Darwin's Cousin Sir Francis Galton (1822–1911) and the Eugenics Movement

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Abstract

A central plank in Nazism, communism, and other totalitarianism movements was eugenics. Eugenics, the science of improving the human race by scientific control of breeding, was viewed by a large percentage of all life scientists, professors, and social reformers for over a century as an important, if not a major means toward producing paradise on Earth. The founder of this new science was Sir Francis Galton, a cousin and close associate of Charles Darwin. Galton's work was crucial in providing the foundation for a movement that culminated in the loss of many millions of lives, and untold suffering for hundreds of millions of people.

Introduction

The now-infamous eugenics movement grew from the core concepts of biological evolution—primarily those ideas expounded by Charles Darwin (Gould, 1996; Himmelfarb, 1959; Shannon, 1920; Haller, 1971; Barzum, 1958). Eugenics took a firm hold in most western European nations and the United States, where it was translated into social policy and still exists in a form often called sociobiology (Sahlins, 1977). It has been well documented that "Eugenics was the legitimate offspring of Darwinian evolution, a natural and doubtless inevitable outgrowth of currents of thought that developed from the publication in 1859 of Charles Darwin's *The Origin of Species*" (Haller, 1984, p. 3). An example of the racism that Darwin produced is illustrated in the following quote from a widely used zoology text in the 1920s:

> The gulf between the most highly civilized and capable races of Europeans and the degraded brute-like African pygmies is so vast that some authorities are impelled to conclude that they belong to distinct species, or at least to subspecies (Newman, 1925, p. 403).

This tragic application, which some would say is a misapplication, eventually contributed to the Nazi Holocaust and many other destructive social movements (Proctor, 1988). The first step that resulted in Galton's life long eugenic crusade was his acceptance of macroevolution. Larson points out that Galton accepted Darwinism for several reasons, not the least of which he expressed in a letter to Darwin saying that it:

> "drove away the constraint of my old superstition" and allowed the acceptance of a purely secular faith in progress. Traditional spiritual beliefs in a fallen creation and human redemption through divine grace gave way to a materialistic view of humanity rising through evolutionary development (Larson, 1995, pp. 18–19).

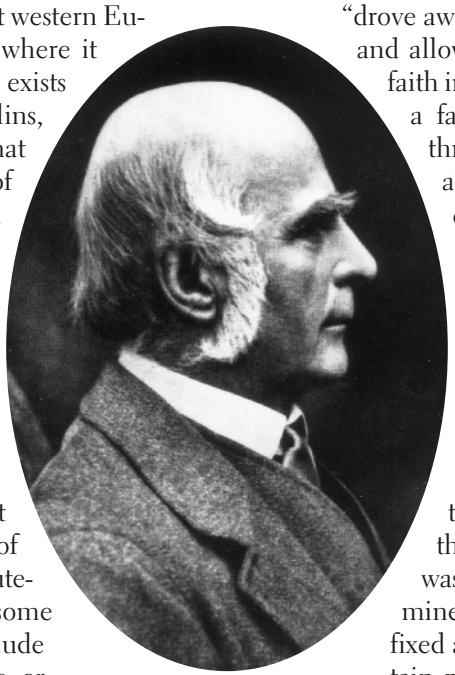

Figure 1. Sir Francis Galton (1822–1911) at age 66

Pearson claimed that Galton was loyal to Darwin "with a loyalty far rarer" then today (1914, p. vii).

Galton was the nephew of Erasmus Darwin, and thus the younger cousin to Charles Darwin. Galton was independently wealthy and held no scientific or teaching post. Best known for his work as the founder of eugenics, he argued that it was largely genetics ("nature") that determined our intellect. Thus, our destiny was fixed at conception and, in the belief that certain people were superior, he strongly advocated controlled breeding to maintain the finest ruling classes (Taylor, 2001).

Understanding why the eugenics movement grew so rapidly and to be so large requires a knowledge of how evolution was viewed in America and Europe during the late 1800s and early 1900s. Many scientists had applied Darwinian analysis to various human "racial" groups, and had concluded that some "races" had evolved further than others. They then reasoned that the presence of certain racial groups in the United States and Europe constituted a

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threat to "the long-run biological quality of the nation." Consequently, it was concluded that "selective breeding was a necessary step in solving many major social problems" (Haller, 1984, p. x). We today are keenly aware of the tragic results of this belief. Most people are horrified by such statements when voiced by modern-day white supremacists and racist groups such as the Arian Nation or Ku Klux Klan. Many of the extremist groups today often quote from, and also reprint and distribute extensively, the scientific and eugenic literature of this time.

