarke, a prominent London midwifery practitioner, in his "Description of an Extraordinary Production of Human Generation," (1793) argued that monsters "seem peculiarly likely to assist us in the prosecution of physiological researches," for "if we were never to see an animal except in its perfect state, we could form no just idea of the comparative necessity of different parts."[14] Thus, while they were once investigated as structural curiosities, in a separate category of natural history, by the end of the century, monsters represented special cases of pathology, capable of illuminating the laws of animal function. By the early decades of the nineteenth century, William Lawrence could argue that "the consideration of monstrous productions" belonged not to "the natural history of our species," but rather to the sciences of "pathology and physiology."[15]

For scientists such as John Hunter, the early eighteenth-century project of description and compilation, based on a code of knowledge which gave priority to structure and appearance, could no longer deliver meaningful information about monstrous births. And this because it was not with external appearance

but rather with the reality beneath appearances--with the hidden functions of life--that they were primarily concerned. Indeed, during the second half of the century, the central organizing principle of natural history, structure, gradually diminished in importance as English scientists focussed their attention instead upon questions relating to animal function. According to Hunter's way of thinking, what appeared on the surface, or what was visible, was understood as conditioned by what was internal and invisible, by functions such as respiration and digestion, conceptual abstractions which could not be seen and could not be represented directly in words. The tremendous range of structural variation in the natural world was subsequently construed as illusory, as masking a deeper uniformity, for differences in structure were considered as mere surface variations of those vital functions which were common and necessary to all living things.

This primary reference to function as the conditioning principle of animal life put a number of questions on the agenda for late eighteenth-century scientists: what are the parts which perform the various functions?, which functions are the most essential in sustaining life?, what is the vital relation between structure and function?, in short, what are the conditions of animal life? It was specifically in relation to physiological questions such as these that scientists from the 1770's undertook studies of monstrosity. Charles Pears, for example, in submitting an account of "a full grown Woman in whom the Ovaria were deficient," (1805) laid the case before the Royal Society "as an addition to those already registered in the Philosophical Transactions, with the view of elucidating such physiological inquiries as are

connected with the state of the organs of generation."[16] According to Pears, "The history of this case, . . . becomes valuable, as it shows that an imperfect state of the ovaria is not only attended with an absence of all the characters belonging to the female after puberty, but that the uterus itself, although perfectly formed, is checked in its growth for want of due structure of those parts."[17] Reporting to the Royal Society of Edinburgh in 1792, Alexander Monro wrote of a monstrous production wanting brain, heart and lungs, a specimen which he found useful in substantiating certain physiological conjectures about the circulation of the blood.[18] Similarly, in 1793, John Clarke argued that a particular monstrous birth was sufficient to prove that "that intimate connexion of the brain and nervous system, which takes place after birth, is not necessary for the formation of a body in other respects perfect."[19] For Anthony Carlisle, a monstrous lamb demonstrated that "the formation and growth of animals in the uterus are independent of any influence from those parts of their brain which properly belong to sensation." (1801) "The careful observance of such circumstances may," he suggested, "bring us to discoveries of the highest value, in that part of physiology [the nervous system] which is now enveloped in deep mystery."[20] Writing in 1809 of a foetus born without a heart, Benjamin Brodie argued that the circulation of blood prior to birth can be "carried on by the action of the vessels only."[21] And, in an account of an acephalous foetus, published in 1814, William Lawrence argued that the examination of these productions can lead to interesting and useful results, for "by shewing us what happens when an important organ is wanting or malformed, it contributes

to fix our opinion respecting its uses."[22] Clearly, as monsters were perceived as objects of physiological study, they tended to lose their value as wondrous beings and functioned instead as ready-made--or natural--experiments, important only insofar as they illuminated particular physiological processes.

The incorporation of monstrosity into the study of physiology tended to discredit former modes of investigating monstrous occurrences. In earlier accounts, authors had often proclaimed each case as a great structural curiosity, stressing the novelty of their report as the main criterion of its value. In contrast, later eighteenth-century authors tended to recommend their cases as useful or instructive to the extent that they were applicable to a particular issue in physiology. This concern is evident, for example, in an account of a monstrous lamb, published by the Royal Society in 1801, in which Anthony Carlisle begins:

> I am much indebted to you for the privilege of inspecting the monstrous lamb sent by Dr. Pulteney of Blandford, whose laudable interest for the promotion of science, induced him to present it to you . . . According to your suggestion, I took the opportunity . . . to examine the brain and its connections: they seem to me very remarkable, and might have afforded matter, to an acute observer, of high interest in the science of physiology, had this monster been weaned alive.[23]

Moreover, instead of limiting their examinations to isolated examples of monstrosity, investigators increasingly referred to other cases of a similar nature, so that the principles of monstrosity might become evident. In 1767, for example, James Johnston provided the Royal Society with a history of a foetus born with a very imperfect brain in which he analysed various reported specimens "similar to this" and then drew some general

conclusions about operations of the nervous system:

> These singular existences afford useful inferences, and shew that the irritability of the heart, is capable of being sustained, by very low degrees of the nervous power, while that irritability is kept up by the fostering heat of the mother. This feeble life is soon extinguished, when the influence of the mother's warmth and circulation cease. Such infants die as soon as born or soon after. . . Such examples . . . demonstrate that the spinal marrow is the principal organ of the intercostal nerves.[24]

Finally, among such scientists, a major concern was to push studies of monstrosity beyond mere description, in order to render the topic more scientifically "useful." According to John Clarke, for example, the "mere description of any monster is of very small utility, unless it tends to explain some action of the animal economy, before imperfectly, or not at all understood."[25] Thus, while scientific journals continued to publish brief descriptive accounts of particular monsters, there was a widespread consensus that this method was not conducive to the promotion of science. In fact, just as structural concerns became secondary to questions of function in the study of monstrosity, so too did anatomical description eventually give way to physiological explanation as the appropriately scientific means of discussing monstrous phenomena.

Implicit in late eighteenth-century works on monstrosity was a definition of life quite different from that which had dominated earlier studies in natural history. According to the mechanistic philosophy of the early eighteenth century, the essence of each living machine was a special type of construction without which it would not work. God, it was believed, had given every natural being its structure and the exact quantity of motion or force

necessary for its working. This meant that between the organic and inorganic worlds, there was no real gulf, but only increasingly complex machines. Among John Hunter's contemporaries, this view was losing its plausibility, for no conceivable definition of life in structural terms alone could do justice to the dynamic and integrated features of vital action. According to Hunter, living things were not mere machines, passive in the hands of God. On the contrary, if the order of creatures was ultimately designed by God and ultimately unchanging, it was nevertheless an active, self-regulating system, an animal "oeconomy" which did not require God's direct intervention for its preservation and continuation. Life was an active force, and living creatures were inherently endowed with special vital principles which allowed them to reproduce themselves, to react to the environment and to fulfill the functional requirements of existence. As observations of monstrosity had confirmed, life was not dependent upon a specific construction of parts, since a tremendous variety of structure was possible to carry out the necessary vital functions. According to John Clarke, for example, monsters demonstrated that:

> nature can deviate from the usual arrangment of parts, without any material inconvenience; and therefore, that the existence of parts so as to be capable of being applied to the purpose for which they are intended, in the perfect state of the system, rather than any precise order of them, is required for carrying on the functions of an animal body.[26]

By the 1770's, to know life was no longer a matter of ascertaining the particular constructions of species. By then, as Foucault suggests, the study of living things was becoming the science of life, an experimental science aimed at elucidating the internal

process of vital function.

With this transition in the study of living things, scientists began to perceive monsters in an increasingly "organic" fashion. In other words, external malformations appeared less as random irregularities of structure and more as manifestations of interrelated and coordinated derangements within a vital system. There were, it was observed, certain vital principles, such as "compensation" or "correlation of parts" which seemed to govern in the production of such derangements. According to John Hunter's elder brother, William, a renowned obstetrician, for example,

> In preternatural cases, we often observe that what is preternaturally deficient or wanting, is in some other way preternaturally made up or compensated . . . as if formed on purpose to make up for that defect. Without some such compensation life could not go on.[27]

Similarly, John Abernethy argued that, in monstrous productions, as in all vital systems, parts are correlated, that "no part of the animal body can in general be very considerably disordered without occasioning a correspondent derangement in other parts of the system."[28]

Increasingly, to discuss monstrosity required not only anatomical description, but also physiological explanations in which peculiarities in structure were explained in relation to the general functions of the internal economy of the animal. It was in this typical fashion, for example, that John Hunter discussed a specimen with a malformed heart. Interested to demonstrate how the deformed aorta affected the organism as a whole, he wrote:

> The liver was larger and occupied more of the left side than it generally does; its structure was undiseased. The viscera of the abdomen in general were

> prefectly sound, and had no peculiarity except their colour arising from the universally morbid circulation, owing to a deficiency probably of the proper quantity of blood circulating through the lungs by it natural course of the pulmonary artery, which was prevented by the aorta opening into both ventricles.[29]

Clearly, what underlay such explanations was the view that malformations occurred in a systematic way and according to some internal physiological logic.

Most significantly, as monsters came to be seen in relation to the science of physiology, it became impossible for scientific investigators to maintain the longstanding view of monsters as whimsical irregularities of nature. It was not that this idea was overturned by any sudden discovery or insight, but rather that the very basis for understanding malformation in such a way was no longer valid. Throughout the second half of the century, in fact, the general scientific discourse concerning monstrosity was increasingly dominated by the idea of regularity. According to Hunter, for example, there "must be" some "principle" governing the production of monsters.[30] This conviction likely arose in part from the extensive observations of monstrous specimens which Hunter undertook in establishing his museum of "monstrous and malformed parts." In arranging and cataloguing his collection, he grouped malformations according to which of the organs were affected and observed recurrent patterns in the types of malformations produced. In keeping with such observations, he referred continually to "species" of monstrosity, noting the characteristics common to various types. Struck by this regularity, Hunter was led to challenge the view of monsters as capricious productions: monsters, he argued did not "appear to be

a matter of mere chance."[31] Instead, they were governed by certain laws. In the production of unnatural hermaphrodites, he wrote, "the same certain laws" seem operate as in the malconformation of other parts of animals.[32] And as he further noted, "from the rarity of any peculiarity in the production of malformations of any particular kind of animals, one would be inclined to believe that there is but one principle governing these formations."[33] Matthew Baillie, too, argued that monsters were essentially regular. As he wrote, "it is exactly the same creative action which produces the natural structure, or any deviation from it; for in cases of deviation the action is either carried too far, ceases too soon, or is diverted into uncommon channels."[34] Thus, for Baillie, monsters were essentially undifferentiated from other living beings, except for such excesses and deficiencies in the creative action. Though the exact processes involved in the production of monstrous formations were unknown, most scientists of the time agreed that monsters, like all other natural phenomena, were governed by determinate laws.

Indeed, by the 1770's, it was generally believed that whatever occurred in Nature was part of a uniform, homogeneous order; why that order should encompass monsters was not altogether clear. "Why nature should, in its greater deviations, fall into a very imperfect formation, much below the standard of her common work," wrote Baillie, "does not appear very obvious."[35] Perhaps, he thought, "it is with a view to check the propogation of great varieties, so as to preserve an uniformity in the same species of animals." In any case, for Baillie, monsters

were a natural occurrence within the natural economy; the question of why monsters occurred was of much less "importance" than the fact that they did occur. All that was, was regular.

These changing views of monstrosity are most clearly evident in late eighteenth-century discussions concerning the origins of monsters. In the early part of the century, theoretical speculations about the causes of monstrous births had centred, as we have seen, around the controversial issue of whether monsters were original or accidental. When they did theorize about this question, most English investigators of the time had favored accidentalist interpretations, suggesting that monsters arose from maternal imagination, or from external mechanical interferences with the embryo, which originally had been created perfect.

During the late eighteenth century, these same issues were still a topic of active discussion, though, in keeping with the experimentalist philosophy generally endorsed, scientific interest was absorbed more with the problem of understanding the physiology of monstrous specimens than with discovering their causes. According to Matthew Baillie, for example, whether monstrosity depended "on the original formation or was produced afterward in the gradual evolution of an animal did not appear to be a question of much importance, nor perhaps could it be absolutely determined."[36]

Not surprisingly, however, of those later investigators who concerned themselves with the problem of causation, many challenged the validity of accidentalist interpretations. "Upon the whole," Baillie considered, "it is more reasonable to think, that the same plan of formation is continued from the beginning, than that at any subsequent period there is a change in that plan."[37]

Likewise, though John Hunter felt that some evidence indicated the possibility of accidental interferences, he, too, was more inclined to the originalist position to account for the majority of malformations. "Some instances of monstrosity," he suggested, "may be owing to accident," but even in such cases, "there must be a susceptibility for such, which susceptibility must be original."[38] Moreover, he added, "most preternatural formations of the body which a monster is born with arise out of a defect in the first arrangement of the animal matter."[39] Thus, though accidentalism was by no means universally abandoned, there was a marked trend, within the scientific community, towards a broader acceptance of originalist views. From that time, accidentalist theories were the subject of increasing scientific scrutiny.

This was especially true in the case of "photographic" maternal imagination, a theory which, while widely supported among popular audiences, struck numerous scientists of the period as particularly indefensible. A major critic of maternal imagination was William Hunter, who, in the course of his obstetric practice, undertook a methodical study of the matter. According to a later commentator, Hunter "made inquiry in two thousand cases, of the mothers before the birth of their children, in regard to any apprehensions which they had experienced as to markings, deformities or monstrosities, and he carefully noted their answers and the cause, or causes, which they supposed were sufficient to give rise to such malformations."[40] The theory, Hunter concluded, was groundless, for in no case did a single coincidence of mental emotion and a corresponding abnormal deviation occur.

