

CHAPTER XXVII

THE BIOLOGY OF MAN

Introduction. There are many references in the preceding pages to organisms which affect man. However, since man himself is a living organism, he also is a proper object for biological investigation. As a part of the great living world he may occupy a lofty seat in dominion over inanimate nature, over plants and over the lower animals, but he is nevertheless fiber of the living fabric of nature, and a product of ages of adaptation.

Classification. From a taxonomic point of view, he is without any doubt a Chordate, for a notochord, gill slits and a hollow dorsal nerve cord appear during the course of his embryonic development, just as they do in the life of a fish, a frog, a lizard, a hen and a cat. He has a jointed backbone and so is a Vertebrate; he has constant temperatured blood, hair and a diaphragm separating the body cavity into a thorax and an abdomen, and so is a Mammal. Man is a placental Mammal, because in the development of the embryo there is no great quantity of yolk present, and the old reptilian allantois and amnion are arranged to develop into a placenta. He is a Primate, for he has prehensile limbs, his thumb is opposable, his digits have flat nails, he has a collar bone or clavicle and his mammary glands are thoracic. Linnaeus proposed the word Primates to designate the first and highest group of animals. Although Primates such as the chimpanzee and gorilla have not been domesticated, as have the dog, elephant and horse, yet the relatively small amount of investigation so far given to the matter, indicates that the anthropoid apes are the most intelligent of all animals below man. It is the further development of the brain, and everything that this signifies, that places civilized man far in advance of other Primates. Chemical analysis of the body reveals the same chemical elements and compounds, organic and inorganic, as are found in other animals.

Embryology. A careful study of the *embryological development* of man begins with an egg cell, 0.25 mm. in diameter, a microscopic

speck of protoplasm, a typical cell with a nucleus. After fertilization, cleavage stages appear, then a blastula stage is developed, followed by a gastrula stage with ectoderm and endoderm and later mesoderm. A mouth forms by invagination. Other organs which develop are the notochord, the nerve cord, the gill slits, the fish-like heart, the cartilaginous skeleton of the shark, the allantois and amnion of reptile and bird. The heart changes from a two-chambered, to a three-chambered, and then to a four-chambered organ with right and left sides. One can see the lungs, liver, pancreas, pronephros, mesonephros, testis, ovary, Wolffian duct, Müllerian duct (oviduct) form as in other Vertebrates. In certain early stages it is difficult to decide to what class of Mammals this embryo belongs, then mammalian characteristics appear and later primate characteristics. So far as embryological observations go, man is plainly a Primate, a Mammal and a Vertebrate.

Histology. *Histological investigation* shows his skeletal muscle to be made up of muscle fiber units as in other Vertebrates, surprisingly like those of the Mammals and especially the Primates. Histological examination of the smooth muscle of the intestine shows that it is composed of smooth muscle cells as in the intestines of other Vertebrates and more especially Mammals. Similar epithelial cells are found in corresponding locations. Connective tissues such as bone, cartilage, fat, are similar; also the most specialized of all tissues, neurons, are similar. No different types of neurons are found in man than are found in other Mammals. Detailed histological studies of the various organs reveal the fact that liver, pancreas, kidney, testis and lung are all built on the same general histologic plan as the other Mammals. Microscopic resemblance is borne out by the searching powers of the microscope. *Physiological and pathological processes* are also similar. When, by experiment, causes of disease in lower animals are discovered and such diseases prevented or cured, this same knowledge can be applied to the same diseases in man and with the same result.

Comparative Anatomy. Galen (second century, A.D.), the most able anatomist of antiquity, taught for a while at Rome. He was not permitted to dissect human bodies, and was compelled to use bodies of lower animals in his demonstrations. Despite this, his errors were mostly in details, for in general outline, the anatomy of a dog or cat serves fairly well to illustrate human anatomy. When a monkey or, better still, a chimpanzee is available, the