Although the eugenics movement dates back to the original work of Darwin, several discoveries around 1880 caused it to become somewhat scientifically respectable. After a basic understanding of the mechanism of heredity, and the rediscovery of Mendelian genetics which occurred soon after the turn of the twentieth century, more scientists than ever before became convinced that they had unlocked the secret of heredity, and thus the key to evolution (Cravens, 1978, pp. 39–47). These discoveries opened up a whole new understanding about humankind's place in nature, and the key to a method that many felt offered major potential for societal improvement. Just as the variations in animal species made them more or less fit for evolutionary survival, so too it was argued that the variations within certain human racial groups made them more or less fit, depending on the environment (Haller, 1984, pp. x–xi).

The Founder of Eugenics, Darwin's Cousin Francis Galton

In the late 1850s when Francis Galton was in his late 30's, he began his lifelong quest to quantify human traits which he grouped into "races," so that he could develop ways of genetically improving the human race. Strongly influenced by his older second cousin Charles Darwin, Galton concluded that the key to human progress was the direct application of Darwinism to society, reinforced by law and national programs (Gallagher, 1999). So important was the eugenic doctrine that within six years of the publication of *The Origin of Species* "Galton had arrived at the doctrine that he was to preach for the remainder of his life ... this became for him a new ethic and a new religion" (Haller, 1984, p. 10). Once he got his "new religion" he set out to find convincing evidence for it:

> The wealth that he inherited from his father at the age of twenty-two allowed him to broaden his familiarity with various racial types through extensive world travels that included explorations of parts of Africa unknown to Europeans, and then to settle into the life of a Victorian gentleman scientist in London. Galton brought back from his travels a firm conviction that there was a natural hierarchy of the human races that placed Anglo-Saxons above all others. His cousin's masterpiece *On the Origin of Species*... stimulated Galton to investigate how the human species had developed through variation, selection, and inheritance, which were the driving forces of Darwinian evolution (Larson, 1995, p. 18).

In 1865, Galton first published his eugenic ideas in a two-part series of articles for *Macmillan's Magazine*, which he eventually expanded into a book titled *Hereditary Genius* (1865). His article focused on the source of natural abilities such as intellect, personality deposition, and even moral qualities, especially those that enabled one to become an effective leader. He also researched the skills needed to achieve in the arts, sciences, literature and in positive human endeavors in general. Galton openly stated that his goal was

> to produce a highly gifted race of men by judicious marriages during several consecutive generations. Consequently ... to obtain by careful selection a permanent breed of dogs or horses gifted with peculiar powers of running, or of doing anything else, so it would be quite practicable to produce a highly-gifted race of men by judicious marriages during several consecutive generations (Galton, 1869, p. 1).

He proposed in his 1865 *Macmillan's* article that the state sponsor competitive "examinations" to find the "best" humans, and that the male winners marry the female winners.

Galton later even went so far as to suggest that the state rank people according to evolutionary superiority, and then use monetary rewards to encourage those who ranked high to have more children. Those ranked toward the bottom would be segregated into monasteries and convents in order to prevent them from propagating more of their kind (Kevles, 1985, p. 4). Galton knew that for his goals to be successful, he needed to avoid what the common people would regard as extreme statements. One reason Galton was conservative in his comments was because he realized, as did Darwin, that radical claims would insure that their eugenic cause would fail:

> Shaw's later proselytizing of the eugenic cause was not to be looked upon by Galton with much favour: he was too extreme and deliberately provocative, while Galton was preaching caution to elicit public acceptance (Forrest, 1974, p. 258).