Particularly illustrative of the growing medical skepticism over maternal imagination is the comprehensive argument presented by Dr. W. Cooper in 1775. Writing to William Hunter about his investigations of an acephalous birth, Cooper subjected the theory to a lengthy critique:

> The particular hypothesis, which has been almost universally adopted, is, that monstrosity and marks in children depend upon the imagination and longing of the mother. Such pernicious a principle as this ought to have very rational evidence, and the most striking facts to support it. But is it not directly to the contrary? Indeed a great many ridiculous stories have been related to the world, which, however, upon a little reflection, either obviate themselves, or else are contradicted by those facts that occur. May we not exemplify this observation by the case of twins now related? One of the children was perfect, and is still living; the other proves to be remarkably defective. Does not the question naturally arise here, how could one child be affected by the disturbed imagination of the mother and not the other? But the mother, upon repeated examination, recollects no fright in particular while she was pregnant. Neither, if she did, would it at all invalidate the force of our argument upon this subject; for she could not possibly see any child without a head: and more especially, because other parts, as the viscera and medulla spinalis, were equally defective, which are entirely out of the reach of the eye or imagination of the mother to form any idea about them. To elucidate this point still further, can any candid person possibly suppose, that the casual agitation of mind of a pregnant woman, should either produce or destroy a whole system of blood vessels, nerves and fibres, which are indispensable constituents of almost every part of the body? And may we not adduce one proof more, in support of our argument, from what happens to animals and vegetables? Among these also, such extraordinary deviations from the general course of nature are by no means uncommon; yet the former are possessed of a much less share of imagination than is usually allotted to the human species; and the latter have none at all. Reasoning in this same manner upon several occasions of this kind in which I have been concerned, my conclusions have always been similar, that the usually assigned cause of the mother's imagination is by no means equal to the manifold effects produced.[41]

Like a number of his contemporaries, Cooper considered the originalist line of reasoning more compelling. As he said, "is it not more reasonable to conclude with you, sir, in your extremely useful lectures, that whatever be the defect or deformity in a monstrous birth, it can never be occasioned by accidents of any kind during pregnancy, but probably has its existence always originating, causê adhuc incognitâ, in the first stamina of the embryo."[42]

There are, I think, various explanations for this growing disillusionment with accidentalist theories. In the first place, it was symptomatic of the more general reaction against mechanistic philosophy and the theological view of nature which had dominated earlier studies. Neither maternal imagination nor mechanical interference conformed with later eighteenth-century views of life and of how the scientific study of life ought to be conducted. When early eighteenth-century investigators debated the problem of accidentalism vs. originalism, it was often in terms which were explicitly theological, and this because God was assigned a very active role in the running of the universe. One of the major arguments against originalism had been that God would not have created beings so apparently contrary to his continuous order. However, by the 1770's, it was generally assumed that there was no real disorder in the natural world. Moreover, since Nature operated somewhat more independently of God, the study of living things was more clearly differentiated from natural theology. For scientists of the time, therefore, monstrosity was not so necessarily a theological issue.

Indeed, when later eighteenth-century scientists endorsed

originalism, it was most typically empirical--and not theological--proofs which were advanced to support their claims. There were, according to contemporary observations, many facts which seemed to undermine the strength of the accidentalist position. John Hunter, for example, found accidentalism inconsistent with his observations of monstrous forms in foetuses which had been aborted at very early periods. Since "monsters are formed as early as we can observe any formation," it was probable, he considered, that the principle of monstrosity occurred in the first arrangement of matter.[43] Moreover, if, as had been claimed, monsters were produced from the coalescing of two embryos in the womb, how, Hunter wondered, could one account for the fact that supernumerary parts were always situated naturally, that "two heads are always on the shoulders; four legs are always placed at the lower part of the belly; a supernumerary finger or toe is on the hand and foot, etc."[44] Similarly, if monsters arose from accidental interferences, how could one explain the numerous cases of "hereditary transmission" in which the identical malformations had recurred "in the children of one family" or in the offspring of a monstrous parent.[45] And finally, assuming that external factors acted directly upon the embryo, then the variety of monsters would be limitless. But this, as Hunter observed, was clearly not so. On the contrary, malformations were restricted to certain predictable types and occurred according to regular physiological principles. In general, it was this type of thinking which undermined the credibility of accidentalist theories, for accidentalism could not be easily squared with the

regularities which were seen to operate in the production of all vital phenomena, including monsters. Such theories were, as Cooper argued,"contradicted by those facts that occur."[46]

Secondly, if certain theories earned the increasing scorn of scientists, this was also a sign of the divisive tensions which were developing between "popular" and "professional" modes of thought. From around 1750, scientists were becoming more conscious of themselves as a coherent group of professionals, distinguished from the uninformed populace and from amateurs by enlightened ways of thinking. From that time, a gulf between expert and non-expert styles of investigation widened, until, by the end of the century, there was a clear demarcation in the minds of scientists between what was scientific and what was not. Maternal imagination, it was felt, was not.

From the middle of the century, members of the literary and scientific elites were becoming highly critical of the activities of amateurs, and particularly of the amateur tendency to value description and collection over "useful" abstraction. In a 1751 edition of The Rambler, for example, Samuel Johnson questioned the scientific value of virtuosi, who ranged the natural world in search of curios without contributing to the growth of scientific knowledge:

> There are, indeed, many subjects of study which seem but remotely allied to useful knowledge, and of little importance to happiness or virtue . . . Yet it is dangerous to discourage well-intended labours, or innocent curiosity . . . It is impossible to determine the limits of enquiry, or to foresee what consequences a new discovery may produce . . . The virtuoso therefore cannot be said to be wholly useless; Collections of this kin are of use to the learned, as heaps of stones and piles of timber are necessary to the architect. But to dig the quarry or to search the field, requires not much of any quality, beyond stubborn perseverance . . . [47]

Similarly, in The Citizen of the World, Goldsmith (1762) protested the amateur tendency to

> view all nature bit by bit; now the probiscis, now the antennae, now the pinnae of--a flea. . . Thus they proceed, laborious in trifles, constant in experiment, without one single abstraction, by which alone knowledge may be properly said to increase.[48]

Within the scientific community, investigators expressed similar sentiments, recommending that contributors provide physiological generalizations as opposed to mere descriptions in their works on monstrosity. The Royal Society, too, was apparently resolved to demand more scientific accountability from its contributors. In 1752, the Society's directors announced a change in policy in the subsequent publication of articles, stressing that they would be screening articles with more discrimination as to scientific usefulness in the future. From that time, the role of amateurs in the study of monstrosity declined noticeably.

Of the authors who submitted accounts of monstrosity to the Royal Society between 1750 and 1800, almost all were medical doctors, teachers of medicine or both. Unlike earlier amateurs, these people tended to have a sophisticated knowledge of anatomy and physiology, and perceived deformities accordingly. They looked for the correspondence between healthy and malformed structures, identifying deformities as imperfect rudiments or misplacements of regular structures. In order to account reasonably for deviations in monstrous humans, observers required a thorough knowledge of healthy anatomy, as is illustrated by the following excerpts from Claude-Nicolas LeCat's description of a monstrous human foetus in 1767:

> These two hydatide bags were behind that represented in Fig. 2 which I took for an imperfect eye, because

> it was transparent, and surrounded by teguments not unlike eyelids . . . Under this kind of parenchymatous substance, which was white and glandular, was a muscular mass, more considerable and conspicuous than one could well have expected in such a subject. It doubtless consisted of the occipital and perhaps frontal muscles, drawn towards each other . . . Thus, there was neither jejunum, or duodenum, or stomach, or any liver properly speaking: for that, which I found in the place of it, was a red viscus, and of the conglomerate kind, like the kidney in a foetus . . . I opened it, and was more and more convinced that it was rather a kidney, or knot of renal glands, than a liver, although it was one mass, and placed in the midst of the intestines; it had still less the resemblance of a heart, having no cavity, no vessels, or any muscular fibres.[49]

Being doctors, these investigators were interested primarily in the medical implications of monstrous births. They inquired into such questions as how anatomical deficiencies affected life processes, to what extent health was impaired by malformations and how various cases of monstrosity might be treated. Moreover, many cases which had previously been designated "monstrosities" were redefined as particular disease conditions. In an article submitted to the Royal Society in 1791, for example, Everard Home suggested that certain excrescences of the human body were symptomatic of disease, and not of monstrosity. As he explained:

> . . . I have been induced to lay before the Royal Society the following account of a disease which occurs sometimes in the human body, very remarkable in its effects, but very little understood as to its cause; namely, the production of an excrescence similar to a horn. So curious a phenomenon has naturally attracted the attention of the ignorant as well as the philosopher; and the individuals who have had the misfortune to be subject to this disease have been considered as monsters.[50]

Similarly, John Abernethy discusses the case of a child with an apparently monstrous skin condition, arguing that it is more

properly understood as a symptom of disease, amenable to treatment and cure. According to the child's mother, Abernethy reports, the deformity resembled the entrails of a pig, by which she had either been frightened or disgusted during her pregnancy. Abernethy himself, however, prefers to see this deformity as a disease, most probably, he suggests, "an aneurysmal enlargement of the vessels, in consequence of their anastomoses."[51] As monsters were medicalized in this way, and conceived more as cases of disease than as curiosities, investigators required a specialized medical knowledge to enter into discussions of the subject at all. Their work subsequently became inaccessible to those who could not boast sufficient expertise.

At the same time that "science" was becoming more closed to people with unspecialized knowledge, so there was an effort among scientists to segregate their activities from the uninformed multitudes. Of the three famous natural history collections in the second half of the century, for example, the anatomical exhibits of Brookes, William and John Hunter, only qualified medical men, scientists and occasionally "noble" men of learning were admitted. Similarly, though the British Museum was to be open to the people, the trustees maintained that the museum's main purpose was to promote science and the arts, and "not to cater to the curiosity of multitudes in quest of amusement." In an effort to discourage the "riff-raff," they limited entry to those who had gone through the rather exacting process of reserving tickets of admission.[52] Regarding the open policy of the museum as dangerous, one of the trustees voiced his opposition

as follows:

> a general liberty to ordinary people of all ranks and denominations is not to be kept within bounds. Many irregularities will be committed that cannot be prevented by a few librarians who will soon be insulted by such people . . . If any such people are in liquor or misbehave, they are rarely without their accomplices, . . . who out of an Idle vanity in exerting what they will call their liberty will side with them and promote mischiefs . . . No persons of superior degree will care to come on such days.[53]

Apparently, the learned wanted to keep well away from the mob whose unrestrainable passions posed a threat to the reasoned pursuits of the scientific community.

Given this growing trend towards professionalization then, it is not surprising that various popular theories of monstrosity were targets of derision in scientific circles. In the case of maternal imagination, it struck learned investigators as decidedly unscientific and, in fact, functioned for them as something of a polemical tool in their larger effort to set themselves apart from the ignorant. Indeed, part of Cooper's rationale for denying the theory was that it was "vulgar." What made it vulgar, moreover, was that it represented a way of knowing which relied too heavily upon the senses--and more specifically upon mere appearances. For scientists such as Cooper, who concerned themselves with the <u>invisible</u> principles and the concealed reality of things, such interpretations did not constitute real knowledge. For there was, they believed, often a discrepancy between what appears to be and what is. While some monstrous formations may have loosely resembled various objects or animals that the mother had seen, this did not mean that there was any causal relation between the two events. In fact, since monsters

were governed by the same kinds of principles which operated in all vital phenomena, scientists found it increasingly difficult to imagine how there could be any relation between the two. Monsters, it was true, appeared to be highly irregular, and segregated from nature's ordinary works. But scientists adopted the view that what seemed to be was not, in actuality, so, since in reality there simply was no "disorder." Certainly, scientists were struck by the oddity of monstrous formations and continued to describe them as remarkable and surprising deviations. But according to the scientific point of view, monsters were not cases of subverted natural law, and hence, did not constitute entertaining spectacles of curiosity or wonder.

Perhaps the most patent generalization which can be made of the period between 1750 and 1800 is that it was a time of intense activity and transition in the study of monstrosity. In the preceding analysis, I have suggested various currents of change which were working at the time to transform the way in which monsters were investigated and understood, and in general, these may be comprehended in terms of three broad trends. Firstly, with respect to the people who studied monsters during the period, they were becoming increasingly conscious of themselves as an elite group of professionals, differentiated from popular and amateur elements by enlightened knowledge and thought. Besides the fact that they shared a specialized knowledge of anatomy and physiology, what made these investigators a coherent group was that they saw themselves engaged in a common project to objectify monstrosity, and this in the interests of extracting genuine knowledge from the massive conglomerate of information on the

subject. To know monstrosity, they assumed, meant to reduce it to an object of pathology, to eliminate all that which did not bear upon the generation of authentic knowledge. Insofar as it recognized the legitimacy of nonobjective forms of knowledge, popular "wisdom" came to be seen as a form of intellectual delusion, essentially antipathetic to the aims of science. The result was that the study of monstrosity, rendered inaccessible to non-experts, became increasingly alienated from the world of popular response and understanding.

Secondly, at the same time as the study of monsters was becoming more professionalized, scientists were also bringing a number of new conceptual principles to bear on their researches into monstrous births. In reading the accounts of various scientists of the period, one is immediately struck by how conceptually dissimilar they are from those of the early eighteenth century. What seems to have occurred is something in the way of a "grammatical" transformation, a change, that is, in the underlying rules which conditioned thinking about monstrosity. Most prominently, while early eighteenth-century studies were organized around the principles of structure and visible form, those of the latter part of the century were centrally informed by the concept of function. To later scientists, the structure of a part was, in itself, incomprehensible, except in relation to its use in the organism. Thus, when they compared the anatomical structures of different animals, it was according to the criterion of internal function rather than external form. Above all, their concern was with elucidating the principles of the <u>internal</u> economy.