resemblance is still more striking. When compared, the skeletons of a man, chimpanzee, gorilla, cat, dog, deer and horse, part by part, and bone by bone, reveal differences, but what attracts attention most are the similarities in all these Mammals. Correlated with different forms of locomotion one notes differences in shoulder girdles and in the feet (especially the fingers) of all the above examples. Correlated with differences in food one finds differences in skull structure, teeth, etc. Correlated with differences in intelligence one finds differences in cranial capacities and brains. Due to differences in food one finds specialized stomachs in Herbivora, as compared with Carnivora or with Omnivora (man). But the general structure of the voice-box, larynx, trachea and lungs, oesophagus, stomach, intestine, heart, arteries, veins and capillaries, liver, gall bladder, bile duct, adrenal gland, general anatomy of the brain, spinal cord, cranial and spinal nerves, sympathetic nervous system, demonstrates without any questioning a similar groundwork behind the differences. When man is examined from any morphological, physiological, histological, embryological or chemical standpoint, the only rational conclusion is that the same agency that fashioned fish, frog, lizard, bird or other Mammal also fashioned man. The man-like or anthropoid apes, of all other animals, most closely resemble man. Man did not evolve from these apes, but both had a common ancestor.

The species, *Homo sapiens*, family Hominidae, shows in many details of gross and detailed structure close similarities with the Simiidae. Terrestrial life in the open, erect posture, and greater development of the brain have produced differences. Bipedal locomotion has changed the curvature of the spine, lengthened the legs, modified the opposable character of the great toe, freed the arms for a multiplicity of motions, increased the use of the thumb and made the hand a great instrument of use for attack and defense and for gathering and preparing food.

The human body exhibits many primitive characteristics. The radius and ulna are well developed, and many of the wrist bones are distinct. The fibula of the leg is quite large, and the foot is plantigrade. There are still five digits, and the number of phalanges is the same as the primitive number. The shoulder girdle retains the clavicle. The atlas supporting the skull is primitive. The teeth are simple and the premolars are simpler than the molars. The stomach is far simpler than that of the ruminants

and the vermiform appendix is far less specialized than in the Rodents. In many respects man is generalized in structure, but he also exhibits specialization, such as four curvatures of the spine at maturity and the basin-shaped pelvis aiding in the support of the viscera. The pelvis of anthropoid apes is flat as is that of human embryos. The fore-limbs are short. In the foot, the great toe is very rarely opposable, the shock-preventing arch has developed so that the axis of the foot runs along the inner side through the great toe, which is largest, the others having become smaller. The fusion of the two end phalanges of the fifth toe, in a number of cases, is interpreted as an indication of the progressive diminution

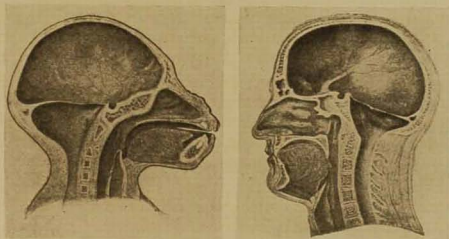


FIG. 389. — Comparison of brain case of ape with that of man. (Photo by American Museum of Natural History.)

of the outer toes and increase of the great toe. The hair scattered over the body usually disappears, and the skin is thus more sensitive. Skin pigment has disappeared in some races. There are thirty-two teeth as in the Simiidae, but they are relatively smaller, especially the canines. Tooth reduction is apparently taking place, as is evidenced by frequent lack of the second incisors and the third molars.

The face is shorter and the facial angle tends to approach a right angle. The facial angle is obtained by drawing a line from the lower margin of the nasal aperture to the ear opening and another line from the forehead to the upper jaw. In the anthropoid apes this is an acute angle. In size the human brain is, on the whole, relatively larger than that of any other Vertebrate. Especially prominent is the large size of the cerebrum in proportion to other parts (Fig. 389). The cerebellum, though much smaller

than the cerebral hemispheres, is relatively large also. The cerebrum covers the cerebellum above and the cortex of the cerebrum is increased in area by a complicated system of convolutions and fissures. Especially well developed are the frontal lobes, supposed to be the physical seat of the higher intellectual powers.

Articulate speech is a special distinguishing characteristic also. This has its physical basis in the greater development of certain regions in the brain. Interchange of experiences between individuals is thus possible. Two heads are better than one, which leads to the formation of generalizations, abstract thought, and hence reason. It is impossible in this synopsis to develop further the very evident relation between development of language and civilization. A wide gulf separates man from the Anthropoids and hence from the rest of animal creation. Nevertheless underneath that gulf extends the connecting ocean floor of fundamental resemblances.

