THE BIOLOGICAL THEORY OF ATAVISM: A HISTORY AND EVALUATION

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Abstract

The history of the biological atavisms, the theory that some individual animals, including humans, at times revert back to an earlier evolutionary type, was reviewed. In the case of humans, many behavioral scientists believed that the atavism response caused persons to revert in a major way, both physically and mentally, to their animal origins. Many criminologists once adopted this theory to explain crime, and partly for this reason it influenced public opinions and official policy. The "criminal physical type" stereotype is still very much with us, even though the theory of atavism as a causative factor in criminal behavior has been empirically disproved.

Examples of so-called atavism are discussed, including extra fingers, nipples, and various body abnormalities such as extreme levels of body hair. It is concluded that no known biological atavism mechanism is sufficient to account for this phenomenon. The probable causes are genetic malfunctions, hormonal problems, or diseases. The research is reviewed that shows why the concept of atavisms has today, like its relatives the vestigial and nascent organ theories, now been discarded.

Introduction

A concern of this review is the problem of theories or ideas which appear valid, once they are established in one discipline or context being uncritically adopted into other knowledge disciplines. Most fields often try to accommodate that which they believe are "accepted" conclusions from other fields without adequate examination of them. This acceptance is often without full awareness of the debate which may exist within the theory's own discipline. Both sociology and psychology have uncritically used for their theory building many theories from the life sciences, especially biology, which were later proved false. Psychoanalysis, the theory of differential association, the unified field theory, behaviorism theory, and the Pygmalion effect (labeling theory) have all borrowed uncritically from biology, and all were later forced to modify their ideas. As Gould (1977, p. 223) noted, the impact of evolution was especially enormous, which:

> . . . illustrates the enormous influence of evolutionary theory in fields far removed from its biological core. Even the most abstract scientists are not free agents. Major ideas have remarkably subtle and far-reaching extensions.

A tragic example of the use of evolution by another field was its uncritical acceptance into the field of criminology. The result was the development of many unfounded theories which have now been completely discredited, some of which have had tragic consequences for multi-thousands of persons (Gould, 1981). The specific aspect of evolution discussed here is **human atavism theory,** or the view that certain physical traits can appear in humans which are the result of a "throw-back" to an earlier stage of our evolutionary history.

Although the influence of evolution on non-biological fields, such as psychology, sociology, and anthropology, has varied, sociologists have in general uncritically accepted the general theory since Comte published his *Polity* (Barnes, 1948, p. 106-107). And it profoundly influenced many social theories—some of which were later rejected in a wholesale manner—Social *Darwinism* is a good example. As Vold (1958, p. 10) claims:

> . . . Man's social organization has developed as a result of his biological evolution—hence, social evolution is subsequent to but essentially parallel with, and presumably a product of, biological evolution. Individual human characteristics and behavior are therefore to be understood as reflections of this common organic and biological inheritance, not free and intelligently self-determined, but biologically determined.

The behavioral sciences were not just influenced by biological evolution but, as Morris (1974) notes, in "the field of sociology, one quickly discovers that the study of man's cultures and societies is universally *cast in the same mold* as the study of his presumed biological evolution." This has been true for decades. Weatherwax (1909, p. 42) long ago noted that "Scientists in general recognize the principle of [biological] evolution, and its influence has carried over into the field of social problems and has had a profound influence on all thought."

A prime example of how evolution has influenced social policy is the theory of atavism in crime theory as developed by the man many regard as the founder of the science of criminology, Cesaro Lombroso (Papa, 1983). His views are covered in his 1876 book *The Criminal Man* (Lindesmith and Levin, 1937) in which Lombroso taught that:

> . . . criminals are a form of evolutionary throwback to a more primitive human type. The criminal, it seemed, was a "being who reproduces in his person the ferocious instincts of primitive humanity and the inferior animals. Thus were explained [the characteristics] found in criminals, savages, and apes: insensitivity to pain, extremely acute sight, tattooing, excessive idleness, love of orgies, the irresistible craving for evil for its own sake, the desire not only to extinguish life in the victim, but to mutilate the corpse, tear its flesh, and drink its blood." (Robertson, 1981, p. 183).

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In 1896 Dallemagne, a prominent French criminologist, assessed Lombroso's enormous influence on crime policy and thought with these words:

> His thoughts revolutionized our opinions, provoked a salutary feeling everywhere, and happy emulation [of his techniques occurred] in research of all kinds. For 20 years, his thoughts fed discussions; the Italian master was the order of the day in all debates; his thoughts appeared as events (Gould, 1981, p. 135).

As to Dallemagne's assessment, Gould (1981, pp. 135-136) adds:

> Dallemagne was recording facts, not just playing diplomat. Criminal anthropology was not just an academician's debate, however lively. It was the subject of discussion in legal and penal circles for years. It provoked numerous "reforms" and was, until World War 1, the subject of an international conference held every four years for judges, jurists, and government officials as well as for scientists.

Background

Throughout western history, most people have accepted the fixation of species view, the conclusion that each animal species was specially created in much the same form that they exist today. Most biological organisms were thus assumed to have changed very little, if at all, throughout history. It was also commonly believed that certain simple forms of life could spontaneously generate into a complete, functioning organism. These life forms were mostly the lower types, although they included some mammals such as mice which were believed to have come from carcasses of dead lions and assorted other places (Collier, 1968, p. 429).

These two core beliefs about the living world, their fixity and separate origins, were held by the masses for most of history. Although some ancient philosophers such as Lucretius taught that animal species had slowly changed or evolved because of various environmental influences, this theory did not receive wide support until Darwin introduced his *theory of evolution by natural selection* in the middle 1800's. Although not original, and discussed by several leading biologists (including some of Darwin's own relatives) long before he published his famous work, *The Origin of Species* in 1859, Darwin's views became the most famous. Once presented, they gained rapid acceptance, and to some degree influenced all other academic disciplines, especially the behavioral sciences (Papa, 1983; Lentini, 1980).