For his book, Galton relied on a methodology to study genius that has been used by many others since (see Goertzel and Goertzel, 1962). The source of his sample population, which spanned two centuries, was the bibliographical encyclopedia, *Dictionary of Men of Time* published in 1865. Not unexpectedly, he found that many of those included in this massive reference work, presumably the most distinguished statesmen, scientists, painters, and jurists of his day, were blood relatives. Galton con-

cluded that families that had eminent members were far more likely than others to produce offspring of ability. Later researchers, such as Karl Pearson, concluded that fully 90% of one's intelligence was inherited (Hofstadter, 1955). The most commonly cited estimate today is 70%, meaning that a good environment could raise the I.Q. of a child from average (I.Q. 100) to as much as 130, which would qualify the child for gifted programs in most cities.

Galton's goal was to produce a super race to control tomorrow's world, a dream about which he not only wrote, but actively promoted for his entire life. To describe his use of evolution to improve humans, Galton coined the word eugenics (from two Greek words meaning *well born*). He also introduced the terms *nature* and *nurture* into scientific discussions, fueling the nature/nurture debate that still rages today. The term *eugenics* was important because

> By giving a popular name to theories that he had already begun developing from the evolutionary concepts of his cousin Charles Darwin, Galton founded a movement that swept throughout Europe and North America during the ensuing half century (Larson, 1995, p. 18).

In 1901, he founded the *Eugenics Education Society* based in the Statistics Department at the University College of London (Jones, 1980). This organization flourished, later even producing the journal *Biometrika*, which was founded and edited by Galton (and later Karl Pearson). Although still a leading journal today, its editors have since rejected the basic philosophy behind its founding.

Galton concluded that not only intelligence, but many other human traits, were primarily, if not almost totally, the product of heredity and thus by "nature". He also believed that virtually every human trait could be evaluated statistically, and that human beings could be quantitatively compared via many hundreds of traits. Galton also was fully convinced that the survival of the fittest law applied to humans, and that reproduction of the race should be under the control of those who were most intelligent and responsible (Pearson, 1924). This idea is not surprising, in view of the importance of social class in Britain. The social class ethos was that a laborer's son should not aspire to a better station in life. The reason was not because of a lack of social skills or education, but because most labor families were believed to be generally genetically inferior. Greene, after noting that many British were influenced heavily by the writings of people like Adam Smith and Thomas Malthus concluded that

> it is no mere coincidence that all of the men who arrived at some idea of natural selection the first half of the nineteenth century—one thinks of William Wells, Patrick Mathew, Charles Lyell, Edward Blyth, Charles Darwin, A.R. Wallace, and Herbert Spencer—were British. Here, if anywhere in the history of science, we have a striking example of the influence of national habits of thoughts on the development of scientific theory .... (1981, p. 49).

Galton, a child prodigy himself, soon set about looking for other superior men to study—by measuring the size of their heads, bodies, and brains. He devised sophisticated measuring equipment for this purpose that supposedly quantified not only the brain and intelligence, but virtually every other human trait that could be measured without surgery. He even designed a whistle to measure the upper range of human hearing, now called a *Galton whistle*, a tool that still is standard equipment in a physiological laboratory. His work was usually anything but superficial; in fact, much of it was extremely thorough. He relied heavily upon the empirical method and complex statistical techniques, many of which he developed specifically for his eugenic work. In fact, Galton and his coworker, Karl Pearson, were regarded as the founders of the modern field of statistics (to which both made major contributions). Their thorough, detailed research was extremely convincing, especially to academicians. German professors were among the first to embrace wholeheartedly their philosophy, as well as the theory of Darwinian evolution.

One cannot attribute the acceptance of eugenics to British attitudes towards class, because *Biometrika* had far more subscribers in the United States than in Great Britain. Eugenist Karl Pearson (1857–1936) at one time even considered moving to the United States, where he thought people would be more receptive to eugenic ideas. The United States was separated from Europe by a large distance, and one of the most impelling goals since the new continent was settled was to avoid a repeat of the wars that tore Europe apart for almost 500 years. To avoid conflicts, vigorous efforts were made to ensure that the new society was white, Anglo-Saxon and, above all, Protestant (Taylor, 2001). Catholics were excluded, or at least were reeducated. Taylor notes:

> Naturally, if the arguments could be backed by science then the appearance of bigotry would be avoided. Eugenics was thus the perfect answer and vigorously applied at immigration ports such as New York. The work of Franz Boas provided scientific data. Would-be immigrants were often refused entry on the basis of head measurements or finger-tip to knee-cap distance (if too short, the individual was clearly insufficiently evolved!) (2001).