Pre-human Characteristics. Most persons have the following characteristics: (1) hair which runs from the shoulder toward the elbow and from the wrist to the elbow. This is also found in anthropoid apes. Hair is oily and, thus placed, would shed rain from an animal crouching in a tree with his arms over his head, as is often the posture of the orang. (2) The vermiform appendix is short in man and in the apes. It is large in the embryo but growth ceases and it becomes relatively small. It is smaller in some persons than in others. Apparently the body functions perfectly without it. In certain herbivorous animals, such as the rabbit, it is large and functional. (3) Dogs and other animals have well-developed muscles for erecting the ears and the hair. These muscles are present, but are small, and usually do not function *in most persons*. (4) In the inner corner of the eye is a third little fold called the *Plica semilunaris*. This is all that is left of the eyelid or nictitating membrane of the eye of some Mammals and Birds. (5) The pineal body rising from the dorsal surface of the diencephalon is a mere remnant in man. In certain Reptiles it is connected with a median eye-like structure in the middle of the head. (6) In most Mammals the incisor teeth in the upper jaw are borne on a separate bone called the premaxillary. There usually is no sign of such a separate bone in either men or the chimpanzee, but separate premaxillary bones in man have been found. (7) The dorsal and front part of the brain in most Mam-

mals is protected by a *pair* of frontal bones. In man this is single in the vast majority of cases, but paired frontal bones sometimes occur. (8) In rare cases a gill slit remains at maturity. Some vestigial structures appear during development, only to disappear later. It has been stated that the first gill slit (or spiracle of Elasmobranchs) is normally retained as the Eustachian tube of the ear. Cases have been found in which more than one gill slit was developed into an ear chamber, and extra external ears appeared. (9) The tail of the adult is reduced to a mere vestige. When it fails to discontinue development, human infants appear with tails. In embryos it is present, and even has muscles as in tailed forms. (10) Up to the sixth month of prenatal growth the body develops a coat of long black hair called the lanugo. This disappears before birth. Sometimes it persists, animal-like, in the adult. The embryos of hairless Mammals such as the elephant and whales also have the foetal lanugo.

(11) It has been observed that newly-born babes have the remarkable power of supporting the weight of the body by clinging to some object, like a stick. It is interpreted as being a vestige from the old arboreal days of the race. The human body has imperfections wrought by natural experiment during the ages. Almost any good oculist could give plans and specifications for a better all-round standard eye than man possesses. This is also true of other organs such as the ear, teeth, lungs, stomach, colon and heart. As one gazes on the works of ancient artists and sculptors, one is led to conclude that the race of men must have been perfect in those days. They depicted strong-limbed, perfectly proportioned men, and women of beautiful form. Such conclusions are erroneous. Those great artists did not picture the average human form as it then existed, but they represented the perfect type as they wished to see it. In spite of the fact that modern science was not present to save for reproduction the weaklings, it is very probable that the lame, the halt and the blind then existed.

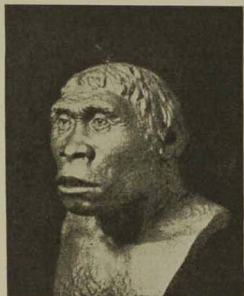
Palaeontology. The science of Palaeontology, with the evidences collected, indicate that Carnivora and Primates arose from an insectivorous-like form, very early in Cenozoic time; that the Primates appeared in the early Eocene Period in that portion of the world as far south of the north pole as would now include Asia. Fossil Primates have been found in America and Europe during

the Oligocene. They reappear in Europe in the Lower Miocene. They were compelled to migrate, due to the southerly progress of cold which killed the forests. Their continued presence in Southern Asia, Africa and South America indicates evolution in these localities after this southward migration.

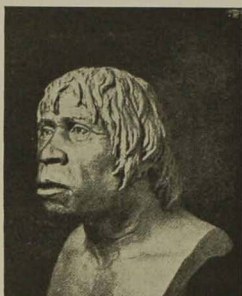
There are several reasons for the belief that the form, ancestral to man, changed from an arboreal habitat to a terrestrial one in Central Asia, somewhere between Miocene and early Pliocene time, and that the pre-human line emerged during the Pliocene. Change from an arboreal to a terrestrial life involved erect posture, which freed hands to execute thought plans. The necessity for finding food developed the hunting habit. Later, the use of clothing and a great variety of food meant ability to range far and wide and the further development of social organizations for the mutual benefit of individuals.