Atavism, A Definition

The term atavism is from the Latin *atavus,* which means "an ancestor," and atavus is a form of *avus,* which means "a great-great-great-grandfather." Atavisms are defined in biology as a reversion to an ancestral type. Atavism proper is a biological theory in which it is believed that some individuals, for unknown reasons, revert in certain ways both physically and mentally back to an earlier "evolutionary" type. This "degeneracy" was at one time believed by many criminologists to have caused the victims to both look more like an "animal" and also to behave "in more savage ways than their civilized counterparts" (Vold, 1958, p. 28). These "animal-people" were also thought to be more apt to involve themselves in criminal behavior. Importantly, this theory was not an obscure view held by a few extremists, but was "probably the most influential doctrine ever to emerge from the anthropometric tradition" (Gould, 1981). To measure the "level of animal traits" a person had, scientists used a number of

> . . . tests to measure the physical characteristics of prison inmates, [and therefrom] Lombroso identified certain features typically found in the criminal population. Among these characteristics . . . were shifty eyes, receding hairlines, red hair, strong jaws, wispy beards, and the like. Lombroso came to the conclusion that criminals are a form of evolutionary throwback to a more primitive human type. (Robertson, 1981, p. 183)

The idea of human atavism was probably first suggested by Darwin (1881, p. 137) when he wrote, "with mankind some of the worst disposition, which occasionally without any assignable cause make their appearance in families, may perhaps be reversions to a savage state from which we are removed by many generations." Since atavistic persons had not only degenerated behaviorally, but physically also, it was commonly believed that criminals could often be identified by *physical traits alone.* Abnormal dentition, asymmetry of face, large ears, eye defects, "inverted" sexual characteristics and supernumerary (extra) nipples, toes and fingers, were all viewed as physical evidence of an atavistic human (Taylor, 1973, p. 41). Exactly how or why the atavistic criminal ended up with this physical and mental regression or degeneration was never fully explained. Nonetheless, atavism was at this time considered a major evidence of evolution (Pal, 1918). It rode close behind the theory of evolution in both respect and acceptance. An early 1940 booklet defending evolution concluded that one of the most compelling proofs of evolution was:

> atavism, which means the reappearance in an individual of a character belonging to [one's] remote ancestors. It is an interesting phenomena . . . if we had really descended from ape-like creatures, we might expect to find some of the characteristics of these ancestors appearing now and then among human beings . . . This 'proof' reminds us that within the last few years a scientist solemnly suggested that the present jazz craze was an evolutionary [atavism, causing a mimicking] of the rhythmic movements of the jelly fish. (Pettit, 1942)

Many behavioral scientists once accepted the belief that rare individual "throwbacks" regularly occurred in "normal" families, producing different types of prehumans. These researchers de-emphasized the effect of the environment and sociological factors in general in causing crime. They spent much time measuring body parts, especially foreheads and brain cases, concluding that the closer the person resembled an ape physically, the greater the behavioral "regression." This method, in contrast to the *experimental versus control*

group and other common research methods in the behavioral sciences, they felt was fully "scientific." Gould (1981, p. 124) notes:

> Lombroso's theory was not just a vague proclamation that crime is hereditary—such claims were common enough in his time—but a specific *evolutionary* theory based upon anthropometric data. Criminals are evolutionary throwbacks in our midst. Germs of an ancestral past lie dormant in our heredity. In some unfortunate individuals, the past comes to life again. These people are innately driven to act as a normal ape or savage would, but such behavior is deemed criminal in our civilized society. Fortunately, we may identify born criminals because they bear anatomical signs of their apishness. Their atavism is both physical and mental, but the physical signs, or stigmata as Lombroso called them, are decisive. Criminal *behavior* can also arise in normal men, but we know the "born criminal" by his anatomy. Anatomy, indeed, is destiny, and born criminals cannot escape their inherited taint: "We are governed by silent laws which never cease to operate and which rule society with more authority than the laws inscribed on our statute books. [In conclusion] crime . . . appears to be a natural phenomenon" (Lombroso, 1887, p. 667).

Types of Atavisms

One of the most comprehensive discussions of the various types of atavisms is by Lull (1932, p. 97). His divisions are as follows:

(1) **Family atavism** is the transmission within a family of individual characteristics which are latent for several generations but occasionally reappear in a family member. Examples include red hair in a child whose immediate parents or grandparents do not display this trait, but which existed several generations back. This is not a true atavism, but is simply the appearance of one or more recessive genes and do not show themselves in the phenotype until enough chance combinations occur so that the two or more recessive genes for the characteristic of concern are present together in one genotype. This recognized phenomena is familiar to every student of genetics, and is not an atavism as the word is usually defined.

(2) **Race atavism** is the appearance of characteristics that are common to "primitive races" in someone who is classified in a more "advanced race." Race atavism is actually similar to family atavism except that it concerns itself only with *certain* characteristics, namely those introduced into the family by miscegenation. Examples Lull gives include the appearance of a large amount of body hair on a person of a race which normally does not have much that is due to the presence of genes that entered the family's gene pool from a racial intermarriage which occurred several generations previously. An example is a WASP child who possesses the traits of another race, and who had an ancestor that married an American Indian, a black, or one of another race two or more generations previously.

Of course, since "race" divisions are vague and arbitrary, what could be called a "race atavistic characteristic" is somewhat dependent upon the observer and his or her opinions regarding the classification criteria used. Lull (1932, p. 97) uses as an example of race atavism the "profuse development of hair on the face and body which occasionally occurs in humans, such as the Russian 'dogman' Adrian Jeftichjew." It is doubtful that this is even a race trait—profuse body hair to the degree found on these individuals is not a characteristic of *any* known past race.

(3) **Teratology atavism** is from *Tepas* or *tera,* which is Greek for "wonder" or "monster." This atavism type consists of the appearance of certain physical characteristics in modern humans which are assumed to have been common in human evolutionary ancestors. This type is the only "true" atavism, and is what is referred to in the literature, and is the type referred to in this paper. Lull's example of a *Teratology atavism* is "the external hind limbs of which a single recorded incidence occurred in a hump back whale taken off Vancouver." Lull (1932, p. 97) notes that "ancestral terrestrial atavists of the whales undoubtedly had these structures, which were gradually lost during other adaptations to aquatic life." Their limbs are assumed to be a wholesale genetic throwback to multi-thousands of previous generations. An example that Lull (1932, p. *97)* provides is the *fistulae,* in humans which refer to the "permanent abnormal openings of the neck which sometimes occurs in the human subject, [and] have been considered as relics of the ancient gill-slits of our piscine [fish] ancestry."

The Historical Importance of Atavism as Evidence For Evolution

The concept of atavism was a major line of evidence that Darwin used to support his theory. As he openly stated (1871, p. 427):

> That this unknown factor is a reversion to a former state of existence may be admitted as in the highest degree probable. . . . [excepting that] man is descended from some ape-like creature, no valid reason can be assigned why certain muscles should not suddenly reappear after an interval of many thousands of generations in the same manner as with horses, asses, and mules, dark colored stripes suddenly reappear on the legs and shoulders, after an interval of hundreds, or more probably thousands of generations.
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> These various cases of reversion are so closely related to those of rudimentary organs given in the first chapter [of his book] . . . some parts which are rudimentary in man, as the os coccyx in both sexes, and the mammae in the male sex are always present; whilst others, such as the supra-condyloid foramin, only occasionally appear, and therefore might have been introduced under the head of reversion. These several reversionary structures, as well as the strictly rudimentary ones, reveal the descent of man from some lower form in an unmistakable manner.