As scientists accorded an increasingly prior role to functional considerations in their studies of the living world, the notion of monstrosity was substantially altered. Just as structural variation could no longer serve as the primary taxonomic criterion for differentiating living things into species, neither could it serve as the standard for segregating monsters in a separate category on the fringe of the natural order. For Hunter's contemporaries, in fact, monstrosity was not so much a taxonomic concept as it was a physiological one. This meant that they did not see monsters as unclassifiable and singular irregularities, which were visibly, and hence, qualitatively distinct from all other animals. Rather, they were seen as pathological deviations from a norm, subject to the same laws as all other living things and thus essentially <u>like</u> other beings save for certain quantitative deviations. Nature, it was assumed, was a homogeneous order, uniformly regular in normal operations and no less so in the production of monsters.

From this, it is clear that the subject of monstrosity was becoming progressively detached from its conceptual base in natural history. There was growing dissatisfaction among scientists with the methods which had previously guided researches into monstrous births. To compile descriptions of monsters, for example, was construed as unproductive. Similarly, having scaled down the range of concerns and responses considered appropriate, later investigators tended to refrain from the kinds of subjective commentary which had characterized earlier writing on the subject. As they were considered in relation to the science of physiology, monsters were regarded in a much more objective manner, as path-

ological specimens, significant to science only to the extent that they contributed to the knowledge of life.

Finally, these modifications in the study and meaning of monstrosity had significant repurcussions on the scientific discourse concerned with the origin of monsters. Specifically, there were a growing number of scientists towards the end of the century who refused to accept the authority of accidentalist theories of monstrosity. Primarily, I think, this was because the idea of external accidental forces acting directly upon the embryo was not easily reconciled with the regularities which were seen to operate not only in monstrosities but in all of Nature's productions. Impressed by this invariable regularity, many scientists suggested that the more intelligent line of reasoning to follow in explaining monsters was originalism. To locate the origin of monstrosities in the first formation of the embryo was an interpretation consistent with the prevailing view of nature as a homogeneous order, and in keeping, too with various contemporary observations of monstrous phenomena (i.e. that malformations occurred in systematic patterns, that they were occasionally inherited, that there were species of monsters). The question of <u>why</u> nature should permit such deviations to occur, so highly problematical to earlier investigators, did not seem to strike later scientists as legitimate grounds for doubting the strength of originalist interpretations. The possible purpose of monsters in the natural economy was, in fact, a topic of discussion seldom raised in their writings.

In considering the character of later eighteenth-century studies in monstrosity, it is possible to identify many features which were to become more pronounced in the nineteenth-century science of teratology. The heightened sense of professional exclusiveness among scientists, the attempt to objectify monsters and the tendency to define them as regular pathological deviations--all of these were characteristic of teratological studies in the nineteenth century. In light of such apparent consistencies, one could argue that the work of later eighteenth-century investigators is best placed within the context of "modern" science. Certainly, Philip Ritterbush so interpreted John Hunter's work, when he designated Hunter as among the "first of the modern biologists."[54]

Modern as they may seem, however, I think that it is mistaken to understand late eighteenth-century works as constituting the beginnings of teratology; firstly, because scientists working at the time did not define themselves as teratologists, and secondly, while those who wrote on teratology in the nineteenth century expressed a general regard for the empirical spirit of later eighteenth-century science, they did not treat writings from that period as immediately relevant to their own researches. Indeed, the papers which such scientists as John Hunter, Matthew Baillie or Everard Home published on the subject of monstrosity were rarely, if ever, discussed in teratological writings of the early 1830's. Apparently, teratologists did not feel deeply intellectually allied with such writers.

What this suggests is that later eighteenth-century

investigations into monstrosity, though they had much in common with teratological researches, were incompatible, in some essential way, with nineteenth-century views of abnormality. The basis for this incompatibility, I think, was that late eighteenth-century scientists did not understand monstrosity as a historical phenomenon--as a series of complex organic events, that is, originating within the organism at some time during its developmental history. This was a premise fundamental to the science of teratology, but one quite foreign to eighteenth-century theories of monstrosity. According to nineteenth-century thought, each living organism was the physical realization of an internal plan of development and organization. All the attributes of the organism were seen as interdependent parts of a dynamic system, and life was a purposive, self-regulating process originating in and inseparable from organization itself. The origin of this system, it was understood, was the embryo, the first of a succession of determinate organic events from which the adult form would slowly emerge. To understand an organism, whether anomalous or normal, therefore, it was necessary to refer to its organic history.

Late eighteenth-century scientists, on the other hand, did not refer to the laws of embryological development in order to account for the origins of monstrosity. Nor did they understand life in precisely the same historical terms as did later scientists. John Hunter, for example, though he regarded life as self-regulating, did not see it as solely dependent upon an internal plan of organization. On the contrary, for Hunter, life depended ultimately on some special vital principle or force "super-

added" to the animal body, a view which tended to leave some role to God in explanations of vital phenomena. In Hunter's work there is, in fact, a certain intellectual tension: certainly his investigations in comparative anatomy and his view of disease was modern in the sense that he defined disease as an internal malfunction originating within the vital system; at the same time, however, he maintained a definition of life which, in its insistence upon the role of certain external principles, places his thought in a pre-modern context. This, I think, makes it impossible to locate his investigations of monstrosity within the nineteenth-century study of teratology. For while he--and most of his contemporaries--did attempt to include monstrosity in the science of vital function, they did not understand it according to the same laws of development and organization which were to dominate nineteenth-century thinking about life and abnormality. Indeed, though Hunter insisted that monstrosity was a law-like phenomenon, he did not regard it in relation to a developmental embryology, and hence did not attempt to explain what the specific laws of monstrosity might be.

NOTES TO CHAPTER TWO

[1]John Clarke, "Description of an extraordinary Production of Human Generation, with Observations," PTRS 83 (1793), pp. 157-8.

[2]John Hunter, Essays and Observations on Natural History, Anatomy, Physiology, Psychology and Geology, 2 vols., ed. R. Owen (London: John Van Voorst, 1861), I, p. 249.

[3]James Palmer, ed., The Works of John Hunter, 4 vols. (London: Longman, Rees, Orme, Brown, Green and Longman, 1837), I, p. viii.

[4]Stephen Cross, "John Hunter . . . and Late Eighteenth-Century Physiological Discourse," p. 11.

[5]Hunter is said to have haunted Charles Byrne, for example, (shown during the 1780's as the "Irish Giant") with such persistence that Byrne was driven to extreme measures to ensure that his bones would be properly buried after his death. He arranged for his remains to be thrown into the sea to foil Hunter's plans to preserve his skeleton, but legend has it that, in the end, Hunter bribed the undertaker a large sum of money for the body. Whatever the "true" details of the story, Hunter did succeed in procuring Byrne's bones and promptly put them on display at the Royal College of Surgeons, where they could be viewed by scientists only.

[6]quoted in John Kobler, The Reluctant Surgeon: A Biography of John Hunter (New York: Doubleday, 1960), p. 106.

[7]Palmer, The Works, I, p. 148.

[8]Ibid., p. 156.

[9]William Coleman, Biology in the Nineteenth Century: Problems of Form, Function and Transformation (New York: John Wiley and Sons, 1971), p. 18.

[10]Palmer, The Works, I. p. 211.

[11]Ibid., p. 219.

[12]Ibid., p. 220.

[13]James Johnston, "A History of a Foetus born with a very imperfect Brain," PTRS 57 (1767), p. 120.

[14]Clarke, "An Extraordinary Production," pp. 157-8.

[15]William Lawrence, Lectures on Physiology, Zoology, and the Natural History of Man (London: James Smith, 1823), p. 369.

[16]Charles Pears, "The Case of a full grown Woman in whom the Ovaria were Deficient," PTRS 95 (1805), p. 225.

[17]Ibid., p. 227.

[18]Alexander Monro, "Description of a Human Male Monster, illustrated by Tables, with Remarks," Royal Society of Edinburgh Transactions 3 (1794), p. 227.

[19]Clarke,"An Extraordinary Production," p. 159.

[20]Anthony Carlisle, "Account of a monstrous Lamb," PTRS 91 (1801), p. 142.

[21]Benjamin Brodie, "Account of the Dissection of a Human Foetus, in which the Circulation of the Blood was carried on without a Heart," PTRS 27 (1809), p. 161.

[22]William Lawrence, "Account of A Child Born Without a Brain, which Lived Four Days," Medico-Chirurgical Transactions 5 (1814), p. 170.

[23]Carlisle, "A monstrous Lamb," p. 139.

[24]Johnston, "History of a Foetus," p. 120.

[25]Clarke, "An Extraordinary Production," p. 157.

[26]Ibid.

[27]William Hunter, "Three Cases of Malconformation in the Heart," Medical Observations and Inquiries 6 (1758), p. 305.

[28]John Abernethy, The Surgical and Physiological Works (London: Longman, Hurst, Rees, Orme and Brown, 1825), p. 9.

[29]John Hunter, Catalogue of the Contents of the Museum of the Royal College, Parts V and VI (London: Richard Taylor, 1831), p. 127.

[30]Hunter, Essays and Observations, I, p. 239.

[31]John Hunter, "Account of an Extraordinary Pheasant," in Observations on Certain Parts of the Animal Oeconomy (London: Nicol and Johnson, 1786), p. 63.

[32]Ibid., p. 64.

[33]Hunter, Essays and Observations, I, p. 248.

[34]Matthew Baillie, "An Account of a remarkable Transposition of the Viscera," PTRS 78 (1788), p. 363.

[35]Ibid., p. 362.

[36]Ibid.

[37]Ibid.

[38]Hunter, Essays and Observations, p. 240.

[39]Ibid.

[40]Fisher, "Maternal Mental Influence," p. 262.

[41]Cooper, "An Extraordinary acephalous Birth," pp. 317-19.

[42]Ibid., pp. 319-20.

[43]Hunter, Essays and Observations, p. 243.

[44]Ibid.

[45]Ibid., p. 246.

[46]Cooper, "An Extraordinary acephalous Birth," p. 318.

[47]quoted in Altick, The Shows of London, p. 22.

[48]quoted in Ritterbush, Overtures to Biology, p. 63.

[49]Nicolas Le Cat, "A monstrous human Foetus," PTRS 57 (1767), pp. 5-7.

[50]Everard Home, "Observations on certain horny Excrescences of the Human Body," PTRS 81 (1791), p. 95.

[51]John Abernethy, Surgical Observations (London: Longman, Hurst, Rees, Orme and Brown, 1810), p. 266.

[52]quoted in Altick, The Shows of London, p. 26.

[53]Ibid., p. 26.

[54]Ritterbush, Overtures to Biology, p. 186.

# CHAPTER THREE

## ORGANIZATION, DEVELOPMENT AND THE SCIENCE OF ANOMALIES

> . . . without a constant reference to the history of foetal development, the exact nature or anatomical structure of malformations cannot be fully understood. . .
>
> -- Allen Thomson, 1844[1]

Although one may discern much that was "scientific" in later eighteenth century investigations into monstrous phenomena, it was only in the fifty year period between 1800 and 1850 that the study of monstrosity became "a science" in its own right. During that time, Isidore Geoffroy Saint-Hilaire published his three volume work, Histoire Générale et Particuliére des Anomalies de L'Organisation chez L'Homme et les Animaux, ou Traité de Tératologie (1832-36), the first comprehensive study devoted to the scientific principles of monstrosity. Though it drew mainly on the recent researches of French and German scientists, Saint-Hilaire's work accorded well with prevailing English theories of life and deviation, and in fact, came to function for English scientists as something of a textbook on monstrosity. In it, Saint-Hilaire touched upon every conceivable issue concerning monstrosity--from classification and history of the science to an analysis of popular beliefs. Most significantly, he set forth the organic laws of malformation as it occurred throughout the living world, and advanced rational explanations for the causes of monstrosity in the organism's embryonic history. It was in this work, too, that he first coined the term, "teratology,"

(from the Greek, "discourse" on "monsters") to denominate that branch of science concerned with organic malformations.

Between 1800 and 1850, English scientists wrote extensively--and variously--on monstrous phenomena. Medical journals of the time contain numerous reports of monstrous births, some strictly descriptive in nature, and submitted for the most part by doctors who apparently felt a professional responsibility to inform the scientific community of any cases of malformation which they encountered. Many other investigators, in keeping with earlier methodologies, referred to cases of monstrosity as useful comparative specimens, purely in the interests of clarifying particular physiological issues. At the same time, however, there were those like William Lawrence or Allen Thomson who manifested an interest in the subject of monstrosity for its own sake, and who, in casting the problem in its theoretical form, endeavoured to acquaint readers not with a particular specimen of monstrosity, but rather with the general laws which governed in the production of all cases of physical abnormality. Among these authors, there was a shared base of knowledge, and a shared sense of contributing to the advancement of a particular discipline. Moreover, in their discussions of malformation, they drew consistently on a revised vocabulary--that of "organization," "development," "anomaly," "abnormality," and embryological "disorder." By the middle of the nineteenth century, then, teratology had become not merely scientific, but in one doctor's words, "a distinct branch of science," a science "characterised by special and peculiar facts, and regulated by laws," and one to which all questions of monstrosity were subsequently referred.[2]

To understand the appearance of teratology, it is necessary to consider it as part of a much larger transformation in the study of life which occurred at the end of the eighteenth century. Recently, there has been much discussion concerning the nature of that transition, and though the issue of how it might best be analysed remains controversial, there is general agreement among historians that the "questions men were interested in and the types of explanations they were prepared to accept" changed significantly at that time.[3] According to Michel Foucault, such modifications in explicit scientific discourse were symptomatic of a deeper revolution in thinking, or of what he terms an epistemic break, in which "one deep organizing mode of thought, the "taxonomical," was giving way to another, the "organic-historical."[4] It was this epistemological transition, in Foucault's view, which permitted the constitution of "life" and contemporaneously, the appearance of biology as the science of life. Without denying the possibility of other types of analysis, I would argue that it was this same transformation which permitted the constitution of "abnormality" and the appearance of teratology as well.