Fossil remains of ancient man are very rare. What is regarded as the partial remains of a primitive man was found in Java in 1894. The skull cap and two upper molar teeth were recovered, and a short distance away a femur bone. Careful comparisons indicate that the animal was rather prehuman than ape-like. The skull capacity was two thirds of the average human skull. The forehead was low and flat, with prominent supraorbital ridges. The brain was therefore small and the frontal lobes especially so. The teeth, though primitive, were more human than ape-like. The body height was probably nearly as great as that of living men. Fossil animals found with it place it between Upper Pliocene and Lower Pleistocene. This is known as the Java ape-man or *Pithecanthropus erectus* (Fig. 390).

A mere fragment of what is regarded as the oldest European race, of which there is any evidence, was discovered seventy-nine feet below the surface in river sands near Heidelberg, Germany, in 1907. This fossil was a perfect lower jaw with teeth. It used to be said of Cuvier, the great French comparative anatomist and anti-evolutionist, that he could examine a single bone and identify the animal of which it had been a part. This Heidelberg jaw has been studied most carefully by even greater experts than Cuvier, and it is regarded as belonging to a higher race than *Pithecanthropus*. From other fossil remains found with it, such as those of primitive elephants, horses, lions, it is believed to have existed in the second interglacial age. There are also indications that



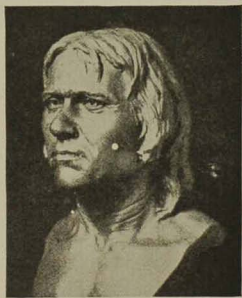
JAVA MAN
Pithecanthropus erectus.



PILTDOWN MAN
Eoanthropus dawsoni.



NEANDERTHAL MAN
Homo neanderthalensis.



CRÔ-MAGNON MAN
Homo sapiens.

FIG. 390. — Heads modelled by Professor J. H. McGregor, based on his exhaustive studies of prehuman and ancient human types. These types probably represent divergent lines. (From original models. Courtesy of Dr. McGregor.)

these men selected and used shaped stones as tools in their daily occupations.

What is known as the Piltdown or dawn man or Eoanthropus was discovered in Sussex, England, in 1912. Portions of a brain case, a canine tooth and part of the lower jaw were found. The tooth and the jaw are thought by some to have belonged to a chimpanzee. The skull remnants indicate a *human type*. It is improbable that two different parts of such different forms as man and ape would occur together.

Very recently (December 1929) in an excavation made near Peking, China, there was found the skull of a primitive human (probably female) which has been named *Sinanthropus Pekinensis*. A complete study will not be possible until it has been entirely removed from its stony matrix. Other remains such as teeth, a jaw and skull fragments have been found in the same excavations and other important discoveries are expected. The cranium of the Peking Man is quite perfect and altogether it is a more valuable find than the fragments which represent the Heidelberg and Piltdown men. The Peking Man probably lived in the early Pleistocene.

In 1856 a skeleton of a primitive man was found in a limestone cavern near Düsseldorf, Prussia. It was partly destroyed by its discoverers. Later similar specimens were found at Spy in Belgium, and in France. It is claimed that they evidence the existence of a primitive race known as the Neanderthal Men: short in height, strongly built, with prominent overhanging brows, retreating forehead, large and human-like brain, massive jaws, receding chin, large hands, thumb not greatly opposable, short lower leg. They were probably not erect and walked with a shuffling gait. This Neanderthal race lived in Europe from the third interglacial stage, through the fourth glacial period. They were unprogressive, but had at least developed well-wrought flint tools and ornaments, which they buried with their dead.

In Wales and France skeletons of an ancient type were excavated years ago, but were not given close study. Five more skeletons similar in character were found in Crô-magnon France, in 1868. These remains have established the existence of the Crô-magnon race of men. It is described as having been a magnificent race — superior to many existing today. The men were over six feet in height, probably taller than the tallest living races. They had large brains, high foreheads and a facial angle as high as modern

men, wide short faces, prominent cheek bones, strong jaws, prominent chins, long legs and were, therefore, swiftly moving. Their burial customs indicate belief in immortality. This race finally declined, leaving but few survivors. Some of these live in France today. On the walls of caves in France and in Spain, Cr6-magnon artists made drawings of themselves, of their tools and of the animals of their day. Fortunately these drawings, preserved for thousands of years, have again come to the view of the descendants of other races of men, who migrated to Europe from Asia. The repopulation of Europe probably took place in the upper Paleolithic.