Lyell (1863, p. 504) even attributed genius in areas as diverse as religion, ethics, philosophy and the sciences to atavisms. In his words:

> The occasional appearance of some extraordinary mental powers may be attributed to atavism; but

> there must have been a beginning to the series of such rare and anomalous events. If, in conformity to the law of progression, we believe mankind to have risen slowly from a rude and humble starting point, such leaps may have successively introduced not only higher and higher forms or grades of intellect, but at a much remoter period may have cleared at one bound the space which separated the highest stage of the unprogressive intelligence of the inferior animals from the first and lowest form of improvable reason manifested by Man.

A common example of an atavism is extreme body hair called *hirsute.* The importance of this trait was noted by Drimmer (1973, pp. 162-163):

> H. Kaulitz-Jarlow, a corresponding member of the Institution Ethnographique, has provided a "scientific" description of Krao at age six. It was the heyday of the controversy over Charles Darwin's theory that man was descended from ape-like creatures . . . and his followers were constantly hoping to turn up a creature intermediate between man and the apes. To some, Krao appeared to be just what they were looking for.
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> In his description, Kaulitz-Jarlow highlighted those features of Krao that he considered particularly simian. 'Thick, jet-black smooth hair covers her head and reaches far down her back,' he said. 'It forms a virtual mane on the back of the neck. Her eyes are shadowed by wide, silky, shiny eyebrows. Her pupils are sparkling and dark black.' Hair, he observed, covered her body from the top of her head to her feet. He went on to point out in detail how closely her facial structure resembled that of the gorilla.
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> Little Krao's character, . . . was amiable; she had an easily satisfied, cheerful disposition. She liked to play and was grateful when attention was paid to her. 'If she is annoyed,' he said, 'her wild nature at once comes to the fore; she throws herself to the ground, screams, kicks, and gives vent to her anger by pulling her hair in a very peculiar way.' Presumably these were also supposed to be ape-like characteristics.

Hirsute evidently does not occur because of the inheritance of a specific genotype, but as a result of hormonal system malfunction, problems in embryological development, or disease (Topping, 1981). A major difficulty in assessing the cause of this phenomenon is both its rarity (In China only about 20 of over one billion people) and the fact that it is usually not researched medically because it is at most a cosmetic problem. The cause of hirsute may not be known for some time because research resources are more likely to be expended in areas which are more directly relevant to saving lives and reducing misery. Thus, it is unlikely that much effort will be expended to determine the cause of the unusual cases which Lull (1932) claims are examples of race atavism.

Most of the examples used to "prove" atavism theory are actually a selection of a wide variety of medical conditions which fit the theory, and an ignoring of those that do not. Triple and double headed monsters (humans and animals born with two or three heads) are not uncommon, but no one supposes that human ancestors had two or three heads. One well known class of human deformities are called *sirens* because of their resemblance to the mythological creatures with the same name due to major structural deformities in the lower extremities which causes the patient to resemble a fish or a snake (Gould and Pyle, 1896, p. 270). Yet, no one has claimed that siren monsters actually once existed in our evolutionary family tree, or any family tree.

Human Atavistic Tails

The most frequently cited modern example of an atavism is the occasional occurrence of "tails" in newborn humans. This proof of evolution was discussed by scientists from Darwin (1896, p. 22) to today. According to Gould and Pyle (1896, p. 277):

> traditions of tailed men are old and widespread, and tailed races were supposed to reside in almost every country. . . . Struys, a Dutch traveler in Formosa in the seventeenth century, describes a wild man caught and tried for execution who had a tail more than a foot long, which was covered with red hair like that of a cow.

Struys quotes other cases, but notes that "whether tails were fleshy or cartilaginous was not known."

Although hundreds of cases were reported between 1850 and 1900 "during the heyday of recapitulation theory and the height of the debates over Darwinism," very few have been well documented until the latter part of the century (Ledley, 1982, p. 1212). Conclusions about human "tails" are typically based on a few cases, a major problem in understanding them because their cause is likely multiple and varied (Gish, 1983). Gould and Pyle (1896, p. 277) admit that many of the past cases could well be examples of people who wear artificial appendages either for show or to exploit others. Due to the difficulty of both researching and verifying these historical accounts—and they clearly vary greatly, both in accuracy and the extent of their believability—it is difficult to draw any conclusions from them. An example which illustrates the credibility problem of these accounts is the following first hand case history on the cause of human tails written by a medical doctor:

> . . . I was called to attend a lady in the country during her accouchement, and seeing that she was likely to have a tedious labor, was very careful in eliciting her history prior to this trying ordeal. She stated she had not felt well for several months—ever since she had worried about some favorite young pigs that were being abused in the yard. Going out she carried the pigs into the house, lifting them fondly by the tail; and that occurrence bore on her mind . . . after labor was completed, the fond son also was blessed with a tail—a nice, well-formed . . . a five-inch tail. . . . the father, who was chagrined at so unusual an anomaly, requested its immediate amputation, which we reluctantly performed; after which he exclaimed: "Now, mine pig-boy does better." The mother, like most women in whom I have found this tendency to "spot" their young, was a very

> frail and nervous temperament, and more than all was ignorant. But, in conclusion, I am convinced that such mothers can, and do often, transmit their mental impressions to the child in utero, thus developing the many so called mother's marks. I could relate several similar instances (Berry, 1894, p. 105).

A good example of the motivations for false reports in this area provided by Andrews (1945, p. 15-16):

> In the Philippine Islands, in 1910, a native was brought to me for inspection. He possessed a blunt bony tail-stump two and one-half inches long. Obviously, it was projection of the coccyx, which, instead of being bent under as usual, continued in a direct line with the spine. A local photographer had retouched and extended the projection in a photograph to a pointed spike six or eight inches long, and sold the pictures to tourists like hotcakes. For years afterward they kept appearing in my mail as indisputable evidence of a "tribe" of people with tails.

As early as 1923, Klaatsch (1923, p. 40) reviewed several human tail claims that he located in the literature, including one that grew to three inches in six months and another two-and-a-half inch long soft tail that developed on a Tamil girl, concluding that:

> Children are occasionally born with tails, and these sometimes have nerves, blood vessels, and muscles—in some cases even cartilage or bone. This type of human tail, is, however, scarce and is generally, at most, an inch long projection. 'Soft tails' are more frequently found, and they run to a length of ten inches or more.

Although many tail reports are false or exaggerated, some of the more recent accounts have been verified and studied (Gould, 1982). Tail-like appendages still occur in humans, and thus can be studied using the advantages of modern research knowledge and techniques. A recent human tail controversy was started by an article in the *New England Journal of Medicine* (Ledley, 1982) which discussed a 7-pound baby born in a Boston hospital with a slender, tapered, 5.5 cm long appendage located on the baby's lower back near the end of the spine. It was covered with hair and skin of normal texture and internally it had a soft, fibrous fatty core (1982, p. 1213). Although it contained nerves, it was not a true tail since it lacked both bone and cartilage. The report (1982, p. 1212) then claimed that the tail "presents a striking clinical confirmation . . . [of] the reality of evolution. . . . The caudal appendage brings this reality to the fore and makes it [evolution] tangible and inescapable [and is a rare glimpse of] the relation between human beings and their primitive ancestors" (1982, pp. 1212, 1215).