If, as Foucault argues, life did not exist in the period from 1650 to 1800, it was because the central concepts of biology, and most particularly, the notions of organization and development, were unavailable to previous natural historians, whose interest was focussed on the external properties of living things and upon the representational arrangement of species in a "scalar, unidimensional hierarchy" of beings.[5] During the second half of the eighteenth century, however, as evidenced in Hunter's work

in comparative anatomy, there was a growing concern with the idea of animality itself, as it was revealed in the interior structures and functions of all varieties of being. By the early nineteenth century, there were a number of scientists who, following Cuvier's lead, considered animal life "far too complicated" to be constrained in terms of a single definition or vital quality; it was no longer reducible to a principle "superadded" to the assembly of structures and organs in the animal body. On the contrary, life was seen as a property of the whole organism and the result of a number of interacting organic processes. It was, in other words, a complex expression of the essential interior processes of a living creature and constituted by the internal laws of organization. Thus, according to William Lawrence, one of the first English proponents of Cuvier's new science of organization, the study of biology had as its object "the various forms and phenomena of life, the conditions and laws under which the state exists, and the causes which are active in producing and maintaining it."[6]

Central to this notion of life, and a dominant metaphor in nineteenth century thought in general, was the concept of organization. According to Francois Jacob, organization came to function in biological thought and appeared increasingly in explicit scientific discourse as "a structure of a higher order to which all perceptible properties of organisms were referred." As he says:

> Form, attributes and behavior all became expressions of organization. By its organization the living could be distinguished from the non-living. Through organization organs and functions joined together. Organization assembled the parts of the organism into a whole, enabled it to cope with the demands of life and inspired forms throughout the living world.[7]

In Lawrence's view, life was "immediately dependent, physiologically speaking, upon organization."[8] In short, life was purposive, its object being to exist and to engender existence; it was conditioned, in that it had continually to respond to external "circumstances;" it was self-regulating, in the sense that each living thing had a plan of development originating within its organization; and finally, inasmuch as organs were "developed, perfected, modified, decayed and destroyed" according to this internal plan, life was historical.

The insistence on the historicity of life was a prominent feature of biological thought in the nineteenth century and one which clearly differentiated "modern" biology from the work of "classical" scientists. Indeed, perhaps the most striking change which took place in the life sciences toward the end of the eighteenth century was the replacement of cyclical or static views of nature by a more historical mode of thinking. From the early 1800's, scientists concentrated their attention less on the conditions of being than on the processes of "becoming." Insofar as it was perceived as part of a dynamic process, any given individual existence came to be defined primarily by what had preceded it. For scientists such as Geoffroy Saint-Hilaire or William Lawrence, in fact, a knowledge of life could not be other than historical, and hence the concept of development became, along with organization, an essential constituent of biological science.

Nowhere in biological thought was this developmental philosophy more clearly revealed than in the theory of epigenesis, which, in the early nineteenth century, supplanted preformation

as the most widely adopted interpretation of foetal development. Though the specific processes and causes of development remained issues of contention throughout the nineteenth century, by the 1820's, the embryological researches of various prominent scientists--C.F. Wolff, J.F. Meckel, Etienne Serres, Geoffroy Saint-Hilaire--had firmly established the reality of individual development as opposed to the preformationist insistence on mere augmentation. By then, there was general agreement within the scientific community as a whole that the theory of preformation, in Lorenz Oken's words, "contradict[ed] the laws of nature's development."[9] Behind this unequivocal rejection of preformation was a denial of generation as a simple productive event, for according to epigenetic logic, the irrefutable facts of generation were "process" and "complexity." Or, as William Coleman explains:

> Epigenesis defines organic development as the production in a cumulative manner of increasingly complex structures from an initially more or less homogeneous material (the fertilized egg). An adult organism is thus produced in epigenetic terms by a sequence of ever-new embryonic formations, each formation building on those that went before and the whole emerging from the undifferentiated fertilized egg. Generation, then, must include not only the reproductive act (essentially, fertilization) but will also embrace that vast complex of events that carries the developing organism from egg to adult.[10]

In focussing upon just those events, and most importantly, in comparing the embryological processes of various animal species, nineteenth-century scientists were deeply impressed with the tremendous developmental unities which were seen to exist "even between creatures far removed from each other in the scale of being."[11] Certainly for Geoffroy Saint-Hilaire and his followers, the single most important truth of biology was the "unity

of organization," the "symmetry of design" which pervaded the animal kingdom. As Stephen Gould suggests, this belief in the unity of nature and its laws "penetrated everywhere" and led quite naturally to the widespread view that the animal kingdom itself was an organism, in a continual state of development from simple to more complex states of organization.[12] A particularly explicit expression of this organic vision was offered by J.F. Meckel, an early advocate of recapitulation, who argued that "the development of the individual organism obeys the same laws as the development of the whole animal series; that is to say, the higher animal, in its gradual development, essentially passes through the permanent organic stages that lie below it."[13]

It was the reorientation of biological thinking around this organic-historical notion of life which, in conceptual terms, made the science of teratology possible. Investigators began to speak of the scientific laws of monstrosity only as thinking about malformation became dominated by the biological concepts of organization and development. According to William Lawrence, for example, probably the first English scientist to apply continental ideas of organization to the problem of monstrosity, monsters or "aberrations of the formative process," must be referred "to the same general principles as the other deviations from the healthy execution of functions," and understood according to "the common rules applying to organized beings."[14] For John North, monstrosity was scientifically comprehensible only in reference to organization, for as he said, "the laws governing the production of these anomalies must be derived from the general laws or principles of organisation."[15] Similarly, in

Geoffroy Saint-Hilaire's view, it was only after all the other branches of the "great science of organization" that teratology was "born."[16] Before a true science of monstrosity could be contemplated, he argued, it was necessary that the laws of organic formation and the general facts of animal organization (considered in all species and ages) be revealed. Such, Saint-Hilaire suggested, was the immense accomplishment of comparative anatomy, which, by relating adult with embryonic forms and by comparing animals with the adult and embryo of various species, had given rise to the theory of "unity of organic composition," the first and most important law of teratology. What this law affirmed was that all animals were formed according to common processes and a common plan. To understand any given formation, therefore, and certainly to understand monstrosity, it was necessary to refer to the organism's developmental history. According to John North, for example, "for many ages, thousands upon thousands of cases of monstrosity were collected, but in order to understand their origin, it was absolutely necessary to know the true laws of the original development of the various organs in the human subject."[17] Similarly, for Allen Thomson, a noted nineteenth-century embryologist, it was unnecessary to

> adduce proofs of the importance of a knowledge of the laws of foetal development to the Teratologist, for it is now almost universally admitted, that every successive step which has been made . . . in the investigation of the formative process of the embryo, has tended to remove some part of the obscurity which belongs to the history of malformation. An extended and careful observation of these malformations themselves has shown that, notwithstanding their vast number, the same or similar forms so frequently return, that they may readily admit of classification; and a comparison of these forms with those assumed by the same parts of the embryo, at different early stages of its formation and development,

> have pointed out so many obvious resemblances between them, as to demonstrate, that, without a constant reference to the history of foetal development, the exact nature or anatomical structure of malformations cannot be fully understood, and consequently their different forms cannot be so accurately distinguished, as to admit of their being classified upon scientific principles.[18]

These revised biological views had immense repercussions on theoretical discussions concerning the origins and causes of monstrosity. Most importantly, they led to the establishment of the theory of arrested and excess development, which, as its name implies, defined monstrosity in purely quantitative terms, as cases of deficient or excessive organic development. There was much discussion among teratologists concerning who the first theorist of developmental arrest was. Some noted the influence of Wolff, Haller or Serres, and others cited J.F. Meckel as its official "founder." According to Allen Thomson, for example, the first suggestion of the theory

> may be due to Harvey, but [it] can only be said to have been distinctly stated as a general principle by Haller and C.F. Wolff. The last, Meckel, however, must be regarded as the chief founder of this view, for it is to his labours more than to those of any other single observer, that it owes the scientific shape it has in modern times assumed, and its general adoption by physiologists.[19]

The concern with attributing credit for the origins of particular theories reflects a distinctively nineteenth-century philosophy about the way science works. However, I would suggest that the theory of arrested development is best understood as a natural consequence of a particular constellation of biological ideas; the question of who initiated it is not only ultimately unanswerable, but also of secondary importance. What is more important is that it constituted a creative application of the

current notions of organization and development to the problem of monstrosity. Indeed, as G. Fisher claimed, it arose from the meeting of comparative anatomy and embryology, and not from any single act of genius:

> Comparative anatomy was brought to the aid of general and descriptive anatomy. The maturely and normally developed human body was compared with the embryo; the various species of organized beings and their embryos were compared with man, and as a result we became acquainted, on the one hand, with the intimate structure, composition and science of the human body, and on the other, with the general facts, plan and unity of animal organization, including all its multiform genera and species, in every age. On these comprehensive views a new theory of anomalies and monstrosities was founded, viz: that of arrest and retardation of development . . . [20]

The novelty of developmental arrest lay in the fact that it defined monstrosity not so much as an anomaly of form or function, but primarily as an anomaly of development. The basic tenet of the theory was that monsters represented disease conditions resulting from an abnormal retardation, or sometimes from an excess, in normal epigenetic development. In his essay on monstrosities, John North explained the theory in particularly concise terms:

> All the organs are formed at various parts of the growth of the ovum. At first each organ is extremely minute, extremely simple; and each afterwards passes through a series of changes in the process of development. When the different organs have arrived at their permanent and natural state, some of them have passed through a greater number of changes than others, and have deviated from their original conformation more than others. In some, the changes are few and unimportant; in others, they are numerous and important. This is the normal, but not the invariable law of development, for an organ may stop or be entirely abortive; or, on the contrary, it may exceed it, and thus arise the two great classes of monsters--one from arrest of development, the other from it excess . . . According to the law which admits the formation . . . of organs, monsters from arrest of development may be considered as permanent embryos . . . We see at the end of their intrauterine life some of

> the organs in the simple state in which they were at first formed.[21]

Developmental arrest was an immensely successful and influential idea, and one which struck nineteenth-century scientists in England, as well as in France and Germany, as a convincing explanation for many of the observed cases of malformation. As Allen Thomson observed in 1844:

> Almost all teratologists are now agreed in referring a considerable number of malformations by defect to the occurrence of an interruption or arrest, as it has been termed, of some of the steps of natural foetal development . . . No one who professes any acquaintance either with embryology or with the various forms of malformation can have failed to be struck with the remarkable resemblances between some of these malformations and the transitory conditions presented by the embryo or some of its parts in different stages of its development.[22]

By the 1830's, developmental arrest was the most widely cited explanation for monstrosity, and in fact came to function not merely as a theory but as one of the irrefutable principles upon which teratology was built.

Implicit in the theory of developmental arrest was the notion that Nature "does nothing undesignedly,"[23] that "even malformations are governed by certain regular, definite and symmetrical laws."[24] Indeed, one of the major objectives of nineteenth-century teratologists was to articulate the fundamental "laws" of teratology, and along with developmental arrest, various other axioms were advanced as the basic governing principles of monstrous development. In general, it is possible to identify four major "laws" which were generally accepted:

1. The unity of organic composition: Intrinsic to both biological and teratological theory, the law of organic unity referred to the deep organizational symmetry which was seen to

pervade the animal kingdom. It was probably the most commonly alluded to principle in teratological writings. In a concise statement of this "first and most important law" of teratology, John North explained simply that "the organs of animals are composed of precisely the same materials, are always essentially the same, and are combined according to definite rules."[25] Commenting on the same principle, A.M. Adam wrote:

> Transcendental anatomy has shown us that throughout the whole of the animal kingdom unity of organisation is the great principle governing the development of species. After the model of a great archetype or types all animals are fashioned; and although their various species present many distinct generic characters and great structural diversities, the unity of organic formation which has presided over their development gives rise to many very striking and unexpected analogies . . . In the various stages of their development the higher animals present transitory organic resemblances, more or less striking, to others which are lower; and the inferior animals again . . . are but the permanent embryos of species which are higher. A remembrance of these facts will enable us all the better to understand teratological phenomena in general . . . [26]

The importance of this principle lay in the fact that it rendered all species of malformation open to scientific explanation, and in so doing, provided rational grounds for the total naturalization--and demystification--of monstrosity. Most specifically, it enabled scientists to account for the resemblances of human monstrosities to various animal formations, a phenomenon which, in the past, had led to a wide range of theoretical conjecture, from hybridization and divine interference to maternal imagination. However, according to A.M. Adam:

> Many of the malformations of the human embryo are analogous to the normal conditions of some of the lower animals,--arrest or disturbance of its development having occurred at a period when the foetus presented some of the specific transitory organic similarities to which I have alluded. The shortened

> limbs and deficient arms of the malformations called phocomeles resemble the condition of the extremities in seals and certain cetacea; a duplex uterus, a cloacal fissure, and a small-sized brain approximate the deformed embryo to the characters of the rodentia; and diaphragmatic incompetency is analogous to the normal organisation of oviparous animals. These resemblances of the malformed foetus to some of the lower animals have been, by the vulgar, attributed to the effects of some impressions made on the maternal imagination during pregnancy . . . rather than to accidental and mysterious circumstances arresting the growth of the embryo, and thereby giving permanence to certain of its rudimentary conditions.[27]

For John North, "organic unity" clearly demonstrated that there was nothing in monstrosity which could not be explained by the laws of organic formation. As he explained:

> By this law of unity of type in the formation of animals . . . we are enabled to explain the resemblance that is so frequently traced between the anomalous formation in one race of animals, and the natural form in others. Nothing is more common than to find that the anomalous structure of monstrous formations, in man for example, represents accurately and definitely the natural structure in other animals. According to this law, every animal in whom there has been an arrest of development, ought to realise, in some of its organs, the condition that is met with among the inferior classes; and such is the case. Again, when there is an excess of development, then we find the same resemblance between the animals which are the subjects of it, and some beings that are higher in the scale. This is occasionally found, but it is not so common as are examples of the human family resembling lower races, in consequence of deficiency.[28]

To illustrate these processes, North provides numerous examples:

> Many of the monstrous formations in man, consequent upon an arrest of development, bear a marked resemblance to different mammalia. For example, the persistence of the tail, the characteristic of mammalia. In the early stages of the human embryo there is a natural prolongation of the os coccygis, which is neither more nor less than a tail, and which is usually removed in the process of development . . . In the process of embryonic life the tail ought to be removed; but if any circumstance takes place in the early period of utero-gestation, so as to arrest or retard the

development of the embryo, the tail may remain.[29]

For North and his contemporaries, "organic unity" clearly demonstrated that malformations were not, as once believed, blind freaks of nature. As such, it offered definite proof for the fact of nature's all-pervasive regularity, and for Breschet's famous assertion that "nothing in Nature is monstrous."