More Recent Evidences of Human Antiquity. There are many evidences of human antiquity. How did the ancestors of the American Indian reach this continent? It is unlikely that they could have crossed great sea-distances in the little boats known to ancient men. They may have wandered by way of Bering Strait. The discovery of ancient cities in South America, which flourished long before the Christian Era, indicate the relatively great antiquity of native Americans. The North American Red men, the Eskimos, the superbly physically perfect peoples of some of the South Sea Islands present other problems. No records exist that give information of their origin. This distribution to the uttermost parts of the habitable globe and subsequent establishment there in the absence of easy methods of transportation must have taken great periods of time. There are no evidences of great sudden environmental changes which would have brought this about. The production of different races must have taken a long time. Egyptian paintings, several thousand years old, indicate that certain races had even then been long established. The development of intelligence was slow also. Babylonian inscriptions, twice as old as the times of Abraham, indicate that civilized nations had existed thousands of years before. The paleontological evidence, while meager, yet corroborates the other evidence.

The Power of Intelligence. Due to the development of the brain and the acquisition of intelligence, man with his relatively poor eyesight extends his vision by means of invention and can see microscopically and macroscopically infinitely more and better than any other animal. With his limited sense of hearing he can also hear farther than any other animal. He can talk across oceans and around the world. Though heavy limbed, he can outrace the swiftest antelope; terrestrial in habit, he can explore the depths

of the ocean like the whale and lacking wings, he can soar far and high, better than any bird. Due to his great intelligence he can in his mind repopulate the stony piles of ancient cities and reconstruct their streets, re-establish their commerce, and can thus view again, centuries later, their birth, their development and decline. He is the most highly adapted of all living things. He has wrenched secrets from Nature, and her forces are his servants. He knows Nature and he knows himself, a little.

But these accomplishments are not true of all men. Races of men exist on the globe today, as they have existed for ages, and are but little higher than other animals. Nor have *all* men who live in civilized communities accomplished great things. Many even now spend their lives in a mere existence but little above that of the animals. The lordship of man has been accomplished by those who were born unusually strong, courageous and daring, by the adventurous and by those endowed with unusual intelligence. Progress has always depended upon leaders. Variation among men is a primary biological law, for they are certainly not created equal. One is born with one talent, one with ten, one with a thousand. The creative genius, moreover, is not necessarily inspired to accomplishment by expected fame or fortune, but often because of an inborn urge for expression. Such men represent a fortuitous combination of genes and fortunate postnatal circumstances.

Civilized man is possibly not as strong muscularly, nor as keen of sight or hearing, nor so adept with his hand, as his forefathers were. And this is due to the appearance of his inventions which so marvelously complement or excel his poor faculties, and lead also to a certain amount of disuse. There is danger in this and it should not be forgotten that an overspecialization in a changing world has caused the extinction of more than the Dinosaurs.

Euthenics. Euthenics refers to agencies undertaken for the improvement of social conditions such as better water supply, better air, better habitations, better food, more wages, more rest and recreation. Medicine is changing from an art to a science, an achievement which is the result of biological investigations. Prevention of yellow fever, malaria, typhoid, diphtheria, smallpox and scarlet fever are instances of victories over disease organisms. The saving of man's domesticated plants and animals from destructive parasites is another sort of biological work, all in the general

direction of human Euthenics. Agricultural science has developed largely by the same agency, namely, biology. In all of this work use has been made of physics and chemistry, which are fundamental to biology. Compare the England of today with the picture drawn by Mark Twain in "A Connecticut Yankee at King Arthur's Court" and note the differences that have taken place in a few hundred years. Mark Twain was not primarily interested in telling a funny story, when he visualized the state of English society in the days of King Arthur.