Among the many anomalies that have been falsely labeled "tails" include a variety of growths. The "tail" usually develops on the person's back, but is also found in many other areas in which they do not normally appear in lower animals—most commonly in the lumbar gluteal areas. They usually have hair and nerves, but rarely bone, cartilage or muscle. It is now known that the portion of the body which undergoes the most profound growth and changes during embryonic development is the nervous system. Because of this rapid growth and the complexity of this system, anomalies are not rare. These finger-like projections, among which include those mislabeled "tails," are often some type of tumor, and many are lipomas. Ledley (1982, p. 1213) notes: "there are no well-documented cases of caudal appendages containing caudal vertebrae or an increased number of vertebrae in the medical literature, and there is no zoological precedent for a vertebral tail without caudal vertebrae."

Allford (1978, p. 37) concluded from her review on the pathological examinations of human tails that "these fingerlike projections were more than likely fibro-fatty polyps." Embryological studies have now emphatically concluded that most examples are some type of tumor or malformation. Further, their location is often definitely too high up on the back to be any type of atavism tail. Allford (1978, p. 37) further concludes that:

> The reason that human tails are never described in medical books of pathology is because they do not exist. What is referred to as tails by some physicians are not true tails but congenital anomalies. In embryonic life, the area that undergoes the most profound growth changes is the nervous system. Because of these changes anomalies frequently result. The fingerlike projections, which are found in many areas on the surface of the body, and very commonly in the lumbar gluteal areas, are congenital lipomas. The congenital dermal sinus is frequently found in the lumbosacral area. Its attachment may be directly under the opening of the skin or may go several centimeters deep and be attached to the spinal canal. Frequently these contain hemangiomas or lipomas.

She found no evidence that these tails are able to 'wag' or move, although if muscle and nerve attachment existed and extended into these finger-like projections, movement was possible. Interestingly, it is not unusual for tailed animals to develop an *extra* tail. If the presence of one tail is an atavism, the development of two in the animal would indicate that many animals once normally had two tails—a conclusion that is totally lacking in evidence. Both of these abnormalities can be explained in other ways. Many causes and types of human tails exist and, although they are extremely rare (probably only a few cases or less per decade worldwide) they are not related to, and often they do not even resemble, animals tails. As Ledley (1982, p. 1214) concludes: ". . . The human caudal appendage does not represent a regression to a lower species . . . it is not a reversion . . ."

Other Atavistic Organs

Other examples of claimed atavisms include the supernumerary digits (extra fingers or toes) and both the suppression and hypertrophy of digits that sometimes occurs in humans and most animals. Both chromosomal information errors and developmental problems can cause an extra toe or finger to develop or, in the case of thalidomide babies, complete lack of, or partial development of, an appendage or even developmental flaws which causes them to look like seal flippers (Fine, 1972). If development in one area was

not suppressed at precisely the correct time, an extra appendage could result. A premature suppression can likewise cause the *lack* of a structure.

Another type are the presence of animal mammary glands on adult humans that resemble those of lower mammals. This was an important line of evidence for evolution because, as Rothenberg (1975, p. 148) notes: "The presence of accessory nipples is thought to substantiate the theory that humans have descended from lower forms of animal life." The cases on record of supernumerary nipples *(polythelia)* and supernumerary breasts *(polymastia)* amount to about 1% of all births, and include both human males and females (Greer, 1977, p. 104). The condition is frequently caused by abnormalities that result from genetic disorders and/or disease. As Rothenberg (1975, p. 147) notes:

> . . . the supernumerary or accessory nipple, . . . found in pairs or singly, are usually seen on the chest wall beneath the true breast or in the upper abdominal region. Most accessory nipples are in a line with the normal nipples but in a minority of cases they are located on the breast itself or in or near the armpit. Extra nipples occur just as often in males as they do in females. As puberty progresses, the accessory nipple may enlarge somewhat. Sometimes, there is breast tissue beneath the accessory nipple but more often true breast tissue is lacking.

A similar but extremely rare deformity, is the total absence of one or both breasts. It affects females more often than males, and more commonly one breast rather than both are missing (Rothenberg 1975, p. 147). As expected, except as a throwback to premammal existence, no claims as to how *this* condition supports evolution have been made.

During the seventh week of human embryo development, the *mammary ridge* first appears. In the human, it develops in the thoracic region and becomes breasts in females and nipples in males and females. Occasionally, Allford (1978, p. 47) notes, more than one nipple develops on each side; an occurrence used as evidence of a human relationship to "lower" mammals because many of them have from six to ten pairs of nipples. Allford, in her practice as a medical doctor, notes that she has never seen more than one extra pair of rudimentary nipples and that chromosomal studies of these cases show that an increase in the number of X-chromosomes in the cells of such individuals often exists.

To be a true atavism, a supernumerary breast in humans would have to occur along the lateral line as they do in lower mammals. This arrangement is required if they are throwback to when human females supposedly had a set of teats similar to a dog. In most cases, though, they do not develop according to this pattern, and the number of added nipples, often which lack breast tissue, are usually no more than one or two. This actual pattern that exists in humans, the so-called "mammary line," forms a vase shaped single line. Its top extends from the armpits, and it narrows as it passes through the normal nipple area, the thinnest part being on the abdomen. They often occur in or near the armpits (as is normal in some kinds of bats) or in the inguinal region (as is normal in some whales) but they can occur almost anywhere on the body—even in locations where mammals do not have mammary glands, such as on the back, arms, legs and buttocks (Klaatsch, 1923). The medical classification of this condition is a genetic or developmental deformity, and it is consistently treated as such by the health establishment. As Rothenberg (1975, p. 148) notes:

> Accessory nipples in a child can be removed easily if their presence disturbs the parents, or if a mature individual with this anomaly finds them unsightly. Simple surgical excision results in a small, transverse, linear scar measuring about 1 inch in length. It can be accomplished readily in infancy, childhood, or in adulthood.

Among the many other putative atavisms includes excessive hair growth (such as the "bearded woman") hair color anomalies, growth of deer-like horns out of the head area, abnormal elasticity of the skin, an ability to move the body in extreme and unusual ways, and a body control which permits one to move the ears, or even the eyeball by their own muscles (for the latter in such a way that can literally pull the eyeball out of their eye sockets) *ad infinitum* most all of which have been shown to be due to disease or gene abnormalities. Citing the famous anatomist, Romer, what these things prove (or do not prove) about evolution is difficult to say. One can select examples such as the cases of individuals born with what seem to be rudimentary tails to prove that these anomalies are a reversion to previous developmental types, but unless compelling evidence exists otherwise, consistent interpretation is required in *all* of these cases, even those where individuals are born with mammary glands on their backs.