2. The law of eccentric development: On the basis of the embryological research carried out by Serres and Geoffroy Saint-Hilaire, nineteenth-century teratologists adopted the view that development proceeds centripetally. As North argued, this was contrary "to the doctrine of Haller and all the physiologists of the eighteenth century," who supposed that "every vessel and every nerve, dividing more and more, proceeded from the heart and brain towards the surface."[30] According to the law of eccentric development, however, the "vessels and nerves are formed before the heart and brain." This meant that anencephaly, along with other conditions in which infants were born without principal organs, could be logically explained by the theory of developmental arrest.

So, too, in Adam's view, could developmental arrest account for those malformations arising from the "non-union" of parts. As he said:

> According to Serres' theory of "eccentric" development, the embryo is primarily formed from two lateral halves, and hence all the organs situated centrally, as the heart, uterus, bladder, etc., are originally double. Of the corresponding organs of the two halves, some are intended to be united, and others to remain distinct and double. Now should embryogenesis at this stage be disturbed, the future appropriate conditions of these organs may be totally disordered; and it is evident that, in such a case, the non-junction of parts which ought to be united, will as surely produce a

> structural malformation, as will the fusion of others destined to remain separate.[31]

3. The law of compensation or "organic balance": Various eighteenth-century investigators had noted the fact that, in most cases of monstrosity, malformations did not occur singly, but rather in conjunction with "corresponding derangements in other parts of the system." In teratological writings of the nineteenth century, this phenomenon was explained in terms of excessive or deficient nutrition in the developmental processes of the organism, by the law of "compensation." As North explained:

> Excess of nutrition in one organ is proved to involve the total or partial atrophy of another, and vice versâ. If one organ be preternaturally large, another is preternaturally small; or if one be preternaturally small, we find, by the same law of compensation, that another is preternaturally large.[32]

Similarly, according to A.M. Adam:

> . . . in the majority of instances [of monstrosity], the general law holds good, that the malformation of one part affects the development of others in a greater or lesser degree . . . It would seem as if, when defective development occurs in one part of the body, nature compensated for the atrophy by the increased growth of some other region . . . organic hypertrophy can only occur in utero, at the expense of the nutrition of some other part.[33]

Related to this theory was the idea that, since all malformations arose from an interference in the development of a normally-formed organ, "they never wholly lose their normal types." In other words,"however deformed a part may be, it never so completely loses its ordinary distinguishing characteristics as to defy recognition."[34] Thus, argues Adam, "the bones composing the anencephalic cranium, rudimentary and malformed though they be, are all severally distinct and capable of recognition

by the anatomist." Behind this explanation was a fundamental belief in order, and a concurrent denial of random chance in the development of monstrosities. In effect, this constituted a denial of the possibility of "monstrosity" itself, for, to the extent that all types of malformation were conceived as determinate deformities within a correlated organic system, there was no malformation which defied rational explanation.

4. The affinity of similar parts for each other: In arguing against accidentalist theories of monstrosity, it will be recalled that John Hunter had cited the tremendous regularities which seemed to govern in cases of double monstrosity. Nineteenth-century teratologists were no less struck with the fact that in such cases "parts of a similar kind were invariably attached to each other."[35] In his study of united twins, Geoffroy Saint-Hilaire deduced from this observation the generalization that "if two or more organs perfectly resemble each other, they seem to have a strong tendency to unite and approach."[36] Such "harmony of union," argued Adam, "was uniform and constant."[37] Thus,

> Arteries are never seen coalescing with nerves, nor the alimentary canal with the abdominal aorta; but in malformations by duplicity, the fusion always takes place between similar parts; sternum is united to sternum, vertex to vertex, pelvis to pelvis, and so on. And not only so, but in such cases the corresponding organs of the united twins are joined together; muscle corresponds to muscle with wondrous certitude, the nerves join nerves, and the arteries their fellow-vessels.[38]

According to North, this "affinité de soi pour soi" was a principle "constant and common to all monsters, and influenced all the facts of double monstrosity."[39] Moreover, it provided scientists with an absolute standard for assessing the truth of

various reports of double monstrosity. As North said:

> Knowing this fact, we can at once distinguish between true cases of monstrosity and those which are alleged to have been met with, but which really never occurred; we can distinguish between the fabulous monsters of by gone days, and those which really existed. Many cases of monstrosity recorded in former times were mere fables. In many such instances one head is represented as growing from the upper, the other from the inferior part of the body; the back of one was said to be attached to the belly of the other. No such cases, I believe, were ever seen. The law regarding the formation of double monsters is universal and invariable . . . [40]

Although the preceding description provides only a summary of the teratological laws which were recognized by nineteenth-century scientists, it suffices to illustrate both the prior role which teratologists generally attached to developmental theory in accounting for monstrosity, as well as their uncompromising insistence upon the regularity of monstrous phenomena. As malformations were perceived in relation to the laws of embryology, it became manifestly clear that they were restricted to certain determinate and recurrent types, and hence could be scientifically classified. The laws of embryology, argued Saint-Hilaire, in determining the number of phases of development of an organism, also determine the possible number of anomalies by arrest so that "only certain types of malformation"--in compliance with the laws of anomalous formation--"are possible."[41] Such malformations, it was acknowledged, recurred regularly throughout the animal kingdom. According to George Fisher, for example, there are "certain well marked teratical forms, which may be regarded as types, which have occurred among the lower animals, in common with man, without regard to species, nation, geographical location, or time, and which have been reproduced again and again."[42]

Impressed by this fact of invariable constancy, various teratologists concerned themselves with the problem of arranging malformations into defined classes, orders, genera and species, with each type objectively designated under its appropriate teratological title. And though scientists disagreed on the particulars of various systems of arrangement, there was universal recognition not only of the possibility but also of the necessity of establishing a scientific system of teratological nomenclature and classification.[43]

If developmental arrest provided a solid theoretical basis for explaining and classifying malformations, however, it did not dispel all the mysteries of teratological development. The one major question which remained "beyond the reach" of teratology was what triggered developmental arrests and excesses in the first place.[44] To account for the immediate causes of disturbances, various proposals were advanced, including disease, hereditary transmission, mechanical violence and the influence of some powerful "moral" emotion in the mother.

While those with specialized knowledge of embryology rejected the "photographic" theory of direct maternal imagination, it was generally admitted that the mother's emotional state, to the extent that it affected organic functions, might also influence foetal development in a more non-specific way. In an article published in The Lancet in 1840, for example, the author, an anonymous contributor, presented the following argument:

> Without holding the vulgar opinion which attributes all anomalies and monstrous developments to impressions made on the mind of the mother during pregnancy, and without for an instant admitting the possibility of the foetus assuming the exact representation of the object

> productive of fright, we may, I think, admit that sudden and strong emotions . . . may not be without effects on the development of the human ovum. Is it, indeed, not rational to suppose that the uterus, the irritability of which is so much exalted during pregnancy, as well as its contents, and the structures connected with it, should have their functions affected by a moral shock received by the great nervous centre?[45]

Similarly, Allen Thomson, though he was more inclined to trace arrests to some original condition of the germ, did not deny the possible effects of mind upon body: According to Thomson, sudden or violent changes in the functions of the mother, derangements of the general circulation, nervous affectations and other circumstances which tend to disturb the uterine functions, may be liable to occasion injury to the foetus, and any violent affectation of the mind of a pregnant woman, insofar as it tends to derange the bodily functions, may produce some effect on the nutrition of the child.[46]

Thomson was equally receptive to the feasibility of mechanical factors influencing development, and in fact, during the 1830's, performed a series of experiments, like those undertaken by Saint-Hilaire, to test the effect of various external forces upon the embryo:

> By placing eggs during incubation in unnatural positions . . . or by covering different parts of the shell with wax . . . , Geoffroy Saint-Hilaire found that he could . . . cause disturbance to the process of development . . . and that not unfrequently the mode of development of the embryo was . . . affected. In 1833 and 1834, I made several series of experiments of the same kind . . . and with a similar result . . . But these appearances . . . cannot be said to afford examples of more than a very limited kind of abnormal development, and are very different from those constant and now well-known forms of malformation which are generally ascribed to arrest of development. It cannot be denied, however, that the experiments of the Geoffroy Saint-Hilaires, and my own, illustrate in some measure, the extent to which some mutilations of the embryo may owe their origin to

mechanical causes acting during development. . .[47]

Such observations notwithstanding, however, the majority of cases of developmental arrest, Thomson surmised, indicated "an original disposition of the ovum or germ as the cause of their production."[48] The idea of certain germs being predisposed to malformation left a great deal unexplained, but it struck Thomson as a likely hypothesis, compatible both with developmentalism and with observations of the hereditary transmission of monstrosity. In any case, while the question of what precipitated developmental abnormalities was not (and has not since been) finally resolved, the theory of developmental arrest did at least provide teratologists with a rational means of explaining and classifying malformations. As Saint-Hilaire argued, the "ingenious theory of arrest," though it did not "illuminate the efficient causes of monstrosity," at least "threw light on its proximate causes," and if it "did not give us immediate means to explain malformations," it did provide the necessary "facts to understand their nature and formation."[49]

The establishment of these biological principles had very deep implications. Most obviously, they discredited, in a very decisive manner, the idea of monsters as irregular beings. In place of this view, asserted Geoffroy Saint-Hilaire, was substituted the "truer, more philosophical notion" of beings impeded in their development and in whom the organs of the embryo have been conserved until birth.[50] According to John North, "the theory of the frequent arrest and retardation of organic development"was the major factor in finally freeing the study of monstrosity from the errors of traditional belief: it "has led

to sound views and the great progress that has now been made in the subject of monsters, the phenomena having been formerly almost universally attributed to some accidental deviation from the track of Nature."[51] However, as he explained, an examination "of original development" has demonstrated that monsters are by no means contrary to Nature's laws, but regular pathological deviations in normal development. Thus, in placing anomalous appearances as abnormal events in embryology, developmental arrest gave to monstrosity the definite signification, not of subverted natural law, but rather, of disease. For, as Canguilhem pointed out, once the etiology and pathology of malformations were known, the anomalous was identified irrevocably with the pathological.[52]

Most importantly, implicit in the theory of developmental arrest was the view that everything in Nature occurred according to uniformly regular principles, and that, in conforming to the same natural laws, the pathological was in essence identical to the normal--and equally subject to scientific study. Indeed, to the extent that monsters were reduced to specimens of arrested or excessive development, they were rendered basically alike normally developed beings, the difference between them being restricted to a matter of quantity rather than kind. Through this denial of the authenticity of qualitative knowledge, the boundary between the normal and the abnormal, in being made to appear illusory, was effectively erased. According to Canguilhem, it was in the early nineteenth century that the real "identity of the normal and the pathological, apparently so different, and given opposing values by human experience, became a kind of

scientifically guaranteed dogma."[53] At that time, there was a general acceptance of the thesis that "pathological phenomena are identical to corresponding normal phenomena save for quantitative variations." This meant that the concept of monstrosity, once defined in qualitative term of structural "difference" became naturalized in the terminology of science as a determinate matter of measurable physiological "deviance." Ultimately, it was this quantification of abnormality which made it possible for teratologists to speak of the "great progress" that had been made in the study of monstrosity. For just as progress in knowledge of the physical world consisted in considering all movements as natural, that is, as conforming to the laws of nature, so too did "progress" in biological knowledge consist in unifying the laws of healthy life and pathological life.[54]

In the interests of reducing monsters to natural objects of pathology, a major aim of the teratological program in the nineteenth century was to restrict the study of monsters to an investigation based purely on objective and quantitative forms of knowledge. Certainly, this is apparent in the proliferation of statistical studies which were undertaken from the 1820's,[55] but nowhere is it more evident than in the designative language formulated by teratologists to discuss anomalous phenomena. The language of nineteenth-century scientists was, in fact, radically different from that of natural historians in the late seventeenth and early eighteenth centuries. In describing a case of conjoined twins in 1670, for example, Jacomo Grandi explained that

the twins were joined in such a way that they "seem'd to kiss one another;"[56] In 1810, Benjamin Gibson provided a much more objective description of a similar double monster, stating merely that "the lips came in contact."[57] Until around 1750, in fact, investigators spoke of monstrosity in a highly "expressive" language. Most often, monsters were described in terms of what Charles Taylor has called "subject-related properties," that is, "properties that things have in the experience of subjects, and which wouldn't exist if subjects of experience didn't exist."[58] In their reports of monstrous births, natural historians typically drew from a common set of adjectives--such as prodigious, wonderful, astonishing, amazing, surprising, amusing, terrible, frightening--all of which, in manifesting feeling, referred to the experience of subjects. Moreover, in describing particular malformations, they relied heavily on subjective impressions: one reads of a monstrous calf with a "Cerberus-like" tongue,[59] conjoined twins "holding each other, as in Loving-manner,"[60] a girl with fingers bent like Turkey's Claws,"[61] and a monstrous child with "Excrescences as if it were artificial Laces."[62]

At the same time, since malformations were not seen to recur in regular classes, there was little specialized vocabulary to designate particular kinds of monstrosity. If writers wished to confer exact information about the special characteristics of the monster in question, therefore, they were obliged to employ anatomical language (as in a monstrous child without a brain) or quantitative descriptions such as:

> the weight whereof was eight pounds and a quarter;
> the Circumference of the left head was about