It has been claimed that the saving of lives by improved euthenical conditions (and this includes not only the work of all philanthropies, but of all medical science) works to the detriment of the race and that the general effect is the survival of the unfit, the propagation of those who will become a burden and a menace to society. One answer to this argument is that countries which stand highest in euthenical progress should be compared with countries where practically no attempt is made to improve conditions, but where natural selection is left comparatively free to eliminate the unfit. Compare, for example, the people of the British Isles with the natives of India; compare Americans in general with the great population of China. One cannot escape from the conclusion that euthenical progress is a sound policy and is good biology. Oftentimes charity and philanthropy take a distressing situation and clear it up. As the result of a helping hand, helplessness disappears, and even productivity is brought about. Parents, poverty stricken through disease or other misfortune, die and leave children who, rescued by charity, grow up into able and valuable citizens. Death is often due to maladjustment of just one part of the living machine. The person involved may be of great potential value to society. Medical science corrects this abnormal condition. A lifetime of usefulness is the profit gained by society.

The public is constantly being informed of the discoveries of medical science. Information regarding the safeguarding of health is given, and, on the whole, men are disposed even from a selfish standpoint to profit by it. Society is the gainer, due to added years of usefulness. Human disease is a great tax upon resources of society. It is a burden that rests upon the shoulders of the well. Countries that carry such a burden also lead the world in accomplishments. Somehow, sadly deficient as it is,

modern euthenical policy in civilized countries helps to conserve intelligence and prolong the period of productiveness. The effect of saving the weak often means that many of these weak are made strong.

What is a perfect organism? Is it not a body perfectly adapted? Is not medical science above all things taking a hand in this very matter, and aiding in adaptation? Is it not pointing out a thousand kinds of imperfect adaptations, and constantly correcting these? Is it not, after all, a case of intelligence assuming control and directing natural forces?

Eugenics. The objector to charitable and philanthropical aspects of the present-day euthenic policy suggests another program, namely, Eugenics. The word literally means "*well born.*" It is more of a propaganda than a science. It is a position that an intelligent person must take after ascertaining the facts of human heredity or genetics. The investigation of human inheritance reveals the perpetuation of many distressing conditions in man. Not only are defects, abnormalities and weaknesses at times perpetuated in increasing numbers, but this unintelligent policy results in burdens that must be paid for by society at large.

The eugenicist rightly claims that far more care and scientific common sense is employed in raising good vegetables and domestic animals than men. For ages man has deliberately chosen the best for parents of his domestic animals, in his endeavor to produce a desired breed. He is only too careful of his pedigreed stock. But where human breeding is concerned, this has been allowed to take its course. The reason probably is that no man considered himself warranted in interfering in a matter of individual liberty, and it is certainly true that men have fought and died for that precious possession — human freedom. Undoubtedly the discoveries made and to be made in the study of human heredity will lead to a curbing of freedom in marriage. What facts indicate that this position is warranted? Certain common human defects have been proved to be dominant Mendelian characters, such as a cataract, an opacity in the transparent part of the eye. In one form it develops in middle life. Such persons become blind. In a study made of 304 families in which this defect occurred, it was found that over half of the thousand children inherited the defect, although the defective parent mated with a normal person. Again, studies of inheritance of certain types of deafness and deafmutism showed

these to be inherited by children. In all of these cases the defects act as handicaps to a normal life. Not only do they involve suffering for the possessors of these characters, but a tax upon society. One of the great discoveries of medical science is that of prophylaxis, which means the *prevention* of disease. Nevertheless, all dominant defects could be largely eliminated from human society by preventing such persons from having children.

Feeble-minded persons, as a rule, are supported in public institutions. The care taken of them is a by-product of modern euthenical policy. Goddard, in charge of the State Home for the Feeble-Minded at Vineland, New Jersey, collected data with regard to the offspring of 122 marriages of the congenitally feeble-minded. They had 482 children, of whom 476 were feeble-minded. He collected data with regard to the offspring of parents, one of whom was normal and the other feeble-minded. From 122 pairs of such parents came 371 children, 193 of whom were feeble-minded and 178 normal. Goddard's studies indicate that feeble-mindedness behaves like a Mendelian recessive. A feeble-minded little girl, an inmate of this splendid institution, had a feeble-minded brother. Both parents were feeble-minded. Goddard looked up this family history. Among the relatives of the same generation as the child he found 16 feeble-minded out of a total of 25, *i.e.*, 64 per cent were feeble-minded; of the parental generation 21 feeble-minded out of a total of 25 persons, or 84 per cent; and of the grandparent generation 6 feeble-minded out of a total of 8, or 75 per cent.

One of the causes of feeble-mindedness is syphilis. Alcoholic parents also have more feeble-minded children than non-alcoholic parents. Abnormality will continue to appear as long as there are parents who are alcoholic and syphilitic. In the study of physiology presented here, it was pointed out that a cretin is an idiotic or feeble-minded, undeveloped individual, a condition brought about by the failure of the thyroid gland to develop. Some years ago 60 per cent of the population of a certain locality were cretins. They were allowed to intermarry and the offspring were cretins. Finally a law was passed forbidding marriage of cretin with cretin. Today but few cases remain. This is an example of the effects of a eugenic program. Studies of the pedigrees of inmates of insane asylums, who are usually committed after middle life and so after some years of married life, indicate the inheritance of many forms of nervous instability or abnormality in their offspring.

One of the best illustrations of the perpetuation of the unfit is shown by the pedigree of the Jukes family of New York State. In five generations this family numbered about 1200 people and was distinctively an American family. Its history is known back to 1720. Kellicott says: "Of these 1200 idle, ignorant, lewd, vicious, pauper, diseased, imbecile, insane and criminal specimens of humanity, about 300 died in infancy. Of the remaining, 310 were professional paupers in almshouses, a total of 2300 years (at whose expense?); 440 were physically wrecked by their own diseased wickedness; more than half of the women were prostitutes; 130 were convicted criminals; 60 were habitual thieves; 7 were murderers. They have cost the state over a million and a quarter dollars, and the cost is still going on."

On the other hand, the history of the famous Edwards family of New England is just as bright as the Jukes' case is dark. Jonathan Edwards was a clergyman in the early days of New England. He was a man of unusual ability. In 1900, 1394 of his descendants had been identified. Of these 299 were college graduates; 13 were college presidents; 65 were college professors; 60 were physicians; 100 or more clergymen; 75 were officers in the army or navy; 60 were prominent authors and writers; 100 were lawyers; 30 were judges; 3 were U. S. Senators, one was a Vice-President of the United States, many were eminent in law, theology, medicine, business, education and public service. The general contribution to social progress made by this family has been decidedly positive and constructive. The general contribution of such as the Jukes family has been decidedly negative and destructive.

Darwin summed up the general attitude of society in these words, "Except in the case of man himself — hardly anyone is so ignorant as to allow his worst animals to breed."

Such agencies as the Galton Laboratory for Eugenics in England and the Eugenics Record Office at Cold Spring Harbor, N. Y., and the active work of Eugenics associations, may lead the way to a correction of these ills. A wisely informed public can throw the weight of public opinion in the right direction. Not one iota of thoughtfulness and kindly treatment of the unfortunate should be surrendered from the present euthenical policy, for the net gain to society is greater than all the loss. But practical eugenics can eliminate most of the cost of euthenics.

An attempt at better immigration laws has been made. Some

states now have eugenic marriage laws. But who is genetically fit? The animal breeder may have a pedigree of his breeding stock for generations back, but where can one go to get such very important information regarding human pedigrees? How many persons know anything about their great-great grandparents? The Eugenics Record Office is prepared to give advice concerning contemplated marriages but it could give better advice if it had a complete record of the family lines concerned. The state would do well to add a record of citizenship to the mere record of birth, marriage and death. Eugenics, now not at all popular, will be a matter of state policy. States will internationally discover that war is a most dysgenic method of settling disputes. War destroys the eugenically fit.

The marriage of the genetically fit should result in a controlled selection of offspring. Unrestricted birth rate, disproportionate to the means of support, means overcrowding, misery and the burden of charitable euthenical measures. In the present state of ignorance concerning human inheritance we are compelled to use euthenical methods to correct the ills of human society. It is a lack of insight to view capitalism as the sole cause of all human misery. Usually capital means industrial activity. Human misery may be due to poor protoplasm as well as to lack of employment or to poor wages.

It is part of the eugenic program to ask the genetically fit to produce, care for and train a representative number of offspring. During the last half century or so there has been a decline in the birth rate in most civilized countries. Large families are not the rule among the wealthy or well educated and this policy is extending to other groups. Unrestricted production of offspring by the irresponsible, the improvident and those dependent on charity, because they are on the whole unfit, is a dysgenic phenomenon. Historians have not always recognized the part played by insufficient food supplies, large populations and starvation as causes of war.

Dr. Stanley P. Davies in his recent book "Social Control of the Mentally Deficient," states that there has been a recession from the early conclusion that feeble-mindedness acted as a single recessive Mendelian unit character as was first claimed. Feeble-mindedness and probably other types of personality involve various complexes of traits and are not as simple affairs as first claimed.

Idiocy is now regarded as being due to disease or injury of the central nervous system or endocrine organs. The parents of mentally defective children in many cases are normal-minded. Individuals that are *feeble-minded by heredity* are not so prolific as has been claimed, — in fact there is a tendency for their germ plasm to die out. Dr. Davies' account of the splendid constructive work in socialization of the mentally deficient who are now trained in institutional farm colonies, for example, demonstrates the great value to society of this sort of euthenical work. It has long been felt that mental defectives are almost certain to be potential criminals. This is not true nor is it true that criminals are always mental defectives. Normal parents *may* have socially unfit children. Whether feeble-mindedness is a Mendelian trait or not, it yet remains advisable to discourage or prevent offspring production by abnormal personalities.

The state is maintained by the socially fit, and for the self protection and happiness of its members the state must continue to extend the policy of ever greater control of the socially unfit. In this work, the assay of personalities will include the part played by heredity *and* environment in determining what makes that personality. The psychiatrist has need of all knowledge bearing on his problems — including but not limited to the knowledge furnished by genetics.

Human Activities and Biology. It is surprising to note that the great mass of the world's population is engaged primarily in making it possible for other human beings to function biologically, *i.e.*, to continue to exist.⁹ This is the principal business of most people. It is not done in a spirit of altruism but is a matter of biological selfishness, namely, the necessity of self-preservation. It is quite surprising that most people do not realize this.

The activities of the potato plant, the wheat plant and the apple tree, so far as these plants are concerned, have no reference to man. The amoeba, hydra, earthworm, frog and other unsocial animals secure directly from their environment their necessities of life. The work of the early pioneers, more or less isolated from human neighbors, was, after all, somewhat similar.

But the development of civilized communities has meant a departure from primitive ways. Society is composed of a host of specialists, most of whom are engaged in particular processes that have to do with making it possible for other members of the

community to continue as living biological organisms. The primitive organism secures its carbohydrate food directly from nature. Think of all the different kinds of workmen whose labors furnish us with bread! Horses, tractors, factories, mines, steel works, railroads, plant breeders, universities, laboratories, legislatures, farmers, warehouse men, salesmen, millwrights, mill hands, geologists, chemists, bakers, retailers, etc. We could extend this analysis to problems concerned in temperature regulation, which include clothing and the building and heating of houses; problems of water supply and problems having to do with excretion, such as sewage systems.

A biological basis should be considered in the study of many social problems. After all, the state or nation is but a group of a particular kind of living organisms associated for mutual benefit and the success of the state depends basically at least on the success with which every man in the state functions biologically. Widespread lack of food in a state is a menace to the continuation of that organization. Man has found great advantages in social organization, which is an outgrowth of the more primitive solitary individual existence. In taking up group living, the individual always has to give up a certain freedom of action which belongs to the solitary life. In spite of this newer social interrelationship, the old first law of self-preservation remains and is at times in conflict with later social responsibilities. Most men are engaged in the special tasks referred to, on account of an inward urge toward self-preservation. Man has learned that on the whole he is much better off in the new way of living. A great complicated and more or less integrated sort of organism has blundered its way onward through the ages. So intricate has this social organism become, that it is quite impossible to conceive of civilized men apart from such a mode of living. Today thieving and murder are examples of the continual outcropping of the old order of things. The criminal is one born without asking to be born into an order of things for which he is not fitted.

Are there evidences of human evolution? Is man static or is he deteriorating? There are some who claim to see in present-day life plenty of evidence of retrogression. Is the human race moving toward any goal? Is the brain of man capable of continuing to maintain order in a world of constantly increasing complicated contacts between alien peoples? Can he maintain mental poise

necessary for the continued operation of the ever-growing giant mechanisms he creates? Can he continue to control the orderly liberation of the ever-increasing stores of kinetic energy he develops? Man certainly differs from the lower animals in that he has a greater mental equipment for determining his goal and thus controlling his evolution. But these questions transcend what is ordinarily referred to as biological science and belong rather to the realm of social philosophy.

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