Atavistic Body Organs

Organs that are claimed to be atavistic occasionally appear in organisms which supposedly represent a 'throwback' to a condition found in some hypothetical ancestral type (Davidheiser, 1969, p. 239). Humans are occasionally born with a pair of ribs in their neck, and such cervical ribs are thought by some evolutionists to be an atavism throwback all the way back to our reptilian ancestry. Humans normally do not have neck ribs, but they naturally occur in many living and fossil reptiles. Yet, the presence of cervical ribs is better understood as a normal human variation. Extra ribs sometimes occur, and when they do they can develop in only two locations, i.e., above and below the normal set. Thus, extra ribs occur either in the neck or lumbar regions (the same reasoning is true of extra fingers or other supplemental organs, a condition which is not rare in humans and animals in general). Interestingly, the cervical ribs are *twice* as common in women as in men (Durham, 1960, p. 99). The logical but absurd conclusion from this is that women are more closely related to reptiles than men, or even that men evolved from reptiles before women. The extra ribs that sometime appear in the lumbar region are called gorilla ribs. This anomaly, incidentally, occurs three times more frequently in *men* than in women (Nordsiek, 1960).

Actually, many of the characteristics described as atavistic, according to Lull (1932, p. 136) "often occur in men, but rarely in women." Many so-called atavistic characteristics are therefore likely related to the

"X" chromosome, or at least the interaction of the "X" and "Y" chromosomes (actually more likely the lack of an "X" chromosome) with other genes. Other causes of atavistic traits include disease and diet problems or hormonal malfunctions that occur during early development.

Atavism and Race

The concept of atavism has clear racial implications. Mongolism, the condition in which an extra chromosome causes a person to be both retarded and have some superficial facial characteristics of this race, is an example. The belief that certain races are 'ancestral,' and thus less evolved than the modern white race, was once mainline science (Down, 1866; Chase, 1980). The term 'Mongolism' comes from the assumption that this condition is an atavistic throwback to an earlier primitive race which it was believed is extinct, but is close to the modern mongoloid race! The term 'mongoloid idiot' also has its source in this once common but clearly mistaken belief (Gould, 1980). Gould (1981, pp. 134-135) adds:

> . . . unknown to most people today the supposed link between degeneracy and racial ranking has left us at least one legacy—the designation of "Mongolian idiocy" or, more blandly, "mongolism" for the chromosomal disorder properly known as "Down's syndrome." Down argued that many congenital "idiots" (a quasi-technical term in his day, not just an epithet) explained anatomical features, absent in their parents but present as defining features of lower races. He found idiots of the "Ethiopian variety''—''white Negroes, although of European descent" (1886, p. 260)—others of the Malay type, and "analogues of the people with shortened foreheads, prominent cheeks, deep-set eyes, and slightly apish nose, originally inhabited the American continent" (p. 260). Others approached "the great Mongolian family." "A very large number of congenital idiots are typical Mongols" (p. 260). He then proceeded to describe, accurately, the features of Down's syndrome in a boy under his charge . . . ("obliquely placed" eyes and slightly yellowish skin) . . . he concluded (1866, p. 261): "The boy's aspect is such that it is difficult to realize that he is the child of Europeans, but so frequently are these characters presented, that there can be no doubt that these ethnic features are the result of degeneration Down even used his ethnic insight to explain the behavior of afflicted children: "they excel at imitation''—the trait most frequently cited as typically Mongolian in conventional racist classifications of Down's time.

These beliefs hardly did much to improve race relations in the Western world, and were a major contributor to the biological racism that developed in the middle 1800's in Europe and the United States.

Objections to the Atavism Theory

Since atavisms are "biological throwbacks" affecting both the appearance and behavior of the animal, a biological mechanism must exist for them to occur. Specifically, some physical means must exist to carry a complete set of intact genetic instructions or "blueprints of several past stages of human evolution" for eons up to contemporary humans. This would require a system which separately utilizes several separate sets of genetic codes, one for the current human and one for a previous stage or stages of evolution. Because human evolutionary development is believed by the largest school to be extremely slow, occurring by almost imperceptible changes from generation to generation, it would seem that humans would have to store either the genetic code of a certain specific period of human evolution, or the entire code for every stage. The latter would be impossible because, according to evolutionary theory, literally *multi-billions* of separate small changes must have occurred in the process of human evolution. Likewise, no evidence exists for a system which would select only a *certain period* of human evolution, and then record this blueprint somewhere in the genetic structure for future use. A whole set of blueprints must be stored because a whole set of structures is involved in most claimed atavisms. The complex mechanism would be required to, in essence, store templates for certain model years, or store the various sets of plans for traits at different and clearly distinct stages of the animal's evolution. The theory of "punctuated equilibria," a modern version of Goldschmidt's "hopeful monster" concept, suffers from many of the same problems.

The survival of the fittest concept would predict that selection favors *only* those biological structures which clearly enabled humans to experience a survival advantage over both other animals and those humans who do not possess the biological structures in question. And the biological structures producing the 'throwback' would in most cases confer little or no advantage to the animal, and thus would not be selected. Further, since many putative atavistic structures are clearly detrimental or fatal, selection would often work *against* their preservation.

It is difficult to even imagine how a biological structure necessary to accomplish that which is described above could possibly have evolved by random mutations. Obviously, the structure would be totally useless until it was completely evolved or developed, and even then, except as a curiosity, it would appear to be useless. In summary, contemporary evolutionary assumptions would conclude that structures which do not confer a survival advantage are unlikely to be selected for, and thus unlikely to be passed on to future generations. Lull (1932, p. 136) even concludes that atavistic characteristics,

> are such as to make their owner more conspicuous and doubtless expose him to dangers from which the more obscure animal would be immune. Hence, [the continuance of some atavisms] is opposed to the principle of natural selection, as the results are a handicap and not an aid in the struggle for existence.

Thus, if some genetically atavistic characteristics would appear, they would be "selected out" and thus would in time no longer appear in the organism.

Atavism and Social Policy; the Major Tragedy of This View

The theory of evolution was most prominently introduced in corrections theory by Cesaro Lombroso.

How he did this was summarized by McCaghy (1976, p. 14) as follows:

> Lombroso was a physician trained in psychiatry and biology, and he was aware of the . . . recent works of Charles Darwin, who connected modern humans with a nonhuman past through his theory of evolution. Lombroso had been involved for some time in the study of physical differences between criminals and normals, but his notion of atavism as a cause of crime emerged as a bolt from the blue during his autopsy of an infamous robber, whom Lombroso found to have skull depressions characteristic of lower primates.