> eleven Inches, that of the right being half an Inch less. The Circumference of the Trunk was about sixteen Inches and a quarter; and the length of both, from head to foot, was full eighteenth inches and an half.[63]

Other times, and most commonly, they employed metaphor to convey an image of a particular formation:

> It was not easy to think of any Sort of Skin, or natural Integument, that exactly resembled it. Some compared it to the Bark of a Tree; others thought it looked like Seal-Skin; others like the Hide of the Elephant, or the Skin about the Legs of the Rhinoceros; and some took it to be like a great Wart . . . The bristly Parts . . . looked and rustled like the Bristles, or Quills, of an Hedge-Hog. (1732)[64]

From around the middle of the century, and increasingly after the early 1800's, this kind of metaphorical language declined in favor of a much more objective and precise terminology. Indeed, if the scientization of monstrosity involved changes in scientific theory and conceptualization, it was also necessarily a linguistic "event," in which a designative language of teratology gradually assumed primacy over an expressive language of wonder in the order of scientific explanation. Writing in 1741 on the subject of Hermaphrodites, for example, James Parsons expressed dissatisfaction with the choice of words available to him, and so coined a more appropriate Latinate term, which would not only provide an efficient designation, but would also eliminate any extra-scientific meaning:

> As some Words are often repeated through the whole Essay, I could not avoid taking the Liberty of forming the adjective Word Macroclitorideus, which, tho' not in Use before . . . is highly necessary here for two Reasons; first, because it is a short Way of expressing what, in English, would be a considerable Sentence; and secondly, a much more decent Term . . . where the English word might be less agreeable.[65]

Certainly, among later eighteenth-century authors, Parsons' concern for objectifying the language of monstrosity is very evident. In the writings of scientists such as John Hunter or Matthew Baillie, it is most often objective anatomical description and not metaphor which serves as the standard form of describing monstrous specimens. A typical example is Matthew Baillie's account of a transposed viscera (1788) in which he writes:

> The liver was situated in the left hypochondriac region, the small lobe being towards the right, and the great lobe in the left-side. The ligaments uniting it to the diaphragm corresponded to this change, the right transverse ligament being longer, and the left being shorter, than usual. The suspensory ligament could undergo little change. . . the gall bladder was seen on the left-side preserving its proper relative situation to the great lobe of the liver, and the vessels of the portae were found to be transposed corresponding to the change of circumstances. The hepatic artery was found climbing up obliquely from the right towards the left, before the lobulus spigelii . . . The ductus communis cholidochus was on the left of the other vessels, being formed from the ductus hepaticus and ductus cysticus in the common way . . . [66]

In such accounts, the wonder adjectives characteristic of early eighteenth-century writing were seldom used to describe monstrous formations. Instead, investigators relied on a less expressive range of modifiers such as unusual, uncommon, imperfect or defective.

During the nineteenth century, these linguistic trends became even more pronounced. Convinced of the need to establish a one-to-one correspondence between word and referent, teratologists sought to formulate an exact, transparent terminology which would allow them to describe monsters not in terms of what they were like, but rather, in terms of what they were. There was, in consequence, a proliferation of new terminology to designate particular

malformations, as well as to name the hundreds of different species of monstrosity. In the case of double monsters, for example, Saint-Hilaire designated several recurring types, including Ensomphalia, Monomphalia, Sycephalia, Monocephalia, Sysomia, Monosomia, Heterotypia, Heteralia, Polygnathia, etc.[67] Similarly, in his lecture on monsters, John North enumerated a wide range of malformations and designated each according to its proper teratological label:

> Displacement of the brain is by no means uncommon, constituting hernia cerebri or encephalocele . . . Exomphalos, or umbilical hernia, may occasionally arise after birth . . . but generally . . . is a primitive malformation. The hair of the eyelashes is sometimes turned in at birth, constituting what is termed trichiasis . . . Irregular openings of the male urethra are by no means uncommon . . . Sometimes it opens at the upper part of the penis, constituting a species of malformation technically termed epispadias; at other times the opening is on the lower part of the penis, constituting another species of malformation, called hypospadias . . . [68]

In keeping with their efforts to demystify abnormality, teratologists avoided words like prodigy, wonder or curiosity and recommended cases of malformation as "interesting" or "instructive" "specimens" of "anomalous" or "abnormal" growth.

At the same time as the language used to describe monstrous phenomena was becoming more objective, the signification of the term, "monster" was itself in flux. It will be recalled that, throughout the seventeenth and early eighteenth centuries, monsters had been defined according to the twin criteria of structure and appearance. In other words, any apparent irregularities in structure, whether they occurred in animals, vegetables or crystals, constituted a monstrosity. Infused as it was with images of disorder and irregularity, the word carried a considerable

connotative load. Towards the end of the eighteenth century, various scientists began to challenge to traditional definition of monstrosity, and while the term remained ambiguous throughout the nineteenth century, its meaning was significantly restricted.

According to Matthew Baillie, for example, in distinguishing what was monstrous from what was not, structure in itself was no longer an accurate criterion. Commenting on the man with the transposed viscera, he argued:

> It is reasonable to think, that nature should follow some general plan in her operations. There is some effect which she has in view, and she will generally employ the same means to produce it. In the structure of any animal, her view is to form such a combination of parts as to render the animal fitted for certain purposes. She will commonly form the same combination where the same purposes are to be served; or, in other words, there will be the same structure in the same species of animals. The same effect, however, may be produced without a strict adherence to the employment of the same means . . . and therefore there is no reason why nature should not sometimes deviate from her ordinary plans. Accordingly we find there is much variety in animal structure; but this does not commonly affect the animal functions.[69]

In Baillie's view, that which, by virtue of unusual structure, appeared to be monstrous, was not in actuality so. On the contrary, so long as the functions of life were not affected, such a being constituted not a monstrosity (as previous authors had suggested), but merely a variety of animal structure. The term monster, he suggested, should be restricted to those "great deviations which nature produces in the structure of an animal," by which "the animal becomes often unfit for continuing its existence."[70] Thus, for Baillie, monstrosity was not so much a matter of uncommon structure as it was a matter of impaired, or non-viable functions.

Among nineteenth-century scientists, this physiological definition of monstrosity was widely adopted. In William Lawrence's view, for example, monstrosity was by no means a simple concept of visible form:

> In parts . . . where one model is generally adhered to, deviations occasionally take place: these aberrations from the accustomed type are called by anatomists varieties. . . When the body in general, or some large and conspicuous part of it, deviates from the accustomed formation, which deviation is accompanied generally with imperfection in some of the functions, the creature is called a monster.[71]

Similarly, according to Geoffroy Saint-Hilaire, the wide range of malformations which occurred in nature were not "monstrous" but "anomalous," and while he occasionally used the term monster, it was only in reference to those organisms which were so deficient or excessive as to be "unviable." In short, for nineteenth-century scientists, it was primarily viability and not structure which served as the criterion for defining a monster.

If some authors sought to restrict the meaning of the term monster to an objective matter of biological fact (i.e. of viable vs. non-viable structures), there were those who went further, and suggested that the word be removed altogether from scientific discourse. In his 1775 account of an acephalous birth, William Cooper wrote:

> In conformity to the general language of authors, I have in this essay occasionally adopted the use of the term monster. There is, however, something in that word extremely repugnant to our common feelings, and very apt to leave a terrifying impression upon the mind. Why may not the Author of Being sometimes produce variations in the human species, as well as in the animal and vegetable kingdoms, and equally exempt too from such frightful appellations?[72]

According to Cooper, since monster evoked too many vulgar images, it would be more appropriate, "in the present instance, and

every similar one," simply to "explode the common term." By the 1840's, though monster was still widely used in scientific writings to denote seriously malformed organisms, more neutral terms, such as malformation, unusual formation, and imperfect organizations were much more common.

Just as the language of monstrosity became much more scientifically circumscribed, so too were various topics excluded from the scientific discourse on monstrosity. Indeed, as scientists sought to naturalize monsters as objects of disease, the range of concerns which they considered appropriate to their inquiry was considerably narrowed. For the most part, teleological and theological speculations were removed from the teratological agenda, not only because such interests were peripheral to science, but also on the grounds that they constituted potential impediments to the generation of scientific knowledge. Certainly, there was general avoidance of such questions as whether particular monsters had souls. One doctor who did refer to the problem, dismissed it as completely "absurd" when he heard of a mother, who, after the death of her Siamese twins, consulted a doctor's advice to determine whether the monster(s) had one soul or two. Apparently, this was not considered a valid medical question.

Further, commenting on the inherent "dangers" of teleological speculation, William Lawrence warned:

> In order to prove that a brain has existed, and has been destroyed in these cases, Haller observes that it is quite contrary, not only to the wisdom of nature, but to common sense, for arteries, veins, and nerves to be made in a skull, where there is no brain. This is a dangerous argument: is it not equally contradictory that a rectum should be formed without an anus, since

> life cannot be continued without such an opening? If nature be so wise and careful, why did not she provide against the destruction of the head? And why does she go on working month after month, to no purpose, in constructing the numerous other monsters, which are incapable of life? Not contented with exercising his mental faculties on what comes under the operation of his senses, and exploring the instructive scenes of nature, man is ever disposed to enter the regions of imagination, and to give to the beings of his fancy, whom he first clothes with all the attributes of perfection, the designs and actions which accord only with his own shortsightedness and ignorance. He is as positive about what goes on in this unseen region, as if he directed all the operations himself, and can tell you very precisely what does, and what does not harmonize with the wisdom of the Creator, which turns out at last to be the exact representation of his own knowledge or prejudices. Why may not arteries, veins, etc. which usually belong to a brain be formed without a brain . . . It is enough that the thing happens: whether nature has any design in these formations, or not, we leave undetermined, until we are informed of some data on which a decision may be grounded.[73]

Similarly, in recommending his view of life as a process dependent solely on organization, Lawrence insisted that the issue was strictly a physiological one and had no relation to questions of theology. "The theological doctrine of the soul," he argued, "has nothing to do with this physiological question, but rests on a species of proof altogether different."[74] Clearly, in Lawrence's view, between natural theology and biological science there existed a fixed epistemological boundary.

Evidently, most nineteenth-century teratologists shared Lawrence's sentiments, for unlike eighteenth-century authors, they seldom discussed the theological implications of monstrous births in their teratological writings. Indeed, as monstrosity came to be perceived as the outcome of a regular, biological process, it

ceased to arouse the same sense of wonder for Nature as artist or for God as creator. Both Nature and God, as active, personalized agents of creation, receded further to the background of scientific thought. Epigenesis tended to focus attention on the temporal, on-going processes of development, thus weakening the tendency, manifested by investigators all through the eighteenth century, to contemplate a specific creative force in the production of monsters.[75] The over-riding interest of teratologists was to show how natural forces and causes were themselves responsible for malformed organisms, and consequently, it was to these causes and not to external agents that they referred in their writings. In this sense, the subject of monstrosity became independent of both God and Nature, and situated instead within the conceptual nexus of Life.

At the same time as scientists refrained from theological commentary, they also tended to avoid discussions concerning the ethical or moral import of monstrosity. Various authors did venture briefly into the moral realm in commending the civilizing role of science in authorizing more humane attitudes towards monsters. In his essay on "Diploteratology" (a word he coined for the study of double monsters), for example, Fisher condemned the barbarism which had been sanctioned in former periods of darkness:

> The barbarisms of the Greeks and Romans were executed on such unfortunate children as the parents or neighbors pleased to call "monsters." This opinion and practice received the sanction and support of the most learned of that day. As recently as the beginning of the seventeenth century, Riolanus, one of the most distinguished men of his age, gravely tells us that

> children with six fingers, giants, dwarfs, etc., who are made after the image of the devil, may be allowed to live, but should be removed from the sight of the public, and perpetually shut up in some chamber or place of security. The rudiments of this superstition still exist. Even at the present time, there is a strong popular opinion participated in by not a few persons of intelligence; but, as far as I am aware, having no advocates in the medical profession that not only justifies, but almost demands it as a duty of the accoucheur to destroy the life of the most unnatural monsters, either by suffocation or by the employment of anesthetics.[76]

Certainly, the scientization of monstrosity meant that monstrous children, however abnormal or rudimentary their development happened to be, were identified absolutely as natural and unequivocally as human. In theory, this also rendered them morally neutral, for in equating the monstrous strictly with the pathological, teratologists denied the role of "evil" in the production of monstrous formations. Consequently, the moral stigma against either child or parent was effectively annulled.

However, while monsters were humanized in this way, they were by no means personalized, for, in keeping with their project of objectification, scientists showed little interest in discussing any questions relating to the psychological or subjective dimension of abnormal existence. To the degree that they were scientized, monsters lost their value as beings and instead functioned as interesting specimens of pathology, useful only to the extent that they elucidated the norm. Commenting on the scientific utility of monstrous specimens, Fisher noted that the "necessary consequence of an exact and profound knowledge of anomalies will be that the study of normal and abnormal facts, intimately associated together, [will] lend each other a mutual and powerful support."[77] Likewise, according to James

Palmer, to the subject of monstrosity "much attention has of late years been deservedly directed, since [it] . . . helps to throw much light on the laws of normal formation."[78] Thus, as Canguilhem suggests, if during the nineteenth century, the madman was in the asylum where he served to teach reason, so the monster was in the embryologist's jar where he served to teach the norm.[79]

Inasmuch as monsters were "apprehended" in this way, they became studies in abnormal human development and problems thereafter for the intellect alone. As such, they were not expected to induce any overt subjective response, whether of shock, wonder or disgust, so that any allusion to the apparent eccentricity of particular malformations all but disappeared from the exchanges of expert scientists. There seems to have been a strong sense among teratological experts, in fact, that what was extra-scientific was also decidedly unscientific. Consequently, professionals responded to monsters as they would to any other biological specimen of scientific interest--in the designative and unemotive language of reason.