The idea that humans could achieve biological progress, and eventually breed a superior race, was not seen as heretical to the Victorian mind, nor did it have the horrendous implications or the societal taint of Nazism that it does today. Galton saw the fruits of recent advances in technology and the results of the Industrial Revolution, which had proved humans could achieve mastery over inanimate nature (Kevles, 1985, p. 2). People understood that by careful selection, farmers could obtain better

breeds of both plants and animals, and so it seemed logical that the human race could likewise be improved (Jones, 1980).

Galton's conclusion was that, for the sake of the human future, pollution of the precious superior gene pool of certain classes *must be stopped* by preventing interbreeding with inferior stock. The next step was that humans must intelligently direct their own evolution, rather than leaving such a vital process to chance alone. Significantly, Galton was not alone in this conclusion; all of the major supporters of evolution, including Charles Darwin, Alfred Russel Wallace (often called the co-founder of the modern theory of evolution), E. Ray Lancaster, and Erasmus Darwin, believed that "evolution sanctioned a breeding program for man" (Haller, 1984, p. 17).

The route to produce a race of gifted humans was to control the marriages of people to one another (Galton, 1869, p. 1). In an effort to be tactful in his discussion of race breeding, Galton used terms such as "judicious marriages" and "discouraging breeding by inferior stock." He did not see himself as cruel, at least in his writings, but believed that his proposals were for the long term good of humanity. Galton utterly rejected, and wrote much against, the Christian doctrine of helping the weak, displaying a tolerable attitude toward human fragilities, and showing charity towards the poor. Although this response may seem cold and detached, it must be viewed in the scientific climate of the time (Kevles, 1985, p. 8). The mind of the eugenic's co-founder, Karl Pearson, has been described as mathematical and without feeling and sympathy. Galton received numerous honors for his work, including not only the Darwin and Wallace Medals, but also the Huxley and Copley Medals. He even was knighted by the British government, and thus became Sir Francis Galton.

Brain Size and Intelligence

To prove his theory, Galton first had to show how radically the races of mankind differed from each other. Then he had to demonstrate that these differences were inherited. Galton was influenced considerably by French physician Paul Broca, who maintained that human intelligence was related directly to brain size. Galton was aware that some brilliant men had small heads, and that many ignorant men had large heads, but he endeavored to explain away these cases, stressing that *in general* the relationship held.

We know today that some relationship between brain size and intelligence exists, but not for the reason that Galton supposed: better diets and environmental conditions produced children who were physically larger, and consequently had larger brains. Children of the upper classes also were often better educated, and had more leisure time to pursue intellectual interests. Children reared in the slums often had poorer diets, and lived in more adverse mental and physical environments. As a result they often were of smaller stature, and consequently faced many other disadvantages. As is recognized today, children from families of eminence are far more likely to have more intellectually stimulating home environments, receive better educations, and attend better schools. They also have more support, encouragement and motivation to achieve eminence.

For this reason, many cases existed that Galton could use to support his theory. Obtaining a high correlation between brain size and intelligence, though, *does not* prove causation, a well-recognized statistical fallacy that Galton ignored. Although the absolute average size of the brain varies, it tends to be correlated primarily with body size. Except in cases of disease or abnormal development, gross brain size has little to do with intelligence (or any other observable trait), and thus evidently is a non-functional characteristic that fails to affect survival. Some of the most brilliant men in history have had very small brains, while others with large brains were mentally retarded, a fact that, as noted, did not dissuade Galton concerning the validity of his theory (Birdsell, 1972, p. 516; Lorber, 1980).

Galton even claimed that talent was rarely impaired by social disadvantage, and he selected examples of individuals that came from humble families who succeeded as "proof" (Kevles, 1985, p. 4). Galton concluded that because a few of these children *did* become successful, most of them *could have* if they had the intelligence, which obviously most did not. Nor did Galton adequately deal with the fact that those of high ability who rose from poverty might have done far better if they had been born in a privileged family and were given many more advantages.

