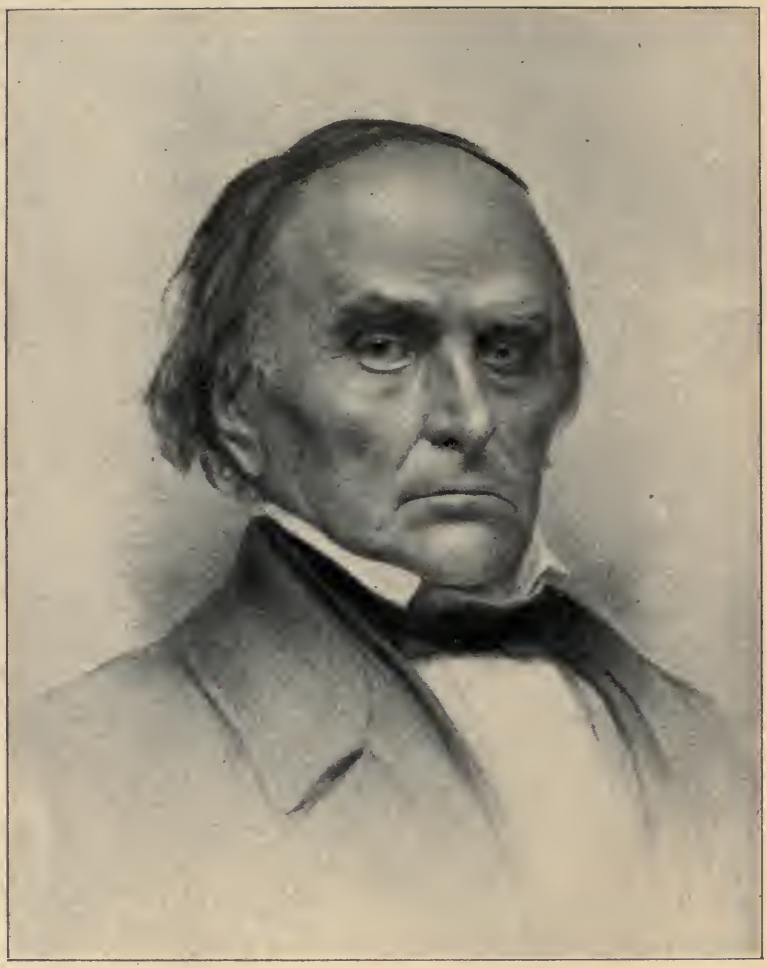
CONTROL OF HEREDITY

REDFIELD

MOSES [A³]
By Michel Angelo



DANIEL WEBSTER [43]

CONTROL

OF

HEREDITY

A STUDY

OF THE

GENESIS OF EVOLUTION AND DEGENERACY

ILLUSTRATED BY DIAGRAMS AND TYPES OF CHARACTER

BY

CASPER LAVATER REDFIELD [37]

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PREFACE.

Travelers tell us that monkeys will watch men around a camp fire, and that as soon as the men leave, the monkeys will occupy their places, warming themselves till the fire goes out. The monkeys can appreciate the warmth coming from the fire, but they do not know enough to keep it up by piling on more wood. Much less do they know how to start a fire when they want it.

If we should assume these monkeys sitting around a fire and engaged in evolving a theory of combustion, we would have a parallel to those biologists who are engaged in trying to give us a chemical formula for heredity without having the least idea of how to manipulate the forces of evolution so as to originate any desired line of development, or to maintain it for succeeding generations when the advantageous variation has been originated by accident. Knowledge that carbon unites with oxygen in certain definite proportions during combustion is both interesting and useful, but its usefulness is secondary to the usefulness of knowing how to build a fire when wanted, and to maintain and control it when it is built.

Selection has been an instrument by which breeders have, in a few generations, vastly improved our domestic animals, but confessedly selection, as applied to the lower animals, is not applicable to civilized man. In the preparation of the following pages it has been my object to provide a simple and practical process of lighting and controlling the fires of evolution, particularly in their application to man. The evolution of man is essentially the evolution

of intellect, and given a process by which the intellectual powers may be developed from generation to generation, we may leave it to our more intelligent posterity to find ways and means for developing themselves along any desired lines. The process of developing the intellectual powers of future generations is, however, but one branch of a general principle involving all lines of evolution, and this branch is so associated with the other branches that development along one line involves development along all lines.

In demonstrating this principle of evolution I have paid particular attention to the genesis of intellectual power, and the proofs adduced show that men of great intellects are by no means abnormal products, but are the result of natural laws working along easily understood lines. The reason why such men as Aristotle, Cuvier, Darwin and Franklin are rare in the history of the world is shown to be because the antecedent conditions for the evolution of such men have been unknown and have arisen fortuitously. With these conditions known, and practically every man being capable of fulfilling his share of them, it should not be difficult to raise the intellectual powers of future generations to a plane vastly above that of the present day.

It may seem like a bold proposition to tell a man that he may cause his children to be born with greater or less intelligence as he chooses, but I believe that those who will read the following pages will see that this is true. If a few parents are induced to intelligently endow their children with better brains and better bodies than they would have done by the operation of mere chance, then I shall feel amply repaid for whatever trouble I have taken to explain that which has been many times stated but which has been persistently misunderstood.

C. L. Redfield.

Chicago, Ill., December, 1902.

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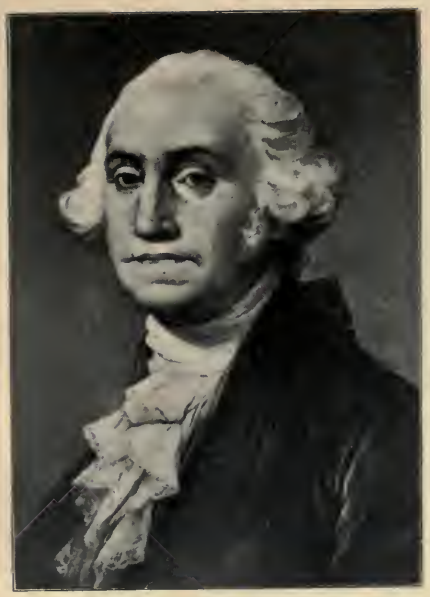

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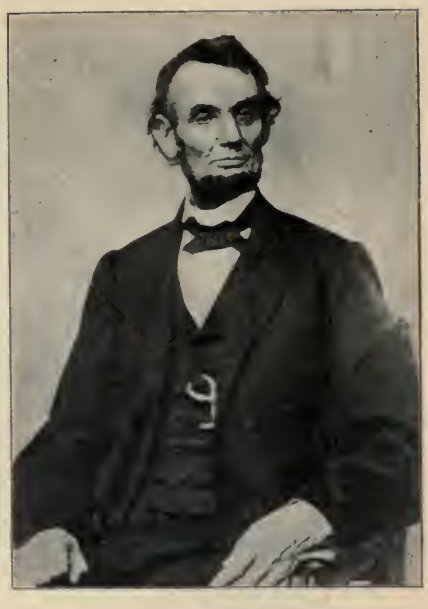

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INTRODUCTION.

"The Lord gave and the Lord hath taken away." In such words man has been wont to blame Providence for the consequences of his own errors and ignorance. Happily this ignorance is being gradually brushed away and man is learning little by little that there are some ills for which he himself is responsible. If there is one thing more than another which we have been in the habit of charging up against Providence it is the results of vicious or defective heredity, yet instead of being a mysterious dispensation of Providence, heredity is the product of natural laws operating along certain prescribed lines. Instead of having a science of heredity our knowledge of the subject has consisted of a series of disconnected facts wholly inadequate to give us an intelligent idea of the processes of Nature. We have known that the children of white parents are white and that the children of colored parents are colored, but we have known little else. Laying the blame for disastrous results upon the shoulders of Providence is but one way of confessing this ignorance.

KINDS OF HEREDITY.

Heredity is of two kinds; first, Structural Heredity, which relates to the size, form and color of an organ without regard to the force or energy that may reside in it; and second, Dynamical Heredity, which relates to the force, power or energy of an organ without regard to its size or form.

Heretofore attention has been principally directed to structural heredity, and examples of the known facts and the theories relating

to them are given as a preliminary to the main work. This main work consists in tracing the genesis of dynamic heredity, and the facts revealed by this investigation give us a better understanding of the processes by which character is produced.

THE GREAT FACTS OF HEREDITY.

In considering the dynamical side of this question, the first and most important fact is that heredity is the product of two factors, one of which is the length of time elapsing between generations, and the other of which is the degree of activity which characterizes the individuals of successive generations. These two factors bear the same relationship to heredity that length and breadth bear to area. No matter how great the length may be we cannot have great area if the breadth is small, and no matter how great the breadth, the area will still remain small if the length is small. In the same way we cannot have a high degree of hereditary development by time alone, nor by activity alone. To produce great development by hereditary action, both factors must be large in the parents, and to produce very great development both factors must be large for two or more generations.

The second great fact is that each individual during his life undergoes certain physical and mental changes, and that those conditions which characterize parents at different ages are transmitted to the offspring which are produced at those ages. This is admirably exemplified in mental aptitudes,—the children of youthful parents being strongly marked by the characteristics of youth, and the children of old parents being marked by the characteristics of age.

The third great fact is that the average length of life tends to approximate twice the average age at which reproduction takes

place. This is illustrated by the fact that as long as parents maintain their health and vigor, the older they are at the time of reproduction, the greater is the average length of life of their offspring.

It is not necessary to recount here all of the facts set forth nor the corollaries to be drawn from them, but we will turn our attention to some of the processes by which the race has risen to its present plane, and to some of the processes by which it may be raised to still higher planes.

INFLUENCES AFFECTING HEREDITY.

In the early history of the race men grouped themselves into communities, and not having to fight for their lives against superior animals they perfected military organizations for the purpose of fighting each other. The young men joined these organizations, and the training they necessarily received developed them physically and mentally. In communities like Greece and Rome it became customary for young men not to marry until after they had returned from the wars. Wars and the training for wars, therefore, not only increased the activity of the individuals, but operated to delay reproduction until considerable development had occurred. The result of this we see in the fact that the most warlike races have been the most progressive races. In modern times the military training given by Germany not only develops her young men, but operates to delay the average age of marriage, and consequently the average age at which reproduction takes place. The result of this will be a rise in the average intelligence of the German people.

Religious movements, from that of Moses down to that of the pestiferous charlatan who claims to be a re-incarnation, have each added to the intellectual activity of the community and consequently have been factors in human progress. The same may be said of

agitations of the present day,—strikes, anarchism, the stress of competition, athletics,—all tend to increase the physical or mental activity of individuals and hence to develop the race generation by generation.

RESULTS OF EARLY MARRIAGES.

Even in communities in which there are many things operating to delay the age of marriage, there are individuals who marry early and who early in their lives produce children. These children of youthful parents are lacking in physical stamina and mental power. They are reckless, careless, sometimes vicious and frequently drift into drunkenness and crime. From this class comes the principal part of our criminals, paupers and prostitutes. The effects of debauchery result in defective children, and if continued for two or three generations result in a high degree of infant mortality or total extinction. The vices of civilized society, especially strong drink and prostitution, operate to eliminate a portion of each generation, and this elimination affects the children of young parents much more than the children of old or middle aged parents.

THE MISTAKES OF GOOD INTENTIONS.

There are certain persons with good intentions, but sadly mistaken, who would protect society against itself by prohibition, by the abolition of war, strikes, and competition, and by legal enactments calculated to preserve the life of each individual born. Let us go back a thousand years in time and assume that this utopian condition had been brought into existence. There being no military necessities to take the youth to war and no stress of competition making it difficult to secure a living, the number of early marriages would have been greatly increased and the children of young parents would have outnumbered the children of middle aged parents. Now

one of the effects of early reproduction is to endow children with intense sexual characteristics, and this results in the children of young parents being much more prolific than children of older parents. A few generations of this process, and the whole population would either have been children of young parents or descended from the children of young parents. Under these conditions the race would have sunk downward instead of rising upward, and the white man of to-day would have been at the level of the savage. Hence, rum, war, intrigue for power, competition, prostitution, and a large number of other vices considered the curses of civilization have in reality been the unconscious causes of progress.