No minor figure in criminology, Lombroso has been described as "one of the best known and possibly one of the least well understood figures in criminology." He was the founder of the positivist school in corrections which applied the scientific method to study the cause of behavior (Lentini, 1980; Scartezzini, 1980). McCaghy (1976, p. 14) claims that:

> his importance in spurring research on the criminal is undeniable . . . Lombroso's most important book was *L'Uomo delinquente (The Criminal Man),* first published in Italy in 1876. Here he presented his doctrine of evolutionary *atavism.* Criminals were seen as distinct types of humans who could be distinguished from noncriminals by certain physical traits . . . to identify persons who were out of step with the evolutionary scheme. Such persons were considered to be closer to apes or to early primitive humans than were most modern individuals; they were throwbacks (atavists) to an earlier stage in human development.

In his *The Criminal Man,* Lombroso included a long series of anecdotes to show that the *usual* behavior of all animals is criminal and amoral. Among the many examples that he provides include the behavior of some who eliminate sexual rivals by "murder," killing out of rage, such as "mad" elephants, and other animals going on stampedes, etc. He even used examples such as ants becoming impatient over recalcitrant aphids which were then killed and devoured as "punishment." Lombroso even concluded that insectivorous plants procure food in ways which are the "equivalent of crime." Having established, at least to his own satisfaction, that animals were "criminal" by our standards, he then proceeded to build a case for the view that humans who commit similar crimes must also have reverted back to their animal ancestry. Even the language use by atavistic criminals, he argued, showed this regression. He concluded that it was similar to "savage tribes" and included many onomatopoeias and personifications of inanimate objects. Said Lombroso (1911, p. 225), "they speak like savages, because they are true savages in the midst of our brilliant European civilization." He describes his conclusions further:

> This was not merely an idea, but a revelation. At the sight that [criminal] skull, I seemed to see all of a sudden, lighted up as a vast plain under a flaming sky, the problem of the nature of the criminal—an atavistic being who reproduces in his person the ferocious instincts of primitive humanity and the inferior animals. Thus were explained anatomically the enormous jaws, high handle-shaped or sessile ears found in criminals, savages, and apes, insensibility to pain, extremely acute sight, tattooing, excessive idleness, love of orgies, and the irresistible craving for evil for its own sake, the desire not only to extinguish life in the victim, but to mutilate the corpse, tear its flesh, and drink its blood. (Quoted in McCaghy, 1976, p. 14)

And, Lombroso's theory was not a work of abstract science. He founded and actively led an international school of 'criminal anthropology' that spearheaded one of the most influential of late nineteenth-century social movements (Papa, 1983). Lombroso's 'positive,' or 'new,' "school campaigned vigorously for changes in law enforcement and penal practices" (Gould 1977, p. 225). Specifically, as Gould (1981, pp. 140-141) noted:

> Lombroso invoked biology to argue that punishment must fit the criminal, not, as Gilbert's Mikado would have it, the crime. A normal man might murder in a moment of jealous rage. What purpose would execution or a life in prison serve? He needs no reform, for his nature is good; society needs no protection from him, for he will not transgress again. A born criminal might be in the dock for some petty crime. What good will a short sentence serve: since he cannot be rehabilitated, a short sentence only reduces the time to his next, perhaps more serious, offense . . . The original Lombrosians advocated harsh treatment for 'born criminals.' This misapplication of anthropometry and evolution theory is all the more tragic because Lombroso's biological model was so utterly invalid and because it shifted so much attention from the social basis of crime to fallacious ideas about the innate propensity of criminals.

An example of the atavistic traits the criminal anthropology school evaluated include ears. For example, (Bean, 1894) describes one ear which at the top formed an almost acute angle, in contrast "to the graceful curve which is characteristic of the normal ear. This [sharp ear] form is very common in those who are tainted with criminal proclivities or who are inclined to abnormality of some sort." The author (1894, p. 261) then gives another example of an ear that is a "coarse unloving appendage to the human head [which] bespeaks a perverted or undeveloped mind. It is a mark of arrested or distorted development." After describing the criminal ear, the author concludes, "such ears as these are a badge of inherited poverty of moral instinct. Why should we not study these placards which nature has erected and thus prepare ourselves intelligently to labor for development of our race?" (p. 262).

The Fall of the Atavistic Criminal Theory

The most well-known early study which empirically disproved the atavism paradigm as a factor in causing crime was completed by Charles Goring (1919). In a study considered at the time to be a model of scientific and technical accuracy, Goring carefully compared approximately 3,000 English convicts with several large groups of Englishmen who did not have criminal rec-

ords. The convicts he studied were all recidivists, and for this reason he assumed that most were of a "thoroughly criminal type. In addition, comparisons were made with 1) university undergraduates, 2) officers in the British army, and 3) hospital patients. His conclusions was that "there were no more protrusions or other peculiarities of head among the prisoners than among the royal engineers" (Vold, 1958, p. 53). Although Goring's work resulted in the final death blow to the theory of atavism and crime, it took years to convince its many devoted followers that the theory enjoyed no validity. As Gould (1981, p. 134) notes:

> Lombroso slowly retreated under the barrage [of the criticism of his theory]. But he retreated like a military master. Not for a moment did he compromise or abandon his leading idea that crime is biological. He merely enlarged the range of innate causes. His original theory had the virtue of simplicity and striking originality—criminals are apes in our midst, marked by the anatomical stigmata of atavism. Later versions became more diffuse, but also more inclusive. Atavism remained as a primary biological cause of criminal behavior, but Lombroso added several categories of congenital illness and degeneration: "We see in the criminal," he wrote (1887, p. 651), "a savage man and, at the same time, a sick man." In later years, Lombroso awarded special prominence to epilepsy as a mark of criminality; he finally stated that almost every "born criminal" suffers from epilepsy to some degree. The added burden imposed by Lombroso's theory upon thousands of epileptics cannot be calculated; they became a major target of eugenical schemes in part because Lombroso had explicated their illness as a mark of moral degeneracy.