Finally, as the subject of monstrosity was incorporated into the mainstream of biological thought, popular explanations of monstrous productions became subject to general ridicule and censure. Certainly, many eighteenth-century scientists had condemned various popular theories, but the scientific repudiation of common sense knowledge became much more intensified and widespread in the nineteenth century. In part, this was symptomatic of the tremendous specialization of teratological knowledge

which was increasingly evident from the early 1800's. In the eighteenth century, those who investigated monsters had been generalists, only secondarily concerned with the problem of monstrosity. In contrast, many nineteenth-century scientists (Allen Thomson, Geoffroy Saint-Hilaire, Serres, Fisher) developed a particular interest in monstrosity, and spent a great deal of their time on teratological research and writing. The result was that teratological knowledge (and the terminology necessary to talk about monsters in a learned fashion) became highly specialized and increasingly divorced from the ordinary world of understanding.

For the expert teratologist, popular theories of monstrosity were simply untenable. This was particularly true in the cases of direct mechanical interference and maternal imagination, theories which, as we have seen, had been critically scrutinized by various scientists from the middle of the eighteenth century. By the 1820's, scientific skepticism toward these theories was widespread. Not only did they fail to penetrate through the deceptive facade of appearance to expose the true reality of things, but both explanations smacked of vulgar credulity. Consequently, in teratological writings of the nineteenth century they were either scorned as unfortunate digressions in the history of teratology, or summarily dismissed as vulgar absurdities. Or, perhaps most disparagingly, they were not mentioned at all.

One of the most stern critics of these theories was William Lawrence. In Lawrence's judgement, the idea of mechanical factors acting directly upon the embryo was not only unsubstantiated by

fact, but "repugnant to all our knowledge concerning the animal oeconomy."[80] Commenting on the theory of direct mechanical interference, he writes:

> By what facts are we justified in believing that the ribs of two foetuses, and the clavicles, can detach themselves from their respective sterna, and become fixed, each to the sternum of the other, as in the skeleton of the double foetuses; that two perfect hearts, if the chest could be thus metamorphosed, could be united into an organ with one auricle only, and with two ventricles, of which each produces a pulmonary artery and an aorta; that a new communicating channel should be formed between the two aortae, as in the double bodied pig already described and in the Hungarian sisters? If we could believe all these wonders, it would not be sufficient; for monstrosities occur when there has been no violence inflicted during pregnancy.[81]

What disturbed Lawrence particularly about the doctrine of mechanical interference was that it ran contrary to the invariable regularities which were observed in monstrous productions. With considerable rhetorical force, he continued:

> Let us allow, what is not supported by a shadow of proof, that a force can be applied to the child in utero, capable of causing this extensive destruction; how does it happen that the head should be destroyed in all cases just so far as the orbits? It must either take place suddenly or gradually. The former cannot be the case, for the brain and its membranes could not be annihilated without killing the child: moreover in the frequency of these cases, how does it happen that the head is never found in this bruised condition? If it be the consequence of gradual pressure, how surprising it is that the destruction should always be found precisely at the same point, that no specimens of an earlier or later stage should ever have been met with! How is the presence of the hair at the edge of the integuments, where it does not exist naturally, to be accounted for? Why are females so much oftener the subjects of such accidents than males? Why do not other parts suffer in the same way, since the brain is protected by a bony case at an early period, while the bones in other parts are internal? How does external force destroy the spinous processes of the vertebrae through the integuments in spina bifida?[82]

If in a somewhat less forceful style, Lawrence's objections against direct mechanistic influences were echoed by a number of nineteenth-century scientists. According to James Pendleton, for example, in his 1826 essay on the principles of monstrosity:

> Double monsters have been ascribed to the union of two ova into one in the uterus, where from pressure they have united; but dissection of these monsters shows such an arrangement of parts to suit the united foetuses as never could have been produced by an accidental union . . . Monsters with deficiency of parts have been ascribed to pressure against the walls of the uterus, causing absorption; this supposition is not admissible, as pressure could never cause a hare-lip, nor remove the cerebrum and cerebellum and not destroy the foetus.[83]

If the theory of mechanical interference was unacceptable to nineteenth-century experts, maternal imagination was even more "repugnant" to their sensibilities. In his treatise on monstrosity published in 1814, Lawrence submitted the theory to a lengthy critique, which was not only exacting, but also particularly representative of the stand which was generally taken on the question by those with specialized embryological knowledge. In his analysis, Lawrence repudiated the theory on two major grounds. In the first place, he summoned an extensive series of arguments to demonstrate that the theory was at odds with the laws of organic composition and development. For example:

> A knowledge of the different kinds, and of the anatomical structure of monsters, affords very strong, and indeed incontrovertible proofs of the absurdity of the common notions. The most zealous advocates of the opinion, which indeed only makes the matter more obscure, will hardly contend that the imagination of the mother can annihilate one-third or one-fourth of a head, and adapt to it an exactly corresponding piece of another head, resembling it so exactly in size, form, features, etc. If it should not be difficult enough to account for the production of this

> symmetrical double head, a harder task remains; viz. to explain how the imagination of the mother changes nearly half the body; for the vertebral column may be double, the breast consequently broader, etc. in such an example. . . . We shall again ask how longing or fright can dispose of the brain, membranes, scull, scalp, etc. as in acephali? How it can stop up the anus, or annihilate the nose, and bring together and confound in one the two eyes? . . . In cases of hare-lip, the parts do not resemble the snout of a hare, but are formed in quite an opposite way. The upper jaw-bones are drawn apart, and the face consequently more than usually broad, instead of being narrow and standing forwards as in the hare. The lip of the hare is not fissured, but merely notched, and covered with long stiff bristles. The fissure of the lip is often the smallest part of the deformity in the human subject; there is a division through the whole of the bony and soft palate, to which a hare's head has nothing analogous.[84]

Along with exposing the theory on these physiological grounds, Lawrence also derided it as an irrational holdover from an unenlightened past. Summarizing various reports of monstrosity from the seventeenth century, Lawrence writes:

> Is it not very clear that the imagination is much more powerfully at work in these good people, than in the poor mothers? Devils, apes, hares and cats are all alike to them. It is difficult to contend against adversaries: if they are driven from their monkeys and hares, they conjure up an array against us, imps, demons and other phantoms of their brains.[85]

And further:

> But it is needless to pursue further a question, on which all rational persons well acquainted with the circumstances are already unanimous . . . This belief in the power of imagination, like the belief in witchcraft, is greater or less according to the progress of knowledge, which in truth differs greatly in different countries and heads. We know that many enlightened women are fully convinced of its absurdity, while soi-disant philosophers are still found who support it.[86]

Thus, while the scientific campaign against these long-standing theories of monstrosity was justified largely by the

new biological philosophy of life, it was also part of the larger scientific program to differentiate popular from professional modes of understanding. Labelled as unscientific, such popular views represented a way of seeing natural phenomena which to the expert, denoted an essentially flawed vision. Indeed, one of the main factors in Lawrence's rejection of maternal imagination was that it drew authority from a form of knowledge which, in granting a prior status to appearances, was itself superficial and deceived, for as he said:

> That the vulgar, who know only the surface of things, and are contented with the most distant resemblances and the loosest analogies, should ascribe the hare-lip to the sight of a hare, is not very strange.[87]

Lawrence, of course, was not alone in condemning popular ways of understanding. This kind of anti-popular rhetoric was, in fact, a common feature of nineteenth-century teratological writing. Though they attacked popular theories on various different grounds, most teratologists shared Lawrence's concern with differentiating real (scientific) from common sense (popular) knowledge. John North, for example, noted the lack of empirical evidence to support popular claims:

> Congenital melanotic stains upon the surface of the skin vary greatly in situation, form, and colour, and sometimes they are covered with hair. They are often, by the public, said to resemble some animal by which the mother has been frightened during her pregnancy. But how is the evidence obtained upon which this foolish belief is founded?[88]

And further:

> According to the popular belief, if a pregnant woman look at a particular object, is disgusted or frightened by it . . . it very frequently happens that the resemblance, both in shape and colour of that object, will be imprinted upon the body of the foetus;

> . . . In support of this belief you will find, in numerous writers, a very imposing array of so-called facts. But examine them closely, and you will also find the evidence upon which they rest is anything but satisfactory.[89]

For George Fisher, popular thought exhibited the same absurd credulity of pre-enlightened periods:

> All the early treatises on this subject are characterized by the extreme credulity of the authors, who recorded the most absurd and improbable cases, and the grossest errors, as well as some rational observations . . . In the older works will be found accounts and figures of single and double monsters of a mixed character, being composed of human and animal bodies; for example, the body of a hog, with the head and neck of a man . . . and in another the head of an elephant with probiscis and tusks well developed!! Nothing can be more absurd than the idea of any progeny whatever resulting from intercourse between man and the lower animals, or among animals of widely different genera. There is, however, a popular opinion yet extant, which gives credance to such an hypothesis.[90]

Such thinking, he continued, was characterized by a blind reliance upon authority, a particularly obstinate barrier to scientific progress:

> The period under consideration, comprising scarcely fifty years, was marked by very great progress. One of the most formidable obstacles to the advancement of science, and which perhaps in some degree continues to retard philosophical progress, has ever been a blind submission to authority. In every age a few master minds . . . have made themselves controlling spirits; and by a dogmatic assumption of authority became established . . . To untrammel the mind from the influence of mere authority, that it may have free scope in the investigation of facts and laws which exist and are established in nature, is the grand antecedent necessary to scientific discovery and permanent progress.[91]

In a similar vein did Fisher lament the lack of sound teratological knowledge among amateur investigators of monstrosity:

> It has frequently been supposed by those into whose

> hands a case of monstrosity has fallen, that it was remarkably rare, if not unique; the desire to preserve the specimen entire for the cabinet or museum has deterred them from making an anatomical examination of its internal organization, the description being restricted to the external configuration; while on the contrary others may have entered into needless detail regarding the structure of the common varieties of monsters, which had been repeatedly described by different observers. All this arises from a want of knowledge of the comparative rarity of several forms, and of the results of previous observations.[92]

And finally, various teratologists implied that the very language of popular discourse was inappropriate to the generation of knowledge. According to Adam, for example, while the word, monster, "having so long held a place in our language, cannot well be dispensed with in treating of congenital deformities," . . . "medical men would do well to avoid using a term so very unscientific and confusing."[93]

From commentary of this kind, it is clear that, in their knowledge of monsters, nineteenth-century teratologists felt themselves to be fortunately removed from the ignorant public. Indeed, by the 1840's, the discrepancy between expert and non-expert attitudes to monsters constituted an irreconcilable intellectual gulf. Having reduced monstrosity to a matter of disease, professionals scorned the kind of naive wonderment pervading the fairgrounds, where monstrous spectacles continued to evoke awe and amazement among curiosity seekers. Among teratologists, these were stigmatized as vulgar responses, based on visual illusion, and on the mistaken view that nature encompassed modes of being which were "different." Certainly, this had been a widely held belief in the eighteenth century, when nature was understood in terms of a dichotomy which opposed "regular" to "irregular" phenomena. For early natural historians, wonder

was a permissible response to monstrosity, for inasmuch as they constituted irregular structural assemblies, resulting from error or sport, monsters were both different and wonderful.

By the nineteenth century, however, scientists had rejected this dichotomy in favor of a more homogeneous view of nature. For teratologists, everything in nature was regular, but because quantitative deviations occurred, some phenomena were Normal and some were Abnormal. Most significantly, between the normal and the abnormal, there was no real discontinuity and no real difference. To the eye, monsters may have appeared to be different kinds of beings, and accidental deviations from nature's laws. According to scientific thought, however, in diverting attention from the true nature of abnormality to its outward manifestations, such common sense impressions were illusory and mistaken. At a deeper level, monsters were merely pathological organisms, abnormally augmented or diminished according to the regular operations of teratological law. Strictly speaking, therefore, there was no monstrosity, but only health and disease, physiology and pathology, the normal and the abnormal. If monsters were still curious in the sense that they provided interesting studies of organic development, they were not Curiosities of Nature and not, therefore, to provide idle intoxication for the senses. On the contrary, as specimens of human abnormality, they were to appeal exclusively to the mind. Thus, while the famous exhibition freak, Claude Seurat, was still being experienced on the fairgrounds as a prodigious wonder of Nature, and sensationalized as "The Living Skeleton," for the more professional readers of the Medical

Advisor, he was above all an interesting biological specimen, a case of "marcores, occasioned by an early obliteration of many of the lacteal vessels and mesenteric glands."[94]

NOTES TO CHAPTER THREE

[1]Thomson, "Double Monsters," p. 479.

[2]Fisher, "Diploteratology," 1866, p. 207. Further, according to Fisher, "the history of anomalies of organization is no longer to be regarded as a mere detail of prodigies, and sports of nature, resulting from supernatural causes, but requires to be studied as a science which is governed by natural and rational laws, no less certain in their operation and results, than those which are concerned in normal development." (1865, p. 235)

[3]J. Goodfield-Toulmin, "Some Aspects of English Physiology: 1780 - 1840," Journal of History of Biology 2 (Fall 1969), p. 283.

[4]Figlio, "The Metaphor of Organization," p. 20.

[5]Ibid., p. 25.

[6]Lawrence, Lectures, p. 52.

[7]Jacob, The Logic of Life, p. 74.

[8]Lawrence, Lectures, p. 6.

[9]quoted in Gould, Ontogeny and Phylogeny, p. 35.

[10]Coleman, Biology in the Nineteenth Century, pp. 35-6.

[11]Adam, "Contributions to Teratology," p. 247.

[12]Gould, Ontogeny and Phylogeny, p. 34.

[13]quoted in Gould, Ontogeny and Phylogeny, p. 37.

[14]Lawrence, "Account of a Child Born Without a Brain," p. 215.

[15]North, "On Monstrosities," p. 858.

[16]Geoffroy Saint-Hilaire, Traité de Tératologie, III, p. 3.

[17]North, "On Monstrosities," p. 857.

[18]Thomson, "Double Monsters," p. 479.

[19]Ibid., p. 484.

[20]Fisher, "Diploteratology," 1865, p. 248.

[21]North, "On Monstrosities," p. 858.