REMOVING THE CURSES OF CIVILIZATION.

While these curses could not heretofore have been dispensed with without causing the destruction of civilization, now that we know the real cause of progress we can eliminate them and still progress faster than before. It being known that it is desirable to eliminate, or at least restrict, the early production of children, it is not necessary that we reach the desired end by first producing them and then laying traps by which they will exterminate themselves through misery and suffering. If we are determined to continue the production of children from immature parents, it certainly would be more humane to follow the ancient Polynesian custom of infanticide. Think of it! The youth to whom we would not intrust the training of a dog we intrust the production of human beings, and then wonder at the causes of pauperism and crime.

REGULATING MARRIAGES.

The legal age at which marriage may be contracted varies in different parts of the world from the age of ten to the age of twenty. In different parts of the United States these ages range

from fourteen to eighteen. As a beginning toward a higher standard, all marriages of men at less than twenty-one and of women at less than eighteen should be absolutely prohibited. To this should be added a graded marriage license fee so arranged as to discriminate against all marriages of men at less than twenty-five and of women at less than twenty-two. The existence of such a discrimination would be the most potent of influences in discouraging early reproduction by calling attention to the causes of mental degeneracy. The moral influence would be greater than the legal restraint.

With very early reproduction restricted to a few illegitimacies, two generations would see our pauper and criminal classes practically extinct. The vices of intemperance and prostitution would also disappear much more rapidly than they would as the result of legal enactments, because these vices are practiced more by the children of young parents than by the children of old parents. This is particularly true in cases where early reproduction is continued for two or three generations.

It may be argued that the restriction of early marriages would cause an increase of prostitution. It is possible, nay probable, that this would be the immediate result of such restriction, but this increase would be quickly followed by a much greater decrease as the children of older parents became more numerous. It may also be argued that the birth rate is now decreasing and that a restriction of early marriages would cause a further decrease amounting to a decrease in population. A remedy for such possible decrease is given in the chapter on sterility.

MODERN CONDITIONS AND REQUIREMENTS.

According to the census of 1900, each child receives an average of 4.45 years of school education. This is about twice the amount

received by the children of 1870. This is good. The increase in education through schools, publications and the increasing complexity of civilization is now so rapid that it needs little or no stimulus. What we need is more and better physical development and an increase in the average age at which reproduction takes place. One year added to the average age of reproduction is, as far as the succeeding generations are concerned, nearly equal to one year added to school education, and in some respects it is much more important. Each year added to the average age of reproduction will, in a few generations, add two years to the average length of useful life, but the race cannot support these added years if the physical development is sacrificed to the mental. Healthy development is a gradual process, hot house development is unhealthy. We have gymnasiums, athletic clubs and physical culture publications. These are good, but we should add to them systematic and scientific physical training for our children. We should add to the curricula of our schools a regular course of physical instruction under competent instructors. These should aim at, not the production of athletes, but the production of sound and healthy bodies. If this be done regularly and systematically, then the average age of reproduction may be advanced from generation to generation and man may yet live as many hundreds of years as he now lives scores of years.

CONTROL OF HEREDITY.

CHAPTER I.

INHERITANCE, VARIATION AND SELECTION.

If two acorns be planted they will sprout into plants which will in due time grow to be two oak trees. The manner of growth in both will be the same. Each will increase its diameter by adding external layers of wood; each will have its trunk knotted and gnarled in the manner peculiar to oak trees; and from the trunk of each will grow branches having like characteristics. From the trunks and branches will grow crooked and twisted twigs which will bear those distinctively shaped leaves known as oak leaves and other acorns like those from which the tree originally came.

PECULIAR DIFFERENCES IN TREES.

While each of these trees is unmistakably an oak, the two will differ from each other in many particulars. One will lean to the right, the other to the left. Where one tree will have a single large branch growing from the trunk and smaller branches spaced irregularly about or above it, the other will have two or more medium-sized branches with smaller branches differently spaced and of different diameters. In fact, if the two trees be accurately compared with each other it will be found that they are not exactly alike in any particular, and this will be true whether the two original acorns came from the same tree or from different trees of the same species. Yet in spite of these differences there will not be

the slightest doubt about the two trees being oak trees, and a botanist will instantly tell us to which species they belong of the two or three hundred into which oaks are divided. If we take other acorns from these two trees, and from them raise other oak trees, they in their turn will have the same points of similarity and difference which have just been noted.

HEREDITY AND VARIATION.

This difference in identity exists in every species of plants and animals, and illustrates both the laws of heredity and the phenomena of variation, though it explains neither. The laws of heredity declare that the offspring are and will be the same as the parent, while the facts of variation teach us that accompanying this likeness there is an unlikeness. From common observation we are led to expect that the children of negro parents will be born with dark skins and curly hair; that the Chinese child will have slant eyes and the peculiar traits of Mongolian people; and that the child of white parents will have those peculiarities that characterize the white race. Going further we can distinguish different branches of the white race, and can tell the children of German, Irish or Italian parents from each other. Even within these branches we can often recognize brothers and sisters and know them to be children of particular parents.

That a son looks like his father or mother has become so familiar to us that we are surprised when he does not, yet few persons who have not given the matter special attention are fully aware of the power of the laws of heredity and the persistency with which particular characters are transmitted from generation to generation. Many examples have been given by writers on the subject of heredity, but it is intended to give here only enough to illustrate

certain well known laws which will be more or less involved in the subsequent discussion.

EXAMPLES OF INHERITANCE.

Dr. Anderson gives the case of a bitch that was born with three legs. "She has had several litters of puppies, and among these several individuals were produced that had the same defect as herself."[1]

Mr. Day[2] gives the case of a mare, "Basto", that had ten foals between 1721 and 1739, one of which was "Crab", by Alcock's "Gray Arabian." A granddaughter of Crab (great-granddaughter of Gray Arabian) had fourteen foals, six being gray and eight being bays or browns. One of these six grays had a gray foal which in turn had ten gray foals by six different stallions. One of the ten had a gray foal born more than a century after the first birth. As this relates to English thoroughbred horses, which are rarely of a gray color, the persistency of a single infusion of blood from a gray stallion is quite remarkable.

In 1770 there was born in Paraguay a hornless bull which became the progenitor of a race of hornless cattle that has multiplied extensively in that country.[3]

ABNORMAL FINGERS AND TOES.

Huxley[4] gives the case of Gratio Kelleia, the Maltese, who was born with six fingers on each hand and a like number of toes on each foot. He had four children, Salvator, who had six fingers and toes like his father; George, who had five each, but with one

(1) Recreations in Agriculture, Vol. I, p. 68.
(2) The Horse, p. 146.
(3) Cyclopædia of Anatomy and Physiology, Vol. IV, p. 1311.
(4) The Origin of Species, p. 92.

toe deformed; Andre, whose fingers and toes were quite perfect, like those of his mother; and Marie, who had five each, but with her thumbs deformed. Salvator, who married a five-fingered and five-toed woman, had four children, three of whom had six fingers and six toes. George had four children, two of whom had six fingers and six toes, and one of whom had six fingers on one hand. Andre's children were all normal, but Marie, who had no defect except deformed thumbs and who married a normal man, had one child with six toes.

In the Colburn family, a woman having six fingers transmitted the deformity to her children, grandchildren, and great-grandchildren. Among her great-great-grandchildren, four out of eight also had six fingers on each hand.

Dr. Lepine reports the case of a man who had only three fingers on each hand, and four toes on each foot. His grandfather and his son had the same deformity.[5]

Adrian de Jussieu gives the case of a woman with three nipples. "The additional nipple was placed in the groin, and served ordinarily for suckling, while in the mother of this woman, who was also born with three nipples, they were all placed on the anterior region of the thorax."[6]

Darwin gives,[7] on the authority of Candole, a curious instance of inheritance of the power of moving the scalp. A man could, as a youth, pitch several heavy books from his head by the scalp alone; and won wagers by performing this feat. His father, uncle, grandfather, and all his three children possessed the same power in the same unusual degree. Eight generations previously the family

(5) Stock Breeding, p. 51.
(6) British and Foreign Medico-Chirurgical Review, April, 1863, p. 460.
(7) Descent of Man, Vol. I, 19.

became divided into two branches, so that the head of the contemporary generation was removed from this man in the seventh degree. This distant cousin lived in a different part of France, and being asked if he possessed the same power, immediately gave an exhibition of it.

BLUSHING.

Darwin also gives[8] the case of a family consisting of a father, mother, and three children, all of whom, without exception, were prone to blush to a most painful degree. Some of them were sent to travel in order to wear away this diseased sensibility, but nothing was of the slightest avail.

Sir James Paget,[9] while examining the spine of a girl, was struck by her singular manner of blushing; a big splash appeared first on one cheek, and then other splashes, variously scattered over the face and neck. He subsequently asked the mother if her daughter always blushed in this peculiar manner and was answered, "Yes, she takes after me." Sir J. Paget then perceived that by asking this question he had caused the mother to blush; and she exhibited the same peculiarity as her daughter.

Girou mentions a family in which the father, the children and most of the grandchildren were left-handed.[10]

It will be observed that while the first seven of these examples relate to organs, their number, color and form, the last three relate not so much to the organs themselves as to the inheritance of unusual functions of those organs. We thus see that peculiarities of function of organs may be inherited as well as the organs themselves, and that differences in kind of function, or amount of func-

(8) Expressions of the Emotions, p. 312.
(9) Ibid.
(10) Animals and Plants Under Domestication, Vol. II, p. 15.

tional capacity, does not necessarily involve noticeable differences in the organs to which these functions belong. For example, in the case of the Frenchman who possessed the power of moving his scalp, we are not informed that there was any unusual development of this part of the anatomy, while, as a matter of fact, if there had been a development of the scalp muscles at all proportional to the power of moving them, such an amazing development would certainly have been commented upon.

TELEGONY.

While the persistency of the gray color in the descendants of the thoroughbred mare Basto illustrates how a single infusion of blood will continue for a long time, it does not illustrate to the fullest extent how small an infusion may cause an appreciable effect. For some reason, not yet fully understood, a mother is more or less affected by the father of her offspring, and often to an extent that will mark her for life and all the future offspring she may have. A case often quoted, and sometimes distorted, is that of a chestnut mare that belonged to the Earl of Morton. In 1815 this mare was covered by a quagga, and the hybrid produced resembled the sire in color and in many peculiarities of form. In 1817, 1818 and 1821 the same mare was covered by a very fine black Arabian horse, and produced successively three foals. Although she had not seen the quagga since 1816 each of the three foals bore his curious and unequivocal markings.[11]

"A colt, the property of the Earl of Suffield, got by Laurel, so resembled another horse (Camel) that it was whispered, nay, even asserted, at Newmarket, that he must have been got by Camel. It was ascertained, however, that the only relation

(11) First published in the "Philosophical Transactions," 1821, p. 20.

which the colt bore to Camel was that the latter had served his mother the previous season."[12]

Miles gives[13] three cases of mares once served by jacks and producing mules. When these mares were subsequently served by pure-bred stallions they produced foals resembling mules.

THOROUGHBRED HORSES.

Speaking of horses in general, "Cecil," a famous breeder of thoroughbreds, says: "It is curious to remark that when a thoroughbred mare has once had foals by a common horse, no subsequent foals which she may have had by thoroughbred horses have ever evinced any pretensions to racing qualities. There may be an exception, but I believe I am correct in saying that there is not. It is laid down as a principle 'That when a pure-bred animal of any breed has once been pregnant by one of a different breed, she is herself a cross ever after, the purity of her blood having been lost in consequence of this connection.' "

Mr. Day says[14] that since Cecil's time there has been only one known case of a thoroughbred mare producing a winner after being covered by a half-bred horse. If this be true for a horse that is one-half thoroughbred, what must be the case when the stallion is only a common horse with no thoroughbred blood?

Darwin gives,[15] on the authority of Dr. Bower, the case of a black hairless Barbary bitch which was first impregnated by a mongrel spaniel with long brown hair. She produced five puppies, three of which were hairless and two of which were covered with short brown hair. The next time she was put to a full-bred black, hair-

(12) Farmers' Magazine, Vol. XXXV, p. 130.
(13) Stock Breeding, p. 257.
(14) The Horse.
(15) Animals and Plants Under Domestication, Vol. II, p. 3.

less Barbary dog, but the mischief had been implanted in the mother and again about half the litter looked like pure Barbarys and the other half like the short-haired progeny of the first father.

McGillivray gives[16] the case of a polled Angus heifer which bore her first calf to a short-horn bull, and was then served by a black polled Angus bull. The calf from the last connection approached the short-horn bull in color and form, and grew horns.

Dr. Wells, of Grenada, put a flock of white ewes to a chocolate-colored, hairy ram, and the following year to a white ram of their own breed. The lambs got by the last connection had fleece more or less of a chocolate hue, and largely mixed with hair.[17]

Miles also gives[18] a number of cases of cows, sheep, pigs, dogs, and hens which were similarly affected by previous impregnations.

In a case known to myself, a dark-haired woman had, by a red-haired man, an illegitimate son who had red hair like his father. She afterwards married a dark-haired man and had by him a second son who had red hair like the first. There have also been reported a number of cases, more or less reliable (or unreliable) of white women who bore mulatto children and subsequently bore white children having negro characteristics.

REVIEW OF TELEGONY.

With the exception of Cecil's remarks, all these cases appear to refer to the effect of the first impregnation, though I know of no reason why they should not apply to later ones. It is probably true, however, that the first impregnation would be more likely to influence the female than later ones, partly because she is younger

(16) Sanders, "Horse Breeding," p. 52.
(17) Ibid.
(18) Stock Breeding, pp. 258 to 263.

and more easily impressed, and partly because the later impregnations would have to share their influence with the previous ones. While the majority of these cases refer to external and apparent characters, those relating to thoroughbred horses refer to functions, and it is quite evident that the functions of organs are fully as liable to be influenced in this manner as are the organs themselves. It is also quite likely that widows have their offspring by a second marriage influenced in the same way.

Although the statements relating to the effects of previous impregnations are vouched for by many observers, recent investigations have thrown doubt on the whole series of phenomena. The trouble is no one seems to have systematically investigated the subject, and many of the so-called facts, especially those relating to human beings, are open to suspicion. In my examination of the pedigrees of eminent men I have observed what appeared to be an unusual number of widows who married a second time, and the children of those second marriages appeared as progenitors. This is suggestive but not demonstrative, and I have not carried out an investigation along this line because it does not appear that the results would be proof of anything.

ATAVISM.

Characters which are ordinarily transmitted from generation to generation sometimes disappear in the child and reappear in the grandchild, the great-grandchild, or even some more remote descendant. This action is called atavism and may be considered as an exception rather that the general rule. There are, however, a good many cases that illustrate this particular action.

Darwin mentions[19] the case of a pointer bitch which had seven

(19) Animals and Plants Under Domestication, Vol. II, p. 46.

puppies. Four of these were marked with blue and white, which is so unusual a color with pointers that she was thought to have played false with one of the greyhounds and the whole litter was condemned, but the game-keeper was permitted to save one as a curiosity. Two years afterwards a friend of the owner saw the young dog and declared that he was the image of his old pointer bitch Sappho, the only blue and white pointer of pure descent which he had ever seen. This led to a close inquiry and it was proved that he was a great-great-grandson of Sappho; so, that, according to the common expression, he had only one sixteenth of her blood in his veins.

Mr. Day mentions[20] the case of a fox-terrier which had a peculiarly graceful action, and was supposed to be of a "perfectly pure" breed. Careful inquiries showed that a remote ancestor had been crossed with an Italian greyhound, and this ancestor had transmitted his graceful movements to this fox-terrier.

Another peculiar case is given by Mr. Darwin.[21] A cross had been made between a setter and a spaniel, and this half-breed was crossed with a pure setter. After several successive crosses with pure setters a male was produced without any apparent traces of spaniel. This apparently pure setter was coupled with a pure setter female and produced spaniels.

Mr. Darwin also gives[22] the case of a breeder who once crossed his fowls with a Malay race and subsequently wished to get rid of the foreign blood. After forty years of effort he was unsuccessful, as some fowls showing the effect of the Malay cross were continually appearing.

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(20) The Horse.
(21) Animals and Plants.
(22) Ibid.

In a litter of pigs two young ones appeared with the marks of the Berkshire that had been used as a cross twenty-eight years before.[23]

A man who had a double tooth in place of one incisor inherited that peculiarity from his paternal grandfather. Another man, healthy in every particular, but the son of a lame man, had children by three wives, and all of these children were lame like their grandfather.[24]

PARTIAL TRANSMISSION.

A very common occurrence is partial transmission, or transmission to part of the offspring and not to all of them. Several of the cases previously mentioned come under this head. Helm mentions one[25] which illustrates it very well. One member of a family had the second and third toes united, and this anomaly was transmitted for three generations to one person only in each generation out of an average of eight descendants in each family.

Napoleon died of a cancer, a disease which he had inherited from his father, but the other members of the family were not afflicted with it.

A case somewhat different but more marked is given by Quatrefages.[26] In 1803 or 1805, M. Decemet discovered in his garden at Saint Denis, in the midst of a bed of acacias (*Rubina psudo-acacia*) an individual without thorns which he describes under the epithet *spectabilis*. It is to the multiplication of this individual by the arts of the gardener that all the thornless acacias now distributed in every part of the globe owe their origin. Now these individuals

(23) Animals and Plants Under Domestication, Vol. II, p. 68.
(24) Miles, Stock Breeding, p. 71.
(25) American Roadsters, p. 13.
(26) The Human Species, p. 38.

produce seed, but if the seeds are sown they yield only thorny acacias.

This last case differs from the others in that the thornless character of the acacias appears not to be transmissible. The cases of the fox-terrier which had a graceful action and the grandchildren who were lame like the grandfather are different from the other cases as they relate to functional peculiarities arising from the inheritance of special structure.

INHERITANCE BY SEX.

In the examples of inheritance so far given, characters were transmitted indifferently to any of the offspring. Another kind of inheritance is known as inheritance by sex. In this class come all of those characters which are not connected with the act of reproduction, but which are transmitted to only one sex and are known as secondary sexual characters, and a mass of cases in which the transmission is to both sexes but more commonly from father to son and from mother to daughter than *vice versa*. Secondary sexual characters are those which pertain to a particular sex, as a beard on a man and sicle feathers on the tail of a cock. Although such characters are not transmitted from one sex to the other, they are transmitted through the opposite sex to later generations of the same sex. Thus the beard that characterizes a man will be transmitted to the son of that man's daughter, though the daughter herself show not a trace of the beard. The inheritance of secondary sexual characters is so well known that it is not necessary to dilate upon them. What is necessary to show is that many characters, not in any sense sexual characters, tend to be inherited more by the sex in which they originated than by the opposite sex.

SEX IN TROTTING HORSES.

Among American trotters the mares are known to be greater performers than the stallions. Helm[27] ranks Hambletonian as the first of the great stallions. Hambletonian was not a trotting stallion and his sire, Abdallah, was neglected and discredited during his lifetime, and it is said he died of starvation. In looking into the ancestry of Hambletonian I find that he was descended from a line of trotting mares, and his record is one of a sire of trotting mares. Goldsmith Maid was his granddaughter, and she had at least two additional trotting mares in her ancestry. I am not able to find, however, that her ancestry included any stallions of fame except Hambletonian and Abdallah.

Sedgwick gives the case of a sporting dog, the issue of a setter mother and a spaniel father, with a setter bitch, and the male offspring were spaniels like the paternal grandfather, while the female offspring were setters, having the color of their mother.[28]

There are breeds of sheep and goats in which the horns of the males differ greatly from those of the female. These differences, acquired under domestication, are regularly transmitted to the same sex. With cats the tortoise-shell color is usually transmitted to the female only, the males being rusty red.[29] Gout is more often transmitted from father to son than from father to daughter.[30] Sanders[31] states that he knows a family residing in Iowa in which the mother and three daughters were destitute of hair, while all of the sons had as much as the average of men.

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(27) American Roadsters, p. 151.
(28) Quoted by Miles in "Stock Breeding," p. 233.
(29) Descent of Man, Vol. I, p. 273.
(30) Ibid., Vol. I, p. 283.
(31) Horse Breeding, p. 24.

In the cases of insanity Philips gives, from 117 insane males, 64 inherited from the father and 53 from the mother. For 147 insane females, 80 inherited from the mother and 67 from the father. In cases of consumption recorded by Lugol, of 106 consumptive males, 63 inherited the disease from the father and 43 from the mother. Of 108 consumptive females, 61 inherited the disease from the mother and 47 from the father.[32]

Speaking of skin diseases Mr. Sedgwick says:[33] "In some of these cases it is recorded that, while the males alone have suffered from the disease, the females alone have been able to transmit it, as in the case of Mr. Appleton, whose daughter conveyed the complaint to his grandsons, and who, in turn, transmitted it through their daughters to their grandsons; the males in this family, as in many others similarly affected, never inheriting the disease from the fathers, but always through females from their grandfathers."

INHERITANCE AT CORRESPONDING AGES.

Not all characters which are transmitted from parent to child are present in the child at birth, but appear at some later stage. In such cases the tendency is for the character to appear in the offspring at the same age that it first appeared in the parent. This rule includes nearly, if not all, secondary sexual characters, which usually appear near the age of maturity, as in the case of beards on men and the change of voice which occurs at puberty. Certain breeds of pigeons do not acquire their characteristic colors until they have moulted two, three or four times; and these modifications of plumage are regularly transmitted.[34] In the diseases like gout, apo-

(32) Quoted by Miles in "Stock Breeding."
(33) British and Foreign Medico-Chirurgical Review, 1861, p. 246.
(34) Descent of Man, Vol. I, p. 272.

plexy and consumption, the tendency is for them to appear at certain definite ages in both parent and offspring.

In discussing this subject Darwin concludes,[35] that where characters first appear late in life in one sex they tend to be transmitted to that sex alone, while those which appear early in life, or before maturity, tend to be transmitted alike to both sexes. The general truth of this rule will be apparent by considering the relationship of adult males and females to their young. When the males and females resemble each other they usually both resemble the young, but when the males and females differ markedly from each other they usually differ in those characters which appear late in life. It is also a general rule that when the adults differ from the young the adult male differs more than the adult female.

INHERITANCE AT EARLIER AGES.

When there is a variation from the general rule that characters tend to appear in parent and offspring at corresponding ages, it seems that they more often tend to appear at an earlier age rather than at a later one. Professor Hyatt has assumed that the earlier appearance of a character is a law of nature, and has laid down what is called the law of acceleration or tachygenesis. He says: "All modifications and variations in progressive series tend to appear first in the adolescent or adult stages of growth, and then to be inherited in successive descendants at earlier and earlier stages, according to the law of acceleration, until they become embryonic or are crowded out of the organization and replaced in the development by characteristics of later origin."[36] While I have no doubt as to the general truth of this law, I am inclined to think that it

(35) Ibid., Vol. I, p. 276.
(36) Smithsonian Contributions to Knowledge, No. 673.

applies less to the organs than it does to the functions of the organs, and that when it applies to the organs themselves, it does so only through their functions. The reasons for this and the causes leading to earlier or later appearance of inherited characters will be explained in a later chapter.

SELECTION.

When a litter of pigs is born, according to the laws of heredity they are like their mother, and according to the laws of variation we find that they differ one from another. When they have grown to mature size we find that some are larger and some are smaller than the mother. If we should select the largest female and from her and the largest obtainable male we raise another litter, it will again be found that some grow to a size larger and some to a size smaller than the new mother. Again selecting the largest male and female for another litter, we again find variations in size above and below the size of the parents, and we will have some specimen larger than any immediate ancestor. Although these variations in size from generation to generation are slight, it will be evident that by accumulating these slight variations it will only be a question of time until a race of pigs would be produced as large as elephants. If, on the other hand, instead of selecting the largest from which to breed the next generation, we should continually select the smallest, it would be only a question of time when we should have pigs as small as mice.

Although this is a hypothetical proposition it is not an absurdity. That such variations occur we know, and no man has yet found any point, or indication of a point, where they cease. In reality our hypothetical case represents only a small fraction of what the scientific world now accepts as a fact. That fact is that

all animal life, from the largest whale down to the microscopic unicellular organism, is descended from some primordial form, and consequently that all animals (and all plants, for that matter) are more or less closely related.

KINDS OF SELECTION.

This process of selecting particular animals or particular plants from which to produce another generation of animals or plants is what is known as "selection." When selection is practiced by man it is called artificial selection, and when that selection has a definite object in view and is carried out with the intention of securing definite results, it becomes methodical selection. It is through the methodical selection and preservation of desirable variations that we have obtained our improved breeds of animals and varieties of plants. So perfect have become the methods of selection that it is said that a breeder can, in a few generations, produce any particular form of animal desired.

During the early history of man, and at the present time among savage and barbarous people, there is a process of selection that is not methodical but depends upon whim, pleasure, or convenience, and consequently is called unconscious selection. Because the man, having to kill an animal, kills the less pleasing or useful and retains the one that pleases his fancy, unconscious selection improves the breed subjected to it though the improvement is not so rapid as with methodical selection.

In a state of nature, very many more young are produced than can possibly survive to reproduce. If there were not a constant elimination of individuals, even the slowest breeding animals would soon overrun the surface of the earth. This elimination occurs through struggles for food during periods of scarcity, contests

between males for the possession of females, and inability to escape from enemies. During a period of drought when there is a scarcity of herbage, the giraffe with the longest neck will be able to obtain the best supply of food and will survive when the shorter necked individual will succumb from starvation. When deers are pursued by wolves, it is the fleet ones that will escape and the slow ones that will fall victims. Among polygamous animals, as wild horses, wild cattle, the deer family and elephants, the larger and stronger males expel or kill the smaller and weaker ones. This process of elimination of the weaker or less perfect, and preservation of the stronger and best adapted has been called natural selection, or the survival of the fittest.

In addition to the forms of selection described, there is another form called sexual selection, a term used to express the process by which a female selects and accepts the attentions of the male which is most pleasing to her. It is through sexual selection that many male birds have obtained their gorgeous plumage and other birds have acquired the power of song.

It will be evident that before there can be selection, or survival of the fittest, there must be variations from which the selection is made, and that to make such selection effective there must be the force of heredity to preserve the variations selected. Having these two forces, selection becomes an explanation of the process of evolution.

It is to Mr. Darwin that we owe our knowledge of the existence of natural selection and its action upon all forms of animals and plants. He considered it as probably the most potent factor in organic evolution, but since his day many naturalists have come to consider it the only factor.

IN-AND-IN BREEDING.

Closely related to methodical selection, as practiced by man on domestic animals, is the process of in-and-in breeding. In-and-in breeding is the mating of closely related animals, often parent and offspring, or brother and sister, for the purpose of fixing a particular character upon a breed. Thus, when a new character appears, the chances of having that character reappear in the offspring are very much increased if the character is common to both parents. As new characters appear rarely, and as the probabilities of the identical character simultaneously appearing in two unrelated animals of opposite sexes are extremely remote, the breeder carefully watches the progeny of the newly varied individual until he finds one of the opposite sex having the same peculiarity, and then mates parent and child. Some, if not all, of the progeny of a couple so mated are quite certain to also have the new characteristics. By the careful selection and mating of these last offspring the new characters are fixed firmly within a few generations. By this process we have a new breed of animals, and as long as there is no cross with animals outside the breed we have what is known as "pure blood." As a consequence, all of our fancy breeds of animals are the product of in-and-in breeding. Darwin considered in-and-in breeding to be injurious when carried to a considerable extent, and this is true when the evil effects are not eliminated by judicious selection of the best individuals and the rejection of the poorer ones. That selection is a full cure for any ill effects of in-and-in breeding is abundantly proved by the superiority of pure breeds over mongrel stock.

EFFECTS OF MATING RELATED ANIMALS.

The evil effects of in-and-in breeding arise from the fact that in many animals there are certain dormant defects. When unrelated

animals are mated there is little probability that the same dormant defects will exist in both, but when both parents are from the same stock the probabilities of the same defect existing in both are increased, and the mating of these two may cause the dormant defect to become a manifest one. Of all animals, man is the most vicious in respect to his personal life. By immoderate indulgences in intoxicants and narcotics, and by dissipation and excesses of all kinds, man acquires a great variety of defects, both dormant and manifest, and these defects are transmitted to his offspring. It therefore happens that with man even a remote kind of in-and-in breeding often results in insanity or degeneracy of some kind, and much has been written about the evil effects of marriage between cousins. Such evil effects, however, do not arise from the relationship itself, but from similar dormant defects inherited from the same vicious ancestor some few generations back.

In-and-in breeding is therefore the mating of animals having identical characteristics, the result of which is to make manifest what was before dormant, or to accentuate and fix what was before mildly manifest and transient. The expression is usually applied to the mating of closely related animals, but in future pages I shall refer to marriage between persons inheriting similar characteristics from different ancestors as a species of in-and-in breeding.

PREPOTENCY.

If the offspring of parents differing considerably from each other be carefully examined, it will usually be found that they resemble one parent more than the other. The power that one parent has more than the other to impress the offspring is called prepotency, and may exist in either the male or female. Usually the male is more apt to be prepotent than the female, as in recip-

rocal crosses between the horse and the ass, in which the mule more strongly resembles the ass, and the hinny resembles the horse. In some cases of crosses between different breeds, one breed is prepotent over the other irrespective of whether it is represented by the male or female.

In cases of crosses between different breeds of animals, prepotency appears to lie with that breed which has had its characteristics most firmly fixed by in-and-in breeding. Thus pure blood animals are prepotent over mongrel stocks. This fact is sometimes taken advantage of by breeders, as was the case of the production of the Charmoise breed of sheep in France. It appears that half-bred English sheep will thrive in France, but that full, or more than half, English blood are failures; also that half-bred sheep do not exhibit the improvement desired. Under these circumstances M. Nalingie-Nouel proceeded as follows: He produced a mixture of four native French breeds, which was without decided character, and to such mixed-blood ewes he put a pure New Kent ram. From this "one obtains a lamb containing fifty-hundredths of the purest and most ancient of English blood, with twelve and a half hundredths of four different French races, which are individually lost in the preponderance of English blood, and disappear almost entirely, leaving the improving type in the ascendant."[37]

As between two individuals of the same breed, the same rule probably holds, that the individual which has had its characteristics the more firmly fixed by in-breeding will be prepotent. In the life of an individual, a character is more firmly fixed in comparative old age than in youth, consequently we may assume, in the absence of evidence to the contrary, that, other things being equal, the older individual will be prepotent over the younger one.

(37) Miles, Stock Breeding, p. 200.

As fixity of character is in contradistinction to variability, in a cross between two races, that race will be prepotent which has been the less variable during the immediately preceding generations. The white race is more variable than the negro, and in crosses between them we find negro characteristics predominate. It is well known that animals and plants under domestication are more variable than they are in the wild state, and it is also known that this variability is induced by the stimulated conditions existing through successive generations. As civilization, as we know it, is a series of intensely stimulated conditions, we see why the civilized races are more variable and less prepotent than uncivilized races. This generalization must, however, be used with caution because the very intensity of civilization acts to give a fixity to some characteristics which are less firmly fixed by a less degree of intensity.

GROWTH AND REPAIR.

Growth is essentially a slow process, depending upon the amount of material digested and assimilated over and above what is necessary to maintain the individual in a uniform condition. As this surplus is always a limited quantity, any acceleration of growth in one part is accompanied by a lack of growth or degeneracy in some other part. Strength and endurance, in the sense of vitality, are as much matters of growth as is mere increase in bulk, and the development of these qualities absorbs assimilated nutriment just as completely. Those animals and plants which are strong, enduring and tenacious of life are those which grow slowly in bulk, while those which increase rapidly in size are weak and are easily killed. Functional power is also a matter of slow development, and while it is associated with the size of the functioning organ it is not proportional to such size. It also absorbs nourishment in its develop-

ment, and the very rapid development of functional power in some one organ can only be at the expense of the proper development of some other organ or quality.

Growth is distinguished from repair in that it involves increase in size without the incorporation of force or power in the growing organ. On the other hand, repair is a process of rebuilding a wasted organ so as to incorporate in it a functional power that it did not have before. Growth and repair sometimes accompany each other and sometimes do not. Thus, the muscles of a child both grow and are repaired; the same muscles in an adult, when used uniformly for a long time, are repaired but do not grow; the hair grows, but is not repaired. In organs which both grow and are repaired the ratio of growth and repair to each other is continually changing. In the embryonic stage there is growth with but little or no repair; in youth the two are nearly equal; and in the adult we have repair with but little or no growth.

CHAPTER II.

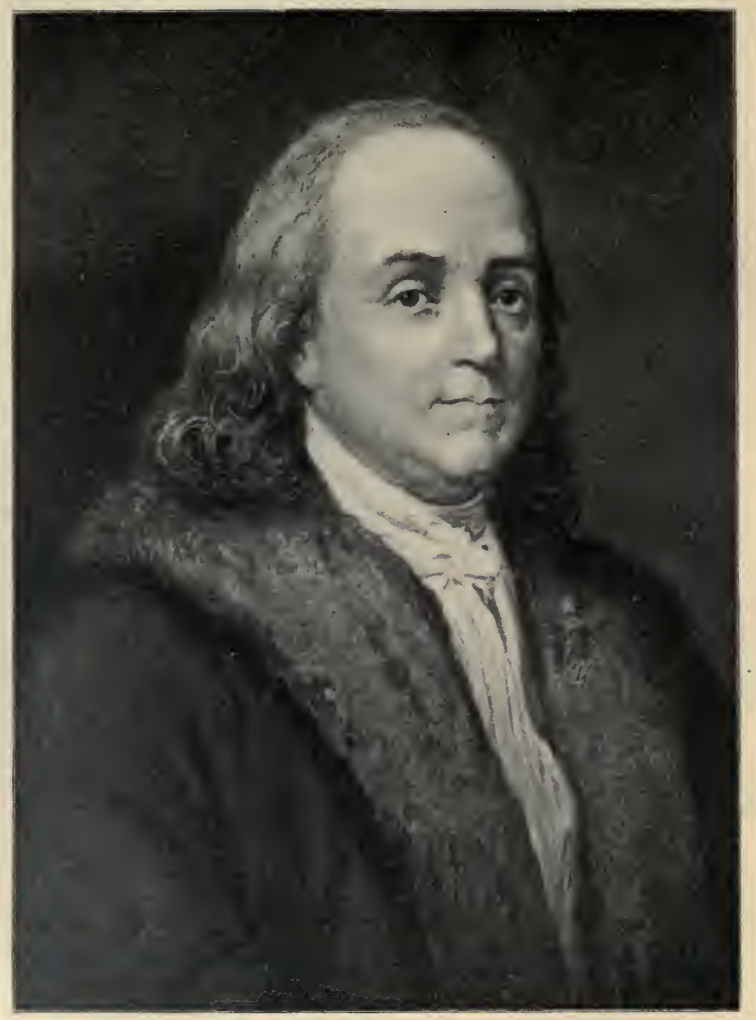
THEORIES OF HEREDITY AND VARIATION.

The persistency with which heredity acts in preserving the peculiarities of races and individuals through many generations, and the ever present variations of these peculiarities have given rise to many diverse theories to account for their relationship to each other. "Like produces like" is a very old saying, and when we consider that the offspring comes directly from the parent, it is difficult to conceive that it would be anything other than that from which it came. We can imagine how the same thing may at certain times take different forms, but not how one thing may become another thing unless it be through the total destruction of the first thing. Thus we may have water now as ice, again as steam, and at another time as snow, but under each and every form it is water. It can be transformed into some other substance only by decomposition and the recombination of its constituent elements with some other elements. Likewise a being descended from a human being can be no other than human. He can be transmuted into a plant only by disintegration and reabsorption. Inheritance being simply an expression for the fact that the deriven is like that from which it is derived, is self-evident and needs no explanation. Variation, on the contrary, being something different from what is apparently self-evident, demands an explanation of when, where and how it arises.

VARIATION DEFINED.

The word "variation," as used in biology, represents two distinct conditions or operations: First, the appearance of an entirely

NAPOLEON [23]



BENJAMIN FRANKLIN [51]

new organ or character; and second, a change, more or less marked, in some organ or character already in existence. It is in this second sense in which the word will be principally used, and it will be variation of existing characters of which the following pages will treat.

"The characters which are inherited, and which are present at birth, are termed congenital, while those that appear in the body under the influence of extreme stimuli are termed acquired."[1] If the character which appears at birth differs from the character of the parent, then we have a congenital variation. An acquired variation we can understand because we can see it occurring as the direct results of causes with which we are familiar, but congenital variations occur out of sight, and we can arrive at the cause of them only by a process of reasoning or experiment.

One of the causes assigned for congenital variations is the result of environment or circumstances under which the ancestors have lived. Dogs taken from England to India degenerate in a few generations; sheep taken from one place to another change in their form and in the quality of their wool; and plants moved from their natural habitat acquire new characteristics which are inherited.

Another cause assigned for variations that become hereditary is the result of use and disuse. Darwin found that tame ducks have their legs larger and wings smaller than wild ducks. This is assumed to be an inherited effect arising from the fact that tame ducks walk more and fly less. Some naturalists think that the large hind legs of a kangaroo are due to his habit of jumping, while others maintain that his habit of jumping is due to the fact that he has large and powerful legs.

(1) Cope, Primary Factors of Origin of Evolution, p. 399.

Still another cause of variation is said to be the fact that the individual is the product of two unlike parents, and consequently cannot be entirely like one without causing inheritance to fail in respect to the other. It cannot be denied that this is a cause, but if it be the only cause, then the question would arise: How did the parents become different? Those who advocate this theory to the exclusion of the theory involving enviroment and use, add to it the statement that the germ plasm out of which the new individual grows is subject to a series of divisions and conjunctions, and that as these divisions and conjunctions are not always equal, the products are variable.

ARISTOTLE ON HEREDITY.

The earliest writer on the subject of heredity appears to have been Aristotle, who lived 384 to 322 B. C. In his "Generation of Animals" (I., Sec. 35), he says: "Children resemble their parents not only in congenital characters, but in those acquired later in life. For cases are known where parents have been marked by scars, and children have shown traces of these scars at the same points. A case is also reported from Chalcedon in which a father had been branded with a letter, and the same letter, somewhat blurred and not sharply defined, appeared upon the arm of his child." At another place (History of Animals), Aristotle refers again to this matter and states that the inheritance of mutilations is rare. From this it is apparent that Aristotle considered that characters acquired in one generation become congenital in the next, and that he carries it far enough to include the occasional transmission of mutilations. Although we frequently hear of inherited mutilations, the reports concerning them are hard to corroborate. Dr. Talbot[2] has, how-

(2) Degeneracy.

ever, by gathering a large amount of statistics, proved that, among Jews, children are not infrequently born wholly or partly circumcised. This appears to be due to the continued repetition of the same mutilation generation after generation.

LAMARCK'S LAWS.

Although Aristotle was the first to advance the theory that acquired characters become congenital characters in succeeding generations, the theory of such transference as an explanation of variations was not fully stated and explained until done so by Lamarck, a French philosopher, in his "Philosophie Zoologique," published in 1809. The statement of his theory may be best given by quoting his third and fourth laws:

THIRD LAW.

The development of organs and their force, or power of action, are in direct relationship to the employment of these organs.

FOURTH LAW.

All that has been acquired or altered in the organization of individuals during their lives is preserved by generation, and transmitted to individuals which spring from those which have undergone these changes.

At another place Lamarck explains his third law as follows:

"In every animal which has not passed the term of its development, the more frequent and sustained employment of each organ strengthens little by little this organ, develops it, and gives it a power proportional to the length of its employment; whereas the constant lack of use of the same organ insensibly weakens it, deteriorates it, progressively diminishes its powers, and ends by causing it to disappear."

The third law and its explanation is now known as the "Law of Use and Disuse," or kinetogenesis; the fourth law, as "Inheritance of Acquired Characters;" and the two of them together as "Lamarckian Factors."

We have in Lamarck's laws a clear and distinct statement of the cause of variations, but Lamarck did not give any adequate proof of their truth. Neither has any one since Lamarck's time been able to give a proof that was entirely satisfactory, though many naturalists believe that these laws are a true statement of facts.

WEISMANN'S THEORY.

The opposing ideas are best represented by the theory of August Weismann, a German embryologist who has carried his investigations back to the earliest known source of life. The most primitive forms of animal life consist of minute rounded bodies of gelatinous substance. These bodies are called "cells," and each is a complete individual in itself. An individual which consists of a single cell is called unicellular, and unicellular organisms are generally designated by the term plasm or protoplasm. Individuals which consist of a number of cells grouped together are called multicellular, and multicellular organisms are a step higher in the scale of nature. In unicellular organisms the cell grows for a time, then there appears around it an equatorial depression like a string tied around the center of a pillow. This depression gets deeper and deeper until the two halves are finally separated and float away as two complete cells. These new cells again grow and each again divides in the same manner. In the lower forms of multicellular organisms an individual consists of a certain number of cells, say sixteen. These cells grow to a certain size, when each cell will divide into two cells of smaller size, making an individual of thirty-two cells. The

individual then divides itself into two groups of sixteen cells, each group becoming an individual. After this division a new period of growth begins, and the processes of division are repeated.

In some forms, after a repeated number of divisions, the cells become weakened or degenerated and are not able to continue the process of growth and division. When this occurs, two cells, or two groups of cells, which have not separated from each other, coalesce or merge into each other and form one stronger individual. After they have remained in this condition for a time they are again able to begin the process of producing new individuals by a series of divisions and subdivisions. In this coalescence we have the beginning of sexual propagation.

DIFFERENT KINDS OF CELLS.

As we get higher in the scale of multicellular beings, the cells become differentiated, so that to some cells are given certain duties to perform, while to other cells are given certain other duties. In a sense these cells are like the different individuals in civilized societies where one man is a farmer, a second is a tailor, a third is a shoemaker, a fourth is a merchant, and so on. Those cells to which are given the office of reproduction are called germ cells, and the substance of germ cells is called germ plasm. The cells which constitute the body of the individual and form the bones and muscles by means of which the individual is able to move about and secure its food, are called the somatic cells, or simply the soma.

When we come to man and the higher animals and higher plants, the germ cells are able to propagate themselves, or at least to become multiplied in number, but they are not able to develop beyond the stage of simple cells without coming into contact and merging (coalescing) with cells of a slightly different character. These two

kinds of cells are known as male cells (spermatozoa) and female cells (ova), and may be borne by different individuals as in most animals, or by the same individual as in the flowers of most plants. When there is a union or coalescence between an ovum and a spermatozoon the resulting cell has the power, under proper conditions, of developing into a complete individual of the parent species.

Weismann's theory is that, in the formation of a new individual out of this compound cell, all of the germ plasm which constitutes it is not used up in the production or growth of the individual, but that part of it is carried over intact within the body of the new individual, and is the material which originates the growth of more germ plasm in the later life of this individual. In other words, he holds that the germ cells grow only from germ cells, and not at all from somatic cells. As we know that somatic cells are the differentiated descendants of germ cells, and have no conclusive evidence that germ cells are produced from somatic cells, there is much reason in Weismann's contention. In fact, the very definition of germ cells and somatic cells implies that the first are for reproduction and the second are not. The relationship of germ cells to somatic cells is like the relationship of bees in a hive to each other, where the queen is for reproduction and the workers are incapable of reproduction, but act simply as gatherers of material to support the colony.

THE ISOLATION OF GERM CELLS.

While the germ cells are housed within and are nourished by the body (the soma), the followers of Weismann insist that that fact does not at all affect the germ cells as such, because they are completely removed from external conditions and their surroundings are so nearly identical, under all circumstances and through any

number of generations, that external circumstances are without influence that will reach a succeeding generation. A man may be born weak and frail, yet may, by care with his food and bodily exercise, develop into a robust individual, but the Weismannians insist that that fact will not make his children stronger or healthier, because they claim it is the somatic cells and not the germ cells that are developed and strengthened. To admit such a result would be to admit use-inheritance, the denial of which is a fundamental part of their theory.

NEO-DARWINIANS AND NEO-LAMARCKIANS.

Those who support the Weismannian theory, and other theories of a similar character, call themselves Neo-Darwinians, not because Darwin was a believer in any such doctrine, but because they explain evolution entirely by variation and selection, the elements on which Darwin based his theory of the Origin of Species. In this, however, they go much beyond Darwin by making "variation" into "congenital variation," while Darwin believed that variations were due in part to the accumulated effects of use and disuse. While the Neo-Lamarckians explain the loss of the power of flight in domestic ducks to the disuse of their wings, the Neo-Darwinians explain that tame ducks, not being required to fly to procure food and to escape enemies, the variations toward greater wing power are not preserved by selection, and consequently that wing power deteriorates. They also argue that ducks with greater wing power are more liable to escape, and that man deliberately kills off ducks liable to escape by flying, and preserves those less able to fly and less wild. They thus bring selection to explain what had before been explained by the inherited effects of use and disuse.

It is maintained by the Neo-Darwinians that as long as any

change can be explained by the known means of congenital variation and selection, it is unreasonable to attribute that change to the inherited result of use or disuse, while at the same time they admit that if any change can be shown which is explained by use and disuse and is inexplicable by congenital variation, then their theory falls to the ground. The introduction of the word "congenital" is the key to the whole controversy, because it is universally admitted that all change is due to variation. The only question is the cause of variation.

Weismann does not fully explain how variations occur, but he assumes that the two uniting cells vary somewhat in size, in form, in chemical formation, or in manner of uniting, and they thereby cause a variation in the resultant being. This kind of variation is called congenital variation. That congenital variation exists in some form is shown by the variations in twins, and in the differences among the different individuals in a litter of puppies, kittens or pigs.

CONFLICT OF THEORIES.

We thus have two theories which conflict with each other and neither of which has been fully and satisfactorily demonstrated. The issue between them is sharply defined, and consists of the question as to whether or not acquired characters are inherited and thus become congenital. If the answer to this question had only an academical interest, or if only related to the animals and plants with which man has to deal, then it would not be very important whether the question were answered or not, as these animals and plants may be dealt with in a satisfactory manner by selection. But as it also involves man, and as we cannot use selection by killing off the poor specimens of humanity and breeding only from the best,

the question takes on an importance that it would not otherwise have.

A little consideration will show the reason why this question is one of vital importance. Man is a free agent, more or less circumscribed by heredity and environment. Consequently he may, in a large measure, do what he pleases, or what his intelligence tells him is wise, convenient or safe. If he goes out walking, he may turn to the right or turn to the left as suits his fancy; he may live a life of goodness, kindness and charity; or he may act the part of the deepest dyed villain as long as his wit will enable him to avoid being found out.

While some men are so hedged in by hereditary traits that they are not able to act by choice anywhere within such a wide range, a very large part, if not the majority of men are so able. Even those who are handicapped by a vicious inheritance, if above the grade of idiocy, are capable of leading relatively better or worse lives, and this capability is very largely dependent upon intelligence and brain power. A man of great mental ability has little difficulty in choosing his mode of life, and he usually chooses to lead a respectable life. The man who is morally weak is the man who is mentally weak.

QUESTION OF MORAL RESPONSIBILITY.

If it be true that all the qualities, good and bad, with which a man is endowed when he is born have their origin in the chemical composition of the germ plasm, or in its divisions, or in its conjunctions, and consequently are absolutely independent of any action of the parents arising from free will, then the parent has no moral responsibility arising from parenthood except such as arises after the child is born. He may, within the range of his free will, be virtuous or vicious, be active or indolent, in fact may be or do any-

thing whatever and his children will not be affected thereby in the remotest degree. They will be exactly what their grandparents transmitted, plus or minus such variations as fortuitously arise.

If, on the other hand, there be such a thing as use-inheritance, and children are influenced for good or bad by the pre-natal actions of their parents within the range of free will, then the moral responsibility of parents reaches back to their own early lives, and after the birth of children reaches forward to their grandchildren. Not only would there be direct responsibility on the part of parents, but that responsibility would extend to the State to see that all reasonable efforts be made to improve and develop future generations. In fact, if use-inheritance be an actuality, then there is within the hands of the present generation the power to improve future generations, and consequently the race, more fully and completely than would be possible through the most scientific process of selection. All that is necessary is positive knowledge that characters acquired by the parents are transmitted to the offspring, and a knowledge of the conditions under which such transmission may take place. If this knowledge will give this power, then it is difficult to conceive of any knowledge that is more important to acquire.

CHAPTER III.

BASIS OF INVESTIGATION.

It having been shown that the problem before us is to determine whether acquired characters are or are not transmitted to the offspring, it becomes necessary to define the range within which such inquiry should be carried. It may be admitted in advance that not all acquired characters are the results of the functional activity of those organs with which they are associated, and consequently that if non-functional characters become inherited, such inheritance is not due to use. Thus, hair which was originally straight may become wavy, that which was light may become dark, or that which was dark may become white. It is difficult to conceive how such changes could be due to any activity of the hair, and they certainly are not due to free will actions on the part of the individual. It is true that hair which was rough and coarse may, by care and attention, become smooth and fine, and it is possible that such an acquired character may become hereditary, but that is quite different from a case in which the character is acquired through the use of the organ itself.

ORGANS AND THEIR FUNCTIONS.

To find the effects of use we should choose an organ which has a functional activity of its own, and one in which such activity is within the control of the individual. An organ and its function are not the same, and the functional activity and power of an organ does not necessarily correspond to the size and shape of the organ. A finger is made of muscle, bone, blood vessels, nerves and skin,

besides certain minor parts. The function of the muscle is contractability from which we obtain force. The function of the bones is to furnish a support or base upon which the muscles may act. The blood vessels supply material to repair the waste due to functional activity of the muscles; the nerves convey sensation by which the action of the muscles may be controlled; and the skin serves as a casing to contain the other parts. The nose, an organ not differing very much in size or shape from the finger, has approximately the same proportions of muscle, bone, blood vessels, nerves and skin, but the functional activity of its muscles is vastly less. When we use the finger we use principally its muscles, when we use the nose we use principally its nerves—olfactory nerves. The external human ear, though differing widely from the finger and nose in shape, does not differ much in the amount of material out of which it is formed. It is, however, inert. What function it has is simply that of deflecting sound waves, and this function is not within the control of the individual.

EFFECT OF EXERCISE.

If we exercise the fingers continually, as in piano playing, they acquire both strength and flexibility. Strength and flexibility are, therefore, acquired characters arising from use of the muscles of the fingers. If we examine the fingers before and after such acquirement, we find that the differences in size and shape are scarcely perceptible. These acquired characters of strength and flexibility give the fingers an increased functional capacity, i. e., an increased ability to perform their natural functions. When we find an individual with characters which might possibly be ascribed to the results of ancestral use, we find these characters are not necessarily organs of increased size, but organs having an increased functional

capacity. Organs of a given size and shape are transmitted from generation to generation with great persistency and with very little variation, but the functional capacity of these organs varies greatly and often varies rapidly. We know that use will cause an organ to vary in power much more rapidly than it varies in size or shape, and when we observe that an organ is transmitted in its normal size and shape, but with tremendously increased power, it is hard to conceive how such a variation could occur except through an ancestor having acquired such power in the same organ and having transmitted that power to the offspring. We have justification for this view from the fact that we see structure arising without having any assignable cause, but we never find functional capacity arising during the life of an individual except through use. From this we see that the inheritance of acquired characters means use-inheritance, and use-inheritance means the inheritance of acquired functional capacity.

It is from this standpoint of the inheritance of acquired functional capacity that we will investigate the subject of the transmission of acquired characters, and the organ selected will be the brain, because the brain varies more widely in power than any other organ. It is only necessary to compare the brain of a Humboldt with the brain of an ordinary mental incompetent to see how great may be the difference in functional capacity when the difference in size is slight.

THE LAW OF PROBABILITIES.

If the Weismannian theory be true in that part which says that ancestral use is absolutely without effect upon descendants, and that variations arise fortuitously within the germ plasm, then advantageous and disadvantageous variations will occur according to the law of probabilities. Thus, if we take one thousand births as they

occur chronologically, or take them in any other manner that does not partake of selection in the biological sense, and from this one thousand determine the kind and extent of variations, then the standard so established will be a very accurate index of the kind and extent of variations in any other one thousand births selected from any class of people in any part of the world. It would be as true for the lower class as for the higher class, because the extent of variation arising at a birth would be measured from the class in which the birth occurred, and there is no reason for thinking that variations would occur more frequently in one class than in another. In nine-tenths of the cases the variations would be very slight and not depart from the ancestral standard in a noticeable degree. In one-tenth the variations would be quite noticeable and would be divided equally between variations above and variations below the ancestral standard. In one case in one hundred the variation would be great, and in one in one thousand the variation would be extraordinary. Variations in one direction are usually followed by variations in the opposite direction, so that a class of people having a given standard of mental power will persist in maintaining that standard through many generations.

DIFFERENT CLASSES.

When, in any community, there exist two classes of individuals, if one class increase in numbers faster than the other class, either through earlier marriages, more prolific marriages, or both, then it is only a question of time when the rapidly increasing class will absorb the less rapidly increasing one. This may be illustrated by a few figures. Assuming a community composed of one thousand blacks, and one thousand whites, if the whites increase in numbers at the rate of ten per cent during each decade, and the blacks increase

at the rate of twenty per cent, then at the end of fifty-year periods the population will stand as follows:

Years.	Whites. 10 per cent.	Blacks. 20 per cent.
0	1,000	1,000
50	1,610	2,488
100	2,593	6,192
150	4,177	15,410
200	6,727	38,160
250	10,830	95,390
300	17,450	237,350

This shows that at the end of three hundred years the rapidly increasing blacks would be 13.6 times as numerous as the slowly increasing whites. But a time comes in each community when the population cannot further increase, or can only increase slowly. This stoppage of numerical increase takes place gradually, and is assumed to first affect those which are normally less prolific, so that before the time when increase ceases for the community, the less prolific have begun to decrease if they have not become wholly extinct.

LOWER CLASSES MOST PROLIFIC.

In the civilized communities of Europe and America there exist two classes of people, known respectively as the intelligent or upper class, and the ignorant or lower class. There is no distinct line of demarkation between them, as they grade into each other through innumerable intermediate degrees. Yet we all recognize these two classes by the intellectual power of the individuals which compose them. While there is no natural line of division between them we may, for convenience, draw an arbitrary line and

say that one-third of the population belongs to the upper class and two-thirds belongs to the lower class. Common observation and the statistics of marriages, births and deaths tell us that the ignorant, the vicious, and the mentally incompetent individuals of a community marry early and rear large families, while the intelligent and desirable members of society marry late and have few offspring. The result of this is that the descendants of the ignorant class are becoming relatively more numerous and threaten to supplant the descendants of the intelligent class.

PROPOSED RESTRICTIONS INADEQUATE.

There is nothing new in this illustration of the relative rates of increase of the inferior and superior classes of society. The subject has been treated upon by many writers. Galton and Haycraft see in this rapid propagation of the less desirable class of people a serious menace to the future of the race, and in fact conclude that the race is degenerating at the present moment. They both argue, as do others, that there should be a restriction and control of child-bearing as the only means of checking this downward tendency. This may be considered as an ideal plan for race improvement, but it is not a practical one in the present state of civilization. If the race be now deteriorating the plan will be still less practical in the future, while if it be not deteriorating, then there is no occasion for the remedy.

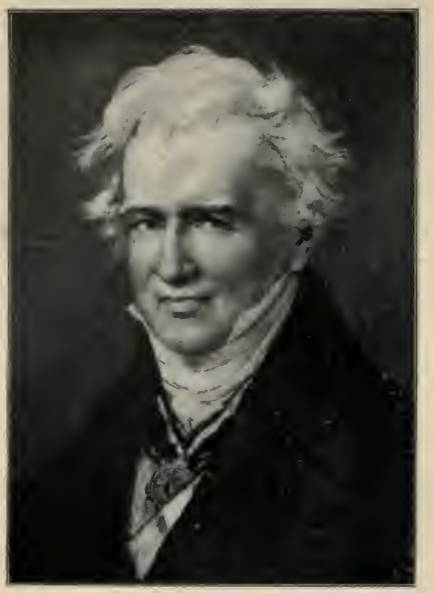
The statistics which show that the lower classes of society reproduce more rapidly than the higher and more advanced classes are simply a modern demonstration of a process that has been going on for several centuries. The proof of this is abundant. We have only to compare the known multiplication of the race with the fact that a very large part of the eminent men of the last two centuries left

BACON [52]
The Philosopher

BISMARCK [44]
The Statesman

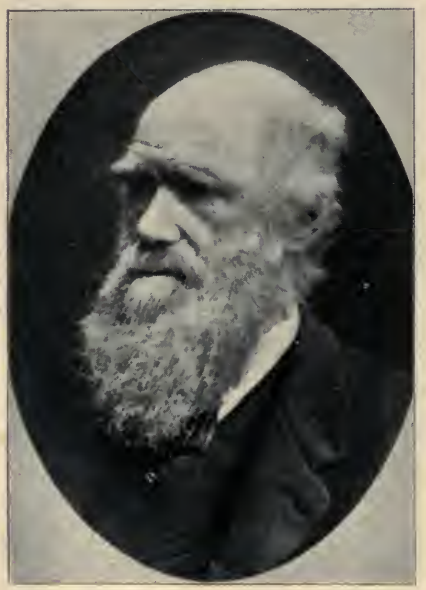
SHAKESPEARE [36?]
The Poet

ALEXANDER THE GREAT [26]
The Conqueror

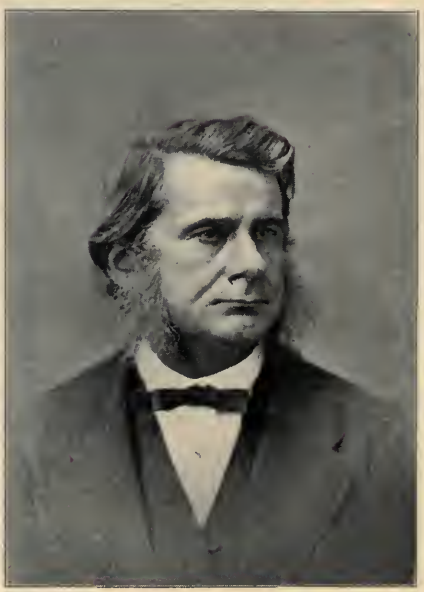


HUMBOLDT [49]

CUVIER [52]



DARWIN [43]



HUXLEY [45?]

no descendants at all, and of those who did very many had sons who fell far below their fathers in the functional capacity of their brains.

DEDUCTION FROM WEISMANN'S THEORY.

From the standpoint that all variations arise fortuitously in the germ plasm, we have the deduction that if this be so, then variations occur according to the law of probabilities, and a class which is inferior in mental capacity will remain inferior, while a class which is superior will remain superior. With this we have the fact that what we know as the inferior class is, and has for a long time been, reproducing itself more rapidly than the superior class. From these two elements there is but one deduction, and that is that the race has been deteriorating for several centuries, and that the mental capacity of the men living today is less than that of the men who lived one, two, or three centuries ago.

THE RECORD OF HISTORY.

But this deduction is directly and flatly contradicted by history. The record of the nineteenth century shows that the mental achievements of its men were greater than those of all other centuries combined. The record of the eighteenth century shows that its men were greater than those of its predecessors and only second to those of the nineteenth century. "Professor Broca found that skulls from graves in Paris of the nineteenth century were larger than those from the vaults of the twelfth century, in the proportion of 1,484 to 1,426."[1] This is an increase in brain size of more than four per cent and indicates a very much larger increase in mental power.

From a premise containing two elements, we have a deduction which is proved to be false, hence at least one of these elements

(1) Descent of Man, p. 140.

must itself be false, and the indications are that the falsity lies with the assumption that variations occur only fortuitously in the germ plasm.

GREECE AND ROME.

It has been shown that the theory of use-inheritance means the inheritance of acquired functional capacity. If this theory be true, then a continuous education from generation to generation should cause the men of each succeeding generation to have greater mental power than those of the preceding generation, and a cessation of education should cause descendants to decline in mental power. History gives us several instances of such series of educated generations. We find in Greece the first case in which the record is sufficiently accurate to enable us to compare it with the theory of use-inheritance. The inhabitants of ancient Greece were divided into two classes, slaves and their masters. All common labor being performed by the slaves, the ruling class was left free for its members to use their time in education, polities and war, all three of which had a tendency to develop their mental powers. At what time education became general among the ruling class is uncertain. Homer lived about 900 B. C., and the fact that his poems have come down to us indicates some kind of record at that early date. The first date at which the chronology of Greece becomes definite is 776 B. C. At about 650 B. C. there was already in existence a reading class of people, though the class at that time was not extensive. From this time on the ruling class seems to have been regularly educated at schools kept by the men most famous for their learning. In any list of famous Greeks we find the greatest number of them, and the men of greatest ability, located in the century between 425 and 325 B. C., and we find that this culmination was gradually reached in

a manner that corresponds exactly with our deduction from the theory of use-inheritance.

In the case of Rome we find the same education accompanied by the gradual increase in number and ability of her great men. In Rome the educational rise commenced somewhat later than in Greece and culminated soon after the beginning of the Christian era.

THE DARK AGES.

For about a thousand years after the fall of the Roman Empire there was in Europe no education of the masses, and no education of any kind except a little attained by the clergy. As priests were forbidden to marry and consequently left no offspring, or at least were not supposed to leave any, there was no possibility of use-inheritance through ancestral education. The almost total absence of any intellectual achievements during this thousand years shows that there was nothing produced which could be referred to as use-inheritance. In other words, the absence of use and the absence of anything that could be called use-inheritance go together for a thousand years.

In the fourteenth century the revival of learning began, and universities were founded at Lyons, Avignon, Orleans, Perugia, Heidelberg, Coimbra and Vienna. In the fifteenth century we have the invention of printing, and thereafter we have a continually increasing amount of education diffused, first through the ruling classes, and afterwards gradually extending to the masses. The theory of use-inheritance demands that accompanying this there should be an increasing number of persons having considerable mental ability, and that mental ability should rise to higher and higher levels as the centuries pass.

RECORD OF THE CENTURIES.

In the back part of the fourth volume of the Encyclopedic Dictionary (edition of 1895) there is a "Pronouncing Dictionary of Biography," containing about nine thousand names. As the list contains the names Smith, Jones and Brown, it is evident that "pronouncing" is not the criterion by which names are included or excluded, but that there are included the names of those who have achieved greatness by some means or other. Opposite each name is the date of birth and death as far as known. To determine how far

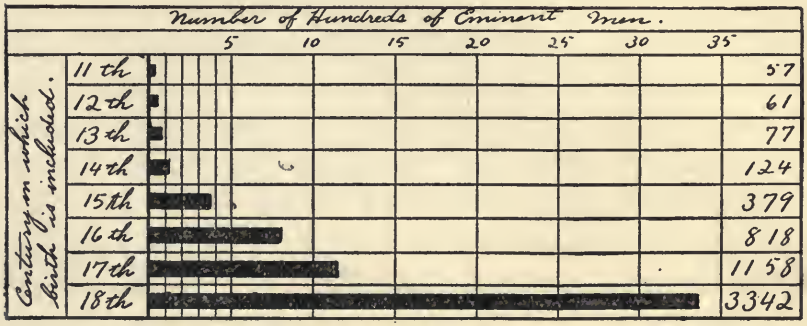


FIG. 1. DISTRIBUTION OF EMINENT MEN GIVEN IN PRONOUNCING DICTIONARY.

this list of eminent men would confirm or contradict the theory of use-inheritance as applied to modern Europe, I tabulated the entire list by their births, arranging them in centuries. The result of this tabulation is given in Fig. 1.

This diagram shows that before the revival of learning Europe produced very few men who were eminent enough to have their names preserved in a Pronouncing Dictionary of Biography, while immediately following the revival the number increased rapidly and

continued to increase from generation to generation. An examination of the list also shows that, of those belonging to the period prior to the fifteenth century, the majority are entitled to have their names in this list only from the fact that they were hereditary monarchs, or princes who became involved in some of the wars of the period. On the other hand, the majority of those included in the seventeenth and eighteenth centuries have their names included because they exhibited great mental power.

ONE HUNDRED GREATEST MEN.

In 1900 Charles Denby, former United States Minister to China, and John Q. Howard, of the Library of Congress, joined in compiling a list of the one hundred greatest men in the world's history. The list begins with Homer and ends with Edison, thus covering a period of 2,800 years. I have subjected this list to the same test so as to locate the men of greatest intellect. In the first 1,200 years of this time there were fifteen men, being Greeks and Romans. In the next 1,200 years there are twelve men, being one in each century except the eleventh, which has two, and the twelfth, which has none. Of these twelve men, all but Alfred the Great, Gutenberg and Dante, are either religious reformers or soldiers. These three are the only representatives of statesmanship, invention and literature in twelve centuries. In the remaining four centuries we have seventy-three men, fifty-three of whom come in the classes of statesmanship, science, invention and literature. Of the one hundred greatest men in the world's history, we have seventy-three per cent of them concentrated in one-seventh of the time, and that one-seventh is located at the place where use-inheritance calls for it to be located.

EDUCATION IN ENGLAND AND SCOTLAND.

On page 125 of "Darwinism and Race Progress," Haycraft says:

"The doors of every profession were barred except to those who possessed capital, and the children of the poor were frequently unable to obtain even the elements of book knowledge, except in Scotland, where primary education had the start of England by three hundred years,"

Two pages further on he says:

"One can hardly explain, on the assumption of race superiority alone, the wonderful potentiality of the Scottish Lowlands, the birthplace of so many who have been distinguished for personal attainments, for the East Coast Englishman is the same blood as the Lowlander, and the division between England and Scotland is by no means an ethnological one; it is, rather, a political division of the old Kingdom of Northumberland."

And yet Professor Haycraft denies the existence of use-inheritance and attempts to explain this on the fortuitous nature of opportunities. Galton, who has made a special study of human heredity, and who is perhaps the first person to deny use-inheritance, tells us that when a man is born with tremendous intellectual power, the lack of opportunities is nothing. He will make his opportunities.

EDUCATION IN AMERICA.

The same distinction that Professor Haycraft mentions between Scotland and England has existed in the United States between the North and South. When the Pilgrims landed on the inhospitable coast of New England they immediately planted the "little red school house," and never since have they failed to maintain it, nor have they failed to supplement it with colleges and universities. In

the South an exactly opposite policy was pursued, except in the case of a few who were slave-holders. In 1671, when the population of Virginia was estimated at 40,000, Sir William Berkeley, the then governor, wrote:

"I thank God there are no free schools nor printing, and I hope we shall not have these hundred years; for learning has brought disobedience and heresy and sects into the world, and printing has divulged them, and libels against the best government. God keep us from both." Of the great men produced in the United States, very few indeed have come from the South, and those who have come from there have had ancestries which were exceptions to the general rule. An invention is the product of a mind capable of moving unaided through unexplored realms. It is an evidence of intellectual power and is largely independent of the educational opportunities of the individual who made it. The inventions produced in the Northern and Southern portions of the United States are a very good index of the mental ability of the inhabitants of the two sections. In the South there is annually produced one invention for each 17,000 of the population; in the Northern states the production is annually ten inventions for each 17,000, and in Connecticut it is nineteen. And yet the people of the South are of the same stock as those from the North. The ancestors of both came from England. If there was any original difference in the mental powers of the two, that difference was in favor of the Southern immigrants. It is true that England dumped some of her pauper stock on Virginia in the seventeenth century, but the "F. F. Vs." also contained such men as Washington, the Randolphs, the Lees, and the Marshalls, families which had achieved fame before coming to America, and which were the peers of anything that New England could show.

EXPLANATION OF NEO-DARWINIANS.

We thus see that our deduction from the theory of use-inheritance is supported by history at all points. But the Neo-Darwinians object to this interpretation of history. They insist that education goes no further than to furnish opportunities for the mind which is potentially great to educate itself and thus become great in fact. This explanation would imply that congenitally great intellects were just as common during the dark ages as at present, and that the reason why we have no record of them is partly because of the lack of records and partly because the lack of education robbed many of them of their opportunities. But this explanation of the Neo-Darwinians does not account for the advance in relative greatness after educational facilities were obtained. Neither does it account for a man like Franklin, who had no educational facilities other than such as he made for himself. Nor does it account for the fact, which will be shown later, that there never has been produced a brain having a great functional capacity except as a descendant from a man who had previously made large use of his brain.

WEISMANN'S STATEMENT.

The explanation, however, is forced by the theory of continuity of the germ plasm and the apparent impossibility of such a thing as brain-use affecting in the remotest degree a material so completely isolated. Weismann says:

"The germ cells arise in their essential and distinctive substances, not by any means from the body of the individual, but directly from the parent germ cells. Inheritance takes place wholly and solely because a substance of definite chemical, and above all, molecular composition, passes over from the germ cells of one generation to

those of the next. This substance, the germ plasm, is located in the cell-nucleus, and possesses, by virtue of its extraordinary complexity of structure, the capacity to develop into a very complex organism. The germ cells of successive generations are related in the same way as a series of generations of unicellular beings which are derived, one from another, by continued divisions."

Weismann's statements are quite positive and he is probably as competent as any one to speak of the elements and origin of germ-plasm, but when his theories in regard to them force an explanation which is inconsistent with known facts we cannot do otherwise but consider such an explanation unsatisfactory.

CHAPTER IV.

BASIS OF INVESTIGATION, CONTINUED.

In investigating the origin of great men, the first noticeable thing is that they are usually sons of prominent men. At this point investigators, knowing the facts of inheritance, jump to the conclusion that superior men are produced only from superior ancestry and inferior men only from inferior ancestry, irrespective of the fact that both had common ancestors some generations back. This common ancestry of superior and inferior men is well shown in the cases of Cromwell and Charles I, who were distant cousins. Of course there is the explanation that the remote ancestor is represented in a very small measure in the two descendants, that on one side there were intermarriages with superior, and on the other side with inferior persons, and that spontaneous variations in the germ cells made up the difference. As there is no evidence that the collateral branch going to Cromwell married persons superior to those which the royal line secured, we have assumption upon assumption made necessary by deduction from an elaborate theory regarding mysterious occurrences in the germ cells.

USE AND DISUSE DEFINED.

The word use, in a biological sense, means an amount of use greater than enough to bring an individual to, and maintain it at, the average functional capacity of the race or species to which it belongs; while the word disuse means an amount of use less than enough to bring the individual to, and maintain it at, such a standard. Use and disuse are, therefore, relative and not absolute terms.

The amount of use necessary to bring the individual to, and maintain it at, the average functional capacity of the species to which it belongs may be called *average use,* and the amount necessary for any particular individual may be called *normal use.* Before an individual can arrive at the average functional capacity of the species to which it belongs it must have passed from the adolescent to the adult stage. The distance into the adult stage which an individual must pass to arrive at the average for its species depends partly upon its inherited functional capacity and partly upon the degree of its functional activity. Hence the acquired functional capacity of an individual is represented by the absolute use minus the normal use. In this connection it should be remembered that the normal use for a particular individual is not a fixed aggregate of use, but varies with the age of the individual. Thus, after an individual has arrived at the average functional capacity of its species it must continue its normal use for the purpose of maintaining itself at this standard. If the individual fails to continue this normal use it falls below the standard and we have a case of disuse. Ordinarily the normal use and the average use do not differ much, but when an individual possesses an organ endowed by heredity with great functional capacity the normal use is much less than the average use, and, conversely, when an individual inherits less than the average functional capacity the normal use becomes greater than the average use.

THE MEASURE OF USE-INHERITANCE.

From our definition of the word use, it is evident that to have use-inheritance in a descendant, there must have been, on the part of the ancestor, an aggregate use greater than the normal use for such ancestor. Stated in other words, use-inheritance is to be measured by the amount of use for each ancestor and not by the aggre-

gate use in a given period of time and independent of the number of ancestors within that time. This may be made still clearer by remembering that use-inheritance means the inheritance of acquired functional capacity, and that unless an individual acquires a functional capacity above the average of its ancestors it will not have an acquirement which it can transmit.

As use really means surplus use on the part of the individual, or use more than the normal use, it is evident that the functional capacity acquired by use is made up of two factors, viz., functional activity of the individual and time. We may assume for convenience that the capacity acquired is proportional to the time occupied in its acquirement. Thus if an individual acquire m capacity in time t, then capacity $2m$ will be acquired in time $2t$. While not strictly true, this is approximately true during the period within which the individual may continue to acquire functional capacity.

AGE AT COMPLETE DEVELOPMENT.

Under uniform conditions the healthy man usually attains his best physical development between twenty-five and thirty, and maintains it to some time between forty and fifty. Occasionally he comes to physical maturity at an earlier age, and sometimes he retains his strength beyond fifty and even beyond sixty. Under conditions which are not uniform he may, by physical training at a particular time, reach his greatest development at any age between twenty-five and sixty, or even seventy. When a man who has passed the age of twenty-five takes up systematic physical culture, the functional capacity of his muscles will develop rapidly under the stimulus of muscular activity. Within a few months or a year he reaches a physical strength and development beyond which further training will not carry him. In this we have a case of use consisting of

extreme functional activity carried on through a considerable period of time. If, after acquiring physical development through special training, he desists from further exercise, his strength and activity will drop away rapidly and to a considerable extent. Then we would have a case of use followed by disuse. The amount in which strength will fall away by disuse will depend upon the length of time during which training was continued. If training be continued for only a short time, then strength would fall away rapidly, while if continued a long time it would fall away less rapidly and to a less extent.

GROWTH OF THE BRAIN.

The growth and development of the brain are similar to those of the body, but are continued for a much longer time. The brain differs from the body in that its functional capacity may be enormously increased without apparent increase in its size. For what length of time the brain continues to grow in size is uncertain, but it appears that the time is extended and the brain is made more capacious by intellectual activity. In Fig. 2 I give Galton's diagram of brain growth as determined by him from students at the University of Cambridge, England. The original diagram is limited to twenty-five years of age, but I have extended it by dotted lines to thirty-three, to illustrate the probable growth to that period. From personal observation I find that in spite of my hair growing thin I wear a slightly larger hat than I found necessary at the age of thirty. From this it would appear that either hats have grown smaller or the growth of the brain continues beyond thirty. The functional capacity, however, continues to increase long after the limit of size is attained. Time is, therefore, an important element in brain development, and it becomes evident that there can be

no appearance of use-inheritance applied to brain power unless the parent has lived many years before reproducing.

The dependence and relationship of acquired functional capacity of the brain upon time is recognized and may be illustrated in many ways. In common law the individual is not supposed to know enough to take care of himself before twenty-one. The Constitution of the United States says he is not eligible to become a Rep-

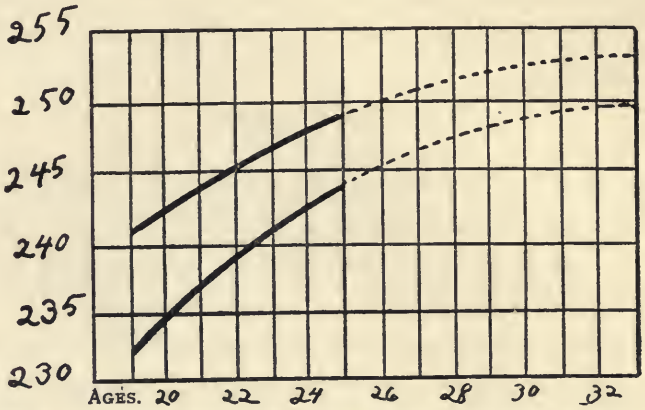


FIG. 2. GALTON'S DIAGRAM (EXPANDED) OF BRAIN GROWTH.

resentative before twenty-five, is not competent to be a Senator until thirty, and not wise enough to be President until thirty-five.

HYPOTHETICAL COMMUNITY.

Let us assume a mining camp with one hundred men whose ages vary from twenty to thirty, the majority of whom have more than ordinary native intelligence, and many of whom have had the benefits of a college education; let us assume, also, that there comes to this community a man of fair intelligence, who is fifty years of age, who had in his youth only limited opportunities for education, but who has had a wide experience in many parts of the world under-

many diverse circumstances; then, in our hypothetical community this older man will immediately become the most prominent man there. He will know better than any one else what to do and how to do it. He will be the arbitrator in disputes and probably will become the Justice of the Peace or the first Mayor of the embryo town. All this will be because his years have developed his brain so that it has a greater functional capacity than the brains of his associates. According to the theory of use-inheritance this man could, from a given mother, beget a more intelligent son than could any other man in the hypothetical community. If the son of such a man should become eminent, we would have an illustration of the ordinary saying that eminent men are the sons of prominent men. But saying that an eminent man is the son of a prominent man is only another way of saying that he is the son of an educated man, because a man is prominent only because of the education he has acquired.

PROMINENCE DEFINED.

A prominent man is one whose brain has great functional capacity. While absorbing facts is a function of the brain, it is not the particular function which produces prominence. That function is the power of using known facts and previous experience in the solution of any problem that may arise, and is usually designated by the words judgment, discretion, and intelligence.

The relative development of the body and the brain is illustrated diagrammatically in Fig. 3, in which the line A represents the bodily development, B the development of the brain, and C the development of the man as a whole. If we assume that these lines represent the normal development of a healthy man, then the theory of use-inheritance would say that his child with the best physical

COPERNICUS [(77+x)÷2]

gle line of ancestors. If all of the ancestors are included then the equation will be

$$Q = M + m(T - t^1) + m(T - t^1) + \text{———}$$

The denominators in the first equation represent the number of ancestors in that generation. When all of the ancestors of a generation are included the denominator of that term disappears and $m(T - t^1)$ represents the average of them all.

EXPLANATION OF THE FORMULA.

In any particular case the term T may usually be determined from the biography of the individual; *t* may be determined by statistics; t^1 does not usually differ much from *t*, but will be greater or less according to what the ancestor inherited from his ancestors; K is usually an unknown quantity, but an indication of its relative value may sometimes be determined from biography; *k* may be generally estimated from known conditions, being greater for Caucasians than for Chinese, greater for Chinese than for Negroes, and greater for Negroes than for Fuegians; and M may be estimated in the same manner as *k*. Whether the individual rises above or falls below the average of the race depends upon two factors, of which *m* may be considered as unknown, while $T - t^1$ may be calculated. If T be less than t^1, *i. e.,* if reproduction takes place at an early age, then $T - t^1$ will be a minus quantity and the descendant will fall below the average. If T be larger than t^1, then the rise or fall will depend upon whether the value of K makes *m* an increasing or decreasing quantity. With man *m* is usually an increasing quantity up to about the age of sixty. It will therefore be apparent that the value of Q will be largely dependent upon the value of T, and that it cannot be large unless T is large.

RECAPITULATION.

Use-inheritance means the inheritance of acquired functional capacity. Before there can be such an inheritance a parent must acquire a functional capacity above the average of the species to which it belongs. The acquirement of such a functional capacity demands a functional activity above the normal. To have the functional capacity large the functional activity must have continued for a considerable time, and it is largest when the activity is continued as long as there is any increase in capacity. Applied to the brain of man, the amount of acquired functional capacity would, within limits, be proportional to the length of time devoted to its acquirement, and would be greatest in comparatively old men. Hence, if there be such a thing as the inheritance of acquired functional capacity, it should be most marked in the descendants of old men, and conversely, if it can be shown that the inherited functional capacity of individuals is proportional to the age of their parents at the time of reproduction, that fact would be evidence of the inheritance of such acquirements. Furthermore, such evidence, if obtained, would not be explainable on any other theory than use-inheritance, because there is no other imaginable reason why great men should only be produced by old fathers.

CHAPTER V.

STANDARD OF COMPARISON.

The Hall of Fame is a building connected with the New York University, and was erected to perpetuate the memory of famous men of American birth. The men selected to have their names inscribed in the Hall of Fame were chosen by ballot, the electors being one hundred[1] eminent men—college presidents, educators, professors of history, scientists, publicists, editors, authors, and judges of the State and National Supreme Courts. The first election, held in October, 1900, resulted in the choice of twenty-nine men. These twenty-nine men and the number of votes each received are as follows:

George Washington	97	Nathaniel Hawthorne	73
Abraham Lincoln	96	George Peabody	72
Daniel Webster	96	Robert E. Lee	69
Benjamin Franklin	94	Peter Cooper	69
Ulysses S. Grant	92	Eli Whitney	67
John Marshall	91	John J. Audubon	67
Thomas Jefferson	90	Horace Mann	67
Ralph W. Emerson	87	Henry Ward Beecher	66
Henry W. Longfellow	85	James Kent	65
Robert Fulton	85	Joseph Story	64
Washington Irving	83	John Adams	61
Jonathan Edwards	81	William E. Channing	58
Samuel F. B. Morse	80	Gilbert Stuart	52
David G. Farragut	79	Asa Gray	51
Henry Clay	74		

These men, selected by ballot as they