The empirical evidence against the theory, the daily contradictions to it, and even the lack of evidence were only part of the reason for the theory's ultimate downfall (Moran, 1978). Another reason was that government experts and criminologists simply went on to new ideas and new hypotheses of crime causation. Other theories which implied that criminals were physically different from non-criminals, such as the work by Sheldon et al. (1940) later came into vogue, but the theory of atavism and crime has not been revitalized to any significant degree since the work by Goring. This raises the question, "How did the theory of atavism develop to take such a prominent place in corrections, complete with many examples which convinced many professionals of the correctness of the theory?" Several hypotheses are listed below:

1. Once a belief is established, its supporters can often find support for it if they look hard enough (Gould, 1981, 1976). In researching a population of "criminals," one can often locate many good examples of persons who supposedly had "ape-like" body characteristics. Unless a comparison group of non-criminals is used, limited insight can be gained by this technique. This is partly what occurred; many examples which supported the theory were located among the criminal population, and it was assumed that comparable examples did not exist, or rarely existed, in the non-criminal population. Topinard (1887, p. 676) said of Lombroso's research,

> He did not say: here is a fact which suggests an induction to me, let's see if I am mistaken, let's proceed rigorously, let us collect and add other facts . . . [rather his] conclusion is fashioned in advance; he seeks proof, he defends his thesis like an advocate who ends up by persuading himself . . . [Lombroso] is too convinced.

2. Certain nationalities or races of people, because of their social environment, discrimination, or for other reasons, are at times for various reasons more likely to involve themselves in crime. These races included several which had the characteristics that were supposedly typical of an atavistic. White Anglo-Saxon Protestants, because of their socioeconomic status and other reasons, were less commonly found among the convicted criminal populations compared to individuals who were members of minority groups such as blacks, Italians, Armenians and others. This explanation, no doubt, accounted for many of the so-called atavistic "evidences," just as it also now accounts for the highly disproportional number of blacks in American prisons.

3. Because of disease, health problems, poverty, etc., certain individuals may develop traits which were similar to the supposed "atavistic man." These traits in turn may make it more difficult to hold a job, or even achieve social acceptance and, as a consequence of these factors, exist within society's laws. Thus, for these reasons these individuals may be more likely to involve themselves in criminal behavior.

In view of these obvious facts, Lindesmith and Levin, (1937, p. 667) conclude that this biological theory of criminality rapidly spreads to the criminology elite because:

> The immediate attention attracted by *L'uomo delinquente* was no doubt due to a number of factors in the intellectual life of the times which caused the acceptance of Lombrosianism [the theories of Atavism expounded by the famous criminologist Cesaro Lombroso] as a logical development of already existing tendencies in the social sciences. Chief among these was the spread of Darwinism. After the publication . . . of Darwin's *Origin of the Species*, Darwinian concepts not only swept through the biological sciences, but were also applied in a wholesale manner in the social sciences—in anthropology, political sciences and sociology. The ideas of Lombroso, although they were by no means new, were stated in an extreme form which attracted the attention of those who were preoccupied with Darwinism and its application to other fields of thought. In the same year that the *Origin of the Species* appeared, an anthropological society was founded in Paris and the next debate witnessed considerable development of interest in this field . . . In general, it may be said that an increased prestige of the natural sciences and especially biology led the beginning of a series of importations from one or the other of these fields into the realm of the social sciences.

Lombrosianism represents the first major importation of this character into criminology.

Lindesmith and Levin (1937, p. 671) also note that the development of science has included periods where "myth and fashion and social conditions have often exercised an influence quite unrelated to the soundness of theories or to the implications of accumulated evidence." Referring specifically to the Lombrosian theories, notably atavism, they state (p. 653):

> From a sociological viewpoint, the advent of Lombroso represents a retrogression or an interlude in the progress of criminology rather than a step in advance. The eclipse of the earlier work may perhaps best be explained as a result of shifting prestige values associated with the importation of social Darwinism into the social sciences, with a growing popularity, in the latter part of the 19th century, of psychiatric and other individualistic or biological theories, and with the isolation of American criminology from earlier European developments.

In addition, Lindesmith and Levin (p. 661) stated:

> the preoccupation of Lombrosians with anatomy and with Darwinian concepts and their assumption that the causes of crime were to be found in the nature of the criminal taken 'individually' rather than in relation to others led them to fail entirely to appreciate the importance of the type of historical research done by Ave-Lalemant and others. What Lombroso did was to reverse the method of explanation that had been current since the time of Guerry and Quetelet and, instead of maintaining that institutions and traditions determined the nature of the criminal, he held that the nature of the criminal determined the character of institutions and traditions.

It also should be stressed that, although Lombrosian theories of crime were very popular, they were also sharply criticized by many. Some biologists recognized the racism in Darwinism, and discerned where the theory was leading science. Others realized that the evidence upon which it was based was not solid, thus Gould (1981, p. 132) notes:

> Lombroso's theory of atavism caused a great stir and aroused one of the most heated scientific debates of the nineteenth century. Lombroso, though he peppered his work with volumes of numbers, had not made the usual obeisances to cold objectivity. Even those great *a priorists*, the disciples of Paul Broca, chided Lombroso for his lawyerly, rather than scientific, approach.

Although Lombrosian authors later modified their theory to allow for the influence of some social factors, even in the case of supposed fully atavistic criminals, the fact is the theory gained considerable attention and was accepted by many for some time after it was proved wrong—and it is still accepted by many, even today, as a valid interpretation of the data.

The Concept of Atavism Today

Ironically, race atavism is still discussed by some scientists as a viable theory. As Gould (1976, p. 16) concludes "despite its weak plot, this old—and dangerous—farce keeps reappearing." In Northern China, evidence of ambiguous footprints, samples of excretion and hair have been interpreted by scientists as evidence that ape-like atavistic creatures exist there. According to Topping (1981, p. 113),

> Chinese scientists now have two theories about these strange creatures. Some believe that the wild men are atavisms—genetic throwbacks to an earlier form of the human species, resulting from chance combinations of ancestral genes. Others say the creatures are actually direct descendants of man's distant ancestor, the great ape, Gigantopithecus.

Genetic breeders occasionally claim that they achieved "reverse evolution" and produce a throwback. The German zoologist Heins Heck claims to have bred back a horse to a tarpan, a miniature horse which allegedly lived in the stone age.

Heck has spent 30 years in the Munich Zoo laboring to create beasts "the like of which have never been seen by living man—a beast, in fact, which had been dead for almost 600 years" (Carpenter, 1949, p. 28). Actually, what Heck has been doing is simply showing that a lot of animal types which were believed to be extinct can be bred back into existence. As Carpenter (1949, p. 28) describes "some freak animals, insects and plants seem to have inherited one or two of the characteristics of their ancient ancestors. They may possess hair in places where their breed has not grown hair in thousands of years. They may sport extra toes or feet that their ancestors discarded centuries before." Although called throwbacks or atavisms, they actually involve rather minor traits, nothing different than causing the set of conditions which allows genetic traits that once commonly existed in a population to again increase in number. An example of this is the breeding of horses so that either one or both of the side splints are functional but, as Gould notes (1980, p. 26),

> horses have never lost the genetic information for producing side toes even though their ancestors settled on a single toe several million years ago. What else might their genetic system maintain, normally unexpressed, but able to serve, if activated, as a possible focus for major and rapid evolutionary change? Atavisms reflect the enormous, latent capacity of genetic systems, not primarily the constraints and limitations imposed by an organism's past.