[22]Thomson, Double Monsters," p. 484. Thomson, however, argued that the theory of developmental arrest did not provide an adequate explanation for many cases of double monstrosity.

[23]Adam, "Contributions to Teratology," p. 399.

[24]Ibid., p. 248.

[25]North, "On Monstrosities," p. 858.

[26]Adam, "Contributions to Teratology," pp. 246-7.

[27]Ibid., p. 248.

[28]North, "On Monstrosities," p. 858.

[29]Ibid.

[30]Ibid., p. 859.

[31]Adam, "Contributions to Teratology," p. 400.

[32]North, "On Monstrosities," p. 860.

[33]Adam, "Contributions to Teratology," pp. 400-1.

[34]Ibid.

[35]North, "On Monstrosities," p. 860.

[36]Ibid.

[37]Adam, "Contributions to Teratology," p. 399.

[38]Ibid.

[39]North, "On Monstrosities," p. 860.

[40]Ibid.

[41]Geoffroy Saint-Hilaire, Traité de Tératologie, III, p. 428.

[42]Fisher, "Diploteratology," (1866), p. 207.

[43]According to Geoffroy Saint-Hilaire, for example, "in teratology, as in all sciences, the establishment of a good classification remains necessary in knowing particular facts. (Traité, I, p. 80).

[44]North, "On Monstrosities," p. 860.

[45]"The Foetus, after Fright of the mother," The Lancet (1840), p. 341.

[46]quoted in Fisher, "Maternal Mental Influence," p. 270.

[47]Thomson, "Double Monsters," p. 486.

[48]Ibid., p. 487.

[49]Geoffroy Saint-Hilaire, Traitĕ de Tératologie, I, pp. 18-19.

[50]Ibid., p. 18.

[51]North, "On Monstrosities," p. 857.

[52]Canguilhem, On the Normal and the Pathological, p. 78.

[53]Ibid., p. 13.

[54]Ibid., p. 71.

[55]Most of the statistical surveys were concerned with tabulating either the proportion of monstrous to normal births, or the relative frequency of various kinds of malformation. There was a great deal of discrepancy in the numbers published (Saint-Hilaire estimated that 1 out of every 3000 births was monstrous, while Adam calculated the ratio as 1 to 232), but by the 1840's, scientists expressed an uncompromising commitment to the ideal of grounding monstrosity in a sound statistical base. It was partly in an attempt to facilitate such computations that Adam argued so strongly for abolishing the word monster. Without the consistent use of a more precise teratological terminology, he argued, scientists could "not hope to obtain correct statistical information on the subject." ("Contributions," p. 243).

[56]Grandi, "Concerning some Anatomical Observations," p. 1188.

[57]Benjamin Gibson, "Description of an extraordinary Human Foetus," PTRS 28 (1810), p. 123.

[58]Charles Taylor, "Language and Human Nature," Alan B. Plaunt Memorial Lectures (Ottawa: Carleton University Information Office, 1978), p. 9.

[59]"An Account of a very odd Monstrous Calf," PTRS 1 (1665), p. 10.

[60]Derham, "An Account of Some . . . Monstrous Births," p. 310.

[61]Ash, "Concerning a Girl in Ireland," p. 1203.

[62]Christopher Krahe, "The Description of a Monstrous Child," PTRS 14 (1684), p. 600.

[63]Durston, "A Narrative," p. 2097.

[64]John Machin, "An uncommon Case of a Distempered Skin," PTRS 37 (1732), pp. 299-300.

[65]Parsons, Mechanical and Critical Inquiry, pp. vii-viii.

[66]Baillie, "A Remarkable Transposition," p. 355.

[67]quoted in Thomson, "Double Monsters," p. 482.

[68]North, "On Monstrosities," pp. 913-16.

[69]Baillie, "A Remarkable Transposition," pp. 359-60.

[70]Ibid., p. 362.

[71]Lawrence, "Account of a Child Born Without a Brain," p. 172.

[72]Cooper, "An Extraordinary acephalous Birth," p. 320.

[73]Lawrence, "Account of a Child Born Without a Brain," pp. 209-10.

[74]Lawrence, Lectures, p. 6.

[75]In late eighteenth-century accounts, authors often referred to "Nature" as a personified, active force in the production of monsters. Nineteenth century authors, though they occasionally personified Nature, most typically referred to the biological processes and laws which were involved. Compare, for example, Matthew Baillie's discussion on page 148 with North's explanation on page 134.

[76]Fisher, "Diploteratology," (1865), pp. 238-9. In "Maternal Mental Influences," p. 255, Fisher writes: The civilized world has made one long and progressive step in removing the origin and cause of physical malformation from the sphere of devils, or angry and unappeased gods, to the more controllable and less frightful power of the unfortunate mother's mind. . . It is to be hoped that the "rich and poor, refined and vulgar, educated and ignorant," throughout the enlightened world, will reliquish their "unquestioning faith" for a spirit of philosophical inquiry, and make another progressive stride, and seek the explanation of malformation in the realm of pathological histology. . . "

[77]Fisher, "Diploteratology," (1865), p. 234.

[78]Palmer, The Works, I, p. 148.

[79]Canguilhem, La Connaissance de la Vie, p. 178.

[80]Lawrence, "Account of a Child Born Without a Brain," p. 207.

[81]Ibid., pp. 207-8.

[82]Ibid., pp. 208-9.

[83]James Pendleton, "Observations on Monstrosities," Phil Journal of the Med and Physical Sciences n.s. 4 (1826), p.297. Allen Thomson, too, admitted that mechanical factors may exert an influence in arresting foetal development, affecting the foetus in a non-specific as opposed to a direct way. However, he felt that "the constancy with which certain forms return and the invariable symmetry that they very generally present, deprives the theory of all its probability." ("Double Monsters," p. 487).

[84]Lawrence, "Account of a Child Born Without a Brain," pp. 202-5.

[85]Ibid., pp. 204-5.

[86]Ibid., pp. 206-7.

[87]Ibid., p. 203.

[88]North, "On Monstrosities," p. 862.

[89]Ibid., p. 919.

[90]Fisher, "Diploteratology," (1865), pp. 240-2.

[91]Ibid., p. 246.

[92]Ibid., p. 234.

[93]Adam, "Contributions to Teratology," p. 243.

[94]quoted in Altick, The Shows of London, p. 261.

## CONCLUSION

Since the nineteenth century, most writers have represented the history of teratology as a detached and linear progression from error to truth. Underlying such interpretations are the central assumptions of "objectivity" and "continuity," premises which in obvious ways obscure and misrepresent the complexities of scientific activity in the past. For while teratologists may have believed in their own objectivity, the essential ambiguity of nineteenth-century biological thought makes it impossible to speak of teratology as a purely detached and objective enterprise. Certainly from the early nineteenth century, a major aim of the teratological program was to neutralize the study of monsters, to model it after the natural sciences, and to restrict it to a discourse of description and fact. The establishment of a designative disease terminology, the rejection of popular "error" and of explicit theological and moral considerations, the reliance upon quantitative theories and statistical studies--all of this may be understood as an attempt to reduce monstrosity to a quantitative and non-evaluative study, distinct from other intellectual disciplines.

However, while teratologists attempted to make the study of monsters a discrete and value-neutral science, their thought was ordered by concepts which were themselves intrinsically ambiguous and evaluative. Anomalous, abnormal, unviable, disorganized, monstrous--these words were invested with multiple meanings and values. When teratologists spoke of monsters as abnormal, for

example, it was, in one sense, in a purely descriptive way; it referred to formations which were statistically unusual. At the same time, however, "abnormal" implied an evaluative judgement; not only were monstrous organisms not usual, but they were less than ideal, and this with reference to both biological and social norms. Certainly malformation was no longer associated with the "evil" of demonic interference or human sinfulness (monsters were no longer unnatural), but it was nevertheless imbued with a clearly negative biological value, as an internal disturbance which threatened an organism from the inside and jeopardized its viablity. In contrast to normal organisms, monsters were disorganized, pathological, abnormal, or, in William Lawrence's terms "imperfect organisations,"[1] often"incapable of independent vitality."[2] And this not only because monsters were biologically marginal or unviable, but also because they represented a threat to the social organism. Such people, according to Lawrence, were often "unfit for active employment,"[3] or "burthensome to others."[4] Thus, to the extent that "organism," "life," "monster" were themselves metaphorical concepts, at a deep level they permitted a continual flow between one kind of thought and another, and effectively erased the boundaries which, on the surface, appeared to distinguish scientific from social or moral thought.

In some cases, teratological discussions displayed an even more obvious conflation of social value and scientific theory. Consider, for example, A.M. Adam's discussion of the relative frequency of malformation in the two sexes. There was, to Adam's knowledge, overwhelming statistical evidence

to suggest that, among human monstrosities, "malformations occur much more frequently in the female than in the male sex."[5] But how, he wondered, were scientists to explain this fact?

> Is the female more weakly and consequently more susceptible to disease and malformation than the male? I do not think that we are warranted in saying so. The only hypothesis which seems to me at all tenable, is not that the sex induces the malformation, but that the malformation determines the sex. I am of opinion that it may occur thus:--A higher degree of formative power is probably requisite for the conversion of the embryo into a male than into a female child, for the margins of the sinus urogenitalis need to be developed more largely, and to be united more extensively in the constitution of the male perineum and scrotum. If, therefore, from the fifth to the fourteenth or sixteenth week, anything happens to disturb or arrest the development of the embryo, its autotrophy, or inherent formative power, becomes so weakened that it cannot possibly accomplish the perfect closure of the primitive cloacal fissure, and the foetus consequently becomes a female.

Implicit in Adam's explanation is the judgement that what is more biologically complex is also more "perfect." According to the prevailing concepts of embryology, in fact, the ultimate ideal of biological development was the perfectly formed human male; all "other" forms of organization were necessarily ranked as "lower" forms of organization and understood, at least metaphorically, as monstrous deviations from the norm. ("In effect," wrote Serres, "invertebrates are often only living monstrosities, if we compare them to perfect vertebrates.")[6] What this meant was that particular social differences--in this case distinctions between the sexes--could be justified on the basis that they were a legitimate reflection of what was "natural." Here social and scientific theory are mixed in such an inextricable fashion

that it is somewhat arbitrary to speak of a distinction between the two.

If nineteenth-century teratology cannot be accurately described as an objective and value-neutral science, neither is it best understood as the culmination of a long and coherent search for the true facts concerning monstrosity. Nineteenth-century teratology was not a mere extension or augmentation of eighteenth-century knowledge. On the contrary, there was much that was new in the teratological approach to the problem of monsters. Unlike the loosely associated investigators of the early eighteenth century, teratologists were conscious of themselves as an elite and exclusive community of professionals, divorced from the world of popular experience by an expert knowledge and by enlightened attitudes towards science and abnormality. Further, when they described cases of monstrosity, it was in a highly designative terminology, radically different from the expressive wonder vocabulary of former periods. In their discussions of the nature and causes of monsters, nineteenth-century scientists drew on a revised set of biological laws and theories which tended to supersede earlier assumptions concerning monstrous phenomena. Developmental arrest, organic unity, eccentric development--all of these theories comprehended malformations in biological and objective terms, as regular pathological deviations in the embryological history of an organism. As such, they altered the basic frame of reference concerning the origin and meaning of monstrosity, placing it squarely within the locus of biological as opposed to theologi-

cal thought. By the 1830's, the authority of scientific over common sense knowledge was an institutionally guaranteed reality; by then, the study of monsters was recognized as a legitimate scientific discipline which could claim authentic knowledge of organic malformations.

At a deeper level, the appearance of teratology may be understood as part of a more general reformulation of biological knowledge which occurred toward the end of the eighteenth century. In attempting to clarify this transformation, I have suggested a number of dichotomies which are useful in comprehending the scientific discourse on monstrosity in the eighteenth and nineteenth centuries. Structure-function, static-dynamic, visible-invisible, appearance-reality, description-explanation, qualitative-quantitative, irregular-regular, imaginary-real: these, I would suggest, constituted the main categories around which past thinking about monstrosity was organized.

In addition to these dichotomies, it is also possible to understand the scientization of monsters in terms of certain central themes. Firstly, after 1750, the teleological determinism of the early eighteenth century began to give way to a new form of physical determinism. From that time, scientists afforded a much less central role to God in their explanations of monstrous phenomena and instead attempted to account for malformations primarily with reference to "Nature." By the 1820's, however, both God and Nature had been demoted, and monsters were being explained in relation to the laws of "Life."

This change was paralleled by another transition in which the principles of "organization" and "development" gradually assumed primacy over "structure" in scientific explanations of life. Indeed, if earlier natural historians regarded monsters as qualitatively differentiated from Nature's regular productions, it was because the study of monstrosity was based, until the middle of the century, on a code of knowledge which gave priority to structure and the classification of animal species. During the second half of the century, however, scientific views of the living world and of what constituted a knowledge of it changed radically. As scientists looked beneath the surface of things, and interested themselves in the invisible processes of life, their investigations of monstrosity were increasingly dominated by considerations of vital function. During the nineteenth century, the study of monsters became absorbed into the sciences of life, and reconstituted around the central principles of organization and development.

From that time, monsters were understood as pathological deviations from the norm, as beings which, though quantitatively deviant, were by no means qualitatively different. When John North or A.M. Adam spoke of developmental anomalies, in fact, it was in the context of a novel set of ideas concerning the nature of life, and in reference to something quite different from what early eighteenth-century investigators had understood as monstrous irregularities of nature. By the 1830's, monsters were no longer monstrous; the study of monstrosity had become the science of anomalies, a science based on a fundamentally new way of 'speaking true.'

NOTES TO THE CONCLUSION

[1]Lawrence, "Account of a Child Born Without a Brain," p. 181.

[2]Ibid., p. 171.

[3]Ibid., p. 181.

[4]Ibid., p. 171.

[5]Adam, "Contributions to Teratology," pp. 244-46.

[6]quoted in Gould, Ontogeny and Phylogeny, p. 51.

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