One "proof" of eugenics came from America, where, Galton concluded, the rigid class structure that existed in Great Britain had been virtually eradicated. If culture prevented talented people from greater achievement, then the number of persons in the arts and sciences in America certainly would far surpass that of Britain. Galton concluded that it did not, and therefore if "the hindrances to the rise of genius were removed from English society as completely as they have been removed from that of America, we should not become materially richer in highly eminent men" (Galton, 1869, pp. 40–43). A serious problem with this generalization was the difficulty in judging a "first class work of literature, philosophy, or art." Galton largely ignored the fact that America and Europe possessed different art values and norms, which blocked the rise of people born into lower social classes. Many Americans produced art that was appreciated in the U.S., but not in Britain. Not many British would conclude that America had more superior artists, writers, etc. (Chase, 1980).

The Making of Galton

Francis Galton's own upbringing in many ways belied his theory. He was born in 1822 into an old family that originally had earned its wealth by manufacturing guns. Galton's father was a banker when he married the daughter of Erasmus Darwin, Charles Darwin's grandfather. His family invested considerable time and energy in Francis' intellectual development. Although Francis Galton's obvious inborn giftedness helped, his sister, who was twelve years his senior, tutored Galton so successfully that at two-and-a-half he mastered basic reading, at four he could write, and at eight he mastered basic arithmetic. In contrast to Francis Galton, his two brothers did not do very well as adults; he was the only one in his family who achieved any measure of public success.

The Galton family admired Erasmus Darwin, and often extolled his eminence in the field of medicine and biology. The family's religious background was Quaker, but Francis' father converted to the Anglican Church at the insistence of his wife, Violetta. This later worked to Francis' advantage, since he was able to attend England's leading universities (which at the time still were restricted to Anglicans).

Although Galton was a precocious child with high intelligence, he did not do well at school. He was sent to medical college at age 16, and did not do well there either (Pearson, 1914). He was evidently bored, unmotivated, and often "partied," attending most social gatherings and staying to the end. He evidently traveled, as is said today, "to find himself." It was only upon reading Darwin's *Origin* in 1860 that he found his true vocation, and for the rest of his life he applied all his considerable energies to advancing eugenics. Although his eugenics science was faulty, however his contributions to statistics, and especially to the field of fingerprints, are scientific milestones for which he should be far better remembered.

In 1844, when Francis was 22, his father died, leaving him a large inheritance. Even with a world waiting for him, and the financial means to explore it, his inclination to do so evidently came not from his genes, but from the influence of those around him. Brooding, depressed, and without goals, Galton consulted a phrenologist who reported that men of his head type were best suited for activities such as colonizing and exploring (Kevles, 1985, p. 6). Believing this obviously erroneous advice to be true, in 1850 Galton went off to explore a part of the world which at that time was largely unknown to Europeans—the foreboding land of dark Africa.

Galton returned to England with a renewed curiosity about both the natural world and the ranking of the races. He soon was awarded a gold medal by the World Geographical Society, and was elected to a Fellowship in the Royal Society as a result of his achievements. This experience also led him to lecture and to write, two tasks at which he excelled. Most of his books went through many editions during his lifetime.

From this point on, Galton's ideas about eugenics rapidly jelled. The knowledge he had obtained during his African travels served to further confirm his beliefs about inferior races, and about how to improve society. This conclusion strongly supported the writings of both his grandfather and his second cousin, Charles Darwin. Galton was also highly rewarded for his scientific contributions, and likely felt that his eugenics work was another way that he could attain even more honors. He concluded that this work was more important than that which he had completed for the various geographical societies, and more important than even his research that helped the fingerprint system become part of the British method of criminal identification.

Eugenics theory is intimately tied to the history of evolution. Haller (1984, p. ix), the author of one of the most definitive works on the history of the eugenics movement, stated: "Eugenics rose out of the Darwinian theory of evolution and attempted to apply the theory to mankind... eugenics... involved the application—or misapplication—to man of the discoveries in genetics that were then transforming scientific understanding of living organisms and the ways that evolution operated." In a letter that he wrote to Darwin, Galton said: "The appearance of your *Origin of Species* formed a real crisis in my life; your book drove away the constraint of my old superstition as if it had been a nightmare and was the first to give me freedom of thought" (quoted in Haller 1984, p. 198). Another aspect of Galton's motivation was:

> Galton, himself an agnostic, found in eugenics an emotional equivalent for religion. "An enthusiasm to improve the race is so noble in its aim" he declared "that it might well give rise to the sense of a religious obligation." He even advocated that law and custom should be utilized to support eugenics for the improvement of the race. This of course is exactly what the Nationalist Socialist Party did not too many years later in Germany (Haller, 1984, p. 17).