These, though, are family atavisms, not true atavisms as discussed here. They are not different than a child having a trait which the family has not seen in generations, such as great-grandmother's red hair.

The problem is when we extend the occurrence of the expression of an inherited genetic trait to claiming the expression of a trait which allegedly existed millions of years in the animal's evolutionary history and which has not been expressed during much, or most, of this time. Although Gould referred to the horses with extra digits as atavisms, he himself (1980, p. 24) notes that they "had been admired and studied since Caesar's time." They are simply part of the gene pool which, for a variety of reasons, may not regularly be expressed and often skips generations, likely because

they are recessive genes and possibly require the uncommon event of a zygote that receives the recessive gene from both mother and father. Just as one would not call a daughter who has her grandmother's eyes an atavism or an evolutionary throwback, likewise, these examples would also not be properly termed such. If one insists on using the term atavism to apply to this occurrence, then it would be necessary to devise a way to differentiate the demonstrated property of various traits skipping a generation or two, for example, and the disproven scenario where a woman gives birth to a primitive evolutionary throwback with traits similar to her alleged ancestors of multi-millions of years ago.

As a whole, though, although atavisms were once commonly presented as proof of evolution in the textbooks for generations, the subject is generally not even mentioned today. Like vestigial organs, embryological recapitulation and nascent organs, the whole concept of atavism has largely been abandoned in the biological sciences. Most all of the conditions formally labeled "atavistic" are now seen as belonging in the domain of medicine and disease. It is yet another embarrassing chapter in the history of Darwinian evolution theory. And although disproved, it is tragically still very much with our culture. As Hicks (1986, pp. 130-156) concluded:

> I only wish that Lombroso's ideas were passe; on the contrary, his atavistic criminal is ever with us. Check the Sunday comics: the conventional comic burglar is bald . . . has a jutting lower jaw, broken nose, low forehead, and isn't bright. During my days as a police officer I searched in vain to root out this criminal, but I discovered that his image was alive and well in the minds of law enforcers.
>
> In 1977, while I was a police training officer (and a graduate student in anthropology), investigators from the Tucson, Arizona, office of the Internal Revenue Service invited a few of us . . . to view a new videotape on conducting interviews and interrogations. . . . My reaction to the tape—not shared by my companions—went from interest to disbelief as I watched the Army investigator explain how one can identify criminal types by the structure of the cheek bones, distance between the eyes, degree of eyebrow growth, composition of the nose and so on, all illustrated by large charts depicting typical criminal faces. I recall that eyebrows that do not separate but represent a more or less hairy continuum from one eye socket to the next indicated nefarious propensities. (My own eyebrows, I am ashamed to say, are connected.) . . . And the reactions of my companions, who had never heard of Lombroso? My boss was impressed. The detective commander wanted a copy of the tape. And the I.R.S. and the Army—I shudder.

Tragically, though, the theory still is reflected itself in modern theories of degeneration (Nachsohn, 1985; Hapham, 1976; Rothenberg, 1975) and even in some schools of "feminist criminology" (Brown, 1986; Klein, 1973; Faccioli, 1976.

Summary

The theory of atavism was examined as an example of the tendency for many sciences to borrow uncritically from other disciplines. Although the theory of atavism was soon found to lack empirical support, it was accepted uncritically for decades and was used in theory building by many criminologists and others. Part of the reason for this was the fact that it relied heavily on the assumption that evolution by natural selection was empirically supported and a valid scientific theory. Only part of this tragedy is the harm that this theory has caused science to progress by misdirecting much energy into non-productive and dead end areas. The far greater tragedy, though, is the fact that the theory probably influenced the criminal conviction of thousands of innocent victims. As Gould (1981, pp. 138-139) mused:

> We do know that Lombroso's stigmata became important criteria for judgment in many criminal trials. Again we cannot know how many men were condemned unjustly because they were extensively tattooed, failed to blush, or had unusually large jaws and arms. E. Ferri, Lombroso's chief lieutenant, wrote (Ferri, 1897, pp. 166-167):
>
> 'A study of the anthropological factors of crime provides the guardians and administrators of the law with a new and more certain method in the detection of the guilty . . . [physical traits] will frequently suffice to give police agents . . . scientific guidance in their inquiries, which now depend entirely on their individual acuteness and mental sagacity. And when we remember the enormous number of crimes and offenses which are not punished for lack of inadequacy of evidence, and the frequency of trials, which are based solely on circumstantial hints, it is easy to see the practical utility of the primary connection between criminal sociology and penal procedure.'
>
> Lombroso detailed some of his experiences as an expert witness. Called upon to help decide which of two stepsons had killed a woman, Lombroso declared (1911, p. 436) that one 'was, in fact, the most perfect type of the born criminal; enormous jaws, frontal sinuses, and zygomata [etc.] . . . He was convicted.'
>
> In another case, based on evidence that even he could not depict as better than highly vague and circumstantial, Lombroso argued for the conviction of a certain Fazio, accused of robbing and murdering a rich farmer. One girl testified that she had seen Fazio sleeping near the murdered man; the next morning he hid as the gendarmes approached. No other evidence of his guilt was offered: 'Upon examination I found that this man had . . . a physiognomy approaching the criminal type. . . . In every way, then, biology furnished in this case indications which, joined with the other evidence, would have been enough to convict him in a country less tender toward criminals. Not withstanding this he was acquitted (Lombroso, 1911, p. 437).'

As Macbeth (1971, p. 57) concluded, "When the first enthusiasm [of evolution] wore off and the bill

for the damages came in, the biologist realized that things had gone too far. There had been bad science as well as bad sociology, and they had to put their house in order." Unfortunately, it was too late for its many victims.

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In one way or another all the major texts of Victorian literature had grappled with this new deterministic naturalism. Struggling against a growing subversion of religious and spiritual authority, the work of Tennyson, Browning, Arnold, and the rest conveys an anguished struggle to hold on to ethical and social values which had formerly been securely grounded in revelation. Arnold's *Literature and Dogma* (1873) was an exemplary text in trying to salvage something of sacred writing—its ethical imperatives and aesthetic character—for an age of growing unbelief. But subsequent history made plain what the perceptive could already foresee: that the grounds for ethics had been eroded as religious orthodoxy shuddered under the destructive weight of deterministic naturalism. By 1929 in *The Modern Temper,* Joseph Wood Krutch acknowledged rather ruefully that the collapse of ethical certitude had been fully accomplished:

> Historical criticism having destroyed what used to be called by people of learning and intelligence "Christian Evidences," and biology having shown how unlikely it is that man is the recipient of any transcendental knowledge, there remains no foundation in authority for ideas of right and wrong; and, if, on the other hand, we turn to the traditions of the human race anthropology is ready to prove that no consistent human tradition has ever existed.

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