Galton called the method of race analysis that he developed "statistics by intercomparison." It later became a common system of scaling psychological tests. This scale permitted Galton "to make a number of general statements about the comparative abilities of different races, statements that were well in tune with" and in many ways were merely re-expressions of, the prejudices of his day (Stegler, 1986, p. 272). Interestingly, Galton rated the ability of the ancient Athenians "very nearly two grades higher than our own—that is, about as much as our race is above that of the African Negro" (Galton, 1869, p. 342). How Galton was able to do this is not entirely clear, but he likely relied almost totally upon the writings of literate Athenians

about whom we know something today (likely the more eminent and talented persons of that culture).

Although biologists of the time provided much of the intellectual and empirical support for the theory, the eugenics movement was supported heavily by the work of "superintendents of asylums for the feeble minded, insane, and alcoholic, of prison wardens and prison physicians, of sociologists and social workers" and those involved in the care of persons with mental or physical problems (Haller, 1984, p. 5). They generally believed that society had a responsibility to care for these persons, and they also felt that society should see to it that such persons did not contaminate future generations.

This conclusion is understandable: those who work with the feeble minded, the institutionalized criminals, epileptics, paupers, and others found their work incredibly frustrating (Dörner, 1981). It often is very difficult to help people change their ways, either by conversation or exhortation. Their general failure to help these people often was explained, not on the basis of the inadequacies or ineptness of the helpers (the social workers, institutions, and doctors involved), but because the patient's condition *primarily* was the result of heredity, and consequently there was *little that one could do to help them*; the caregiver's failure was not his or her fault. Assuming that the patients' conditions were due to heredity, the next logical step was to find ways to restrict the propagation of these people. Numerous laws were passed that required sterilization of a wide assortment of individuals who, for a variety of reasons, found themselves in some institution. Looking back now, we can recognize clearly the reasons for the enormous failure of many of the so-called treatments, and the institution system as a whole (Valenstein, 1986; Doerner, 1981).

Around the year 1900, eugenics was fully accepted as valid by the educated classes. As Kevles stated "Galton's religion [became] as much a part of the secular pieties of the nineteen-twenties as the Einstein craze" (1985, p. 59). There has now been over 200 books written on Galton and his eugenics ideas (Blacker, 1952). Books on eugenics became best sellers; Albert E. Wiggam wrote at least four popular books on eugenics, and several sold very well (Wiggam, 1922; 1924; 1925; 1927), and the prestigious Darwinian family name stayed with the eugenics movement for years (the president of the British Eugenics Society from 1911 to 1928 was Major Leonard Darwin, Charles' son). The obsessional quality of Galton's interest in quantifying every conceivable human activity was reworked by Eliot Slater, a psychiatrist, in his Galton lecture for 1960 (Slater, 1960).

The impact of the eugenics movement on American law was especially profound. In the 1920s, Congress passed numerous laws intended to restrict the influx of "inferior races," including those from southern and eastern Europe, as well as China. These beliefs also were reflected in everything from school textbooks to social policy. American blacks especially faced the brunt of these laws (Stanton, 1960). Interracial marriages were forbidden by law in most states, and discouraged by social pressure in virtually all states. The eugenicists concluded that the American belief that education could benefit everyone was unscientific, and that the conviction that social reform and social justice could reduce human misery substantially was more than wrong-headed, it was openly dangerous (Haller, 1984, p. 6).

According to Haller, it was only between 1870 and 1900 that "educated Americans took giant strides toward a fairly wide acceptance of varying forms and degrees of racism" (1984, p. 50). The year 1870 is an important date because

> before the Civil War the lack of a well-developed racist philosophy in the Western World and a general belief that all men descended from Adam and Eve retarded the growth of race concepts. Only among those defending Negro slavery from increasingly bitter attack did specific biological theories of race become at all important. In the post-Civil War period, however, the general background of evolutionary thought and the writings of European racists provided a climate of opinion that nurtured race thinking (Haller, 1984, p. 50–51).

The conclusion was "the broad, flat nose, the slanted profile of the Negro face, and the smaller, average skull capacity—so it was argued—placed the Negro closer to the anthropoids," (Haller, 1984, p. 52), and since they were inferior, miscegenation was considered the "road to racial degeneration."

Galton not only spent much time studying the races in his extensive travels, but also read widely in the area of anthropology and was involved formally with the Royal Anthropological Institute. He concluded that the Anglo Saxons were far superior to the Negroes, who in turn were superior to the Australian Aborigines (Galton, 1880, p. 17). While Galton himself did not advocate the deliberate extinction of races, he did state that the sentiment *against* the extinction of an inferior race was unreasonable, clearly setting the stage for later abuses (Galton, 1897, pp. 605–606).

Many Jewish thinkers touted the same message; rabbi Henry H. Mayer expressed concern in a service in Kansas City, thundering, "our blood is being adulterated by the infusion of blood of inferior grade" (quoted in Kevles, 1985, p. 61). Even some Protestant and Catholic ministers joined the act, suggesting that the Bible taught eugenics and that we have an obligation to God to apply the "laws" that eugenics had "discovered." As Kevles noted, many of those involved "cast off Biblical religion and, some with enthusiasm, others by default or in despair, had embraced a religion of science" (p. 68). And "with the modern mira-

cles went a modern priesthood: the scientists—no small number of them geneticists. In America, the eugenic priesthood included much of the early leadership responsible for the extension of Mendelism" (Kelves, 1985, p. 69).

An example of Galton's analysis was his study of "the very curious laws of deviation from an average." He employed data on height, and produced a graph using a bar and dot pattern to indicate each case. Each dot represented the height of one man, with the pattern showing a concentration in the middle, and fewer dots as deviation from the middle occurred. The same concept is expressed today in the normal curve theory. By 1875, Galton developed a new way to display these data which he called an *ogive*, a term he borrowed from the field of architecture. This distribution we now refer to as an *inverse normal cumulative distribution function*. Galton, because his goal was to show the dissimilarity of races, began to explore ways of evaluating these differences. The middle (or medium) score he assigned a value of zero (representing mediocrity or the medium), the upper quartile he assigned a value of one, and the lower quartile he assigned a value of minus one. This method later developed into the standard deviation concept.

Crucial in the development of his thinking about the normal curve was a series of experiments with sweet peas, and a tool that later became known as the *quincunx*, a flattened hourglass-shaped device that allows small balls to fall toward the bottom in such a way that, as the balls descend, they cascade through an array of pins. Each shot strikes a pin at each level, falling right or left with equal probabilities each time a pin is hit. The balls are then collected in compartments at the bottom, producing a normal curve. This vivid physical demonstration of the normal curve concept convinced many of the correctness of the eugenic world view (Stigler, 1986).

Conclusions

On occasion, the allegation is made that Darwinism was misused in support of eugenics, when, in reality, neither Darwin or Galton should be faulted for abuses of the theory. The fact is

> Racism was only one step away from eugenics, a school of applied Darwinism founded by Francis Galton with the aim of improving the fitness of the human race by applying the "theory of heredity, of variations, and the principle of natural selection." From eugenics, it was no large leap to genocide (Hsü, 1986, p. 11).

Ultimately the eugenics movement failed, partly because of the excesses arising from it (as in, for example, Nazism). Galton at first encouraged only the "fittest" men and women to marry and produce children, a proposal that became known as "positive eugenics." He later suggested that the unfit be segregated into monasteries and convents to prevent them from reproducing, a proposal called "negative eugenics" (Larson, 1995, p. 19). In time Galton's disciples put more and more attention on negative eugenics, partly because it was simpler to apply!

The fact that negative eugenics became a primary focus of many later eugenicists exacerbated Hitler's eugenic program, which resulted in the loss of millions of lives and widespread violations of human rights. In the words of Harvard biologist Ernst Mayr, "eugenics was conceived by its founders as a way of lifting humans toward greater perfection. It is sadly ironic that this noble original objective eventually led to some of the most heinous crimes mankind has ever seen" (1988, p. 80). Although Galton had founded the eugenics movement, he had not personally fulfilled his own eugenical obligations; the scion of two prominent English families, married to the daughter of a third, he never produced offspring of his own (Taylor, 2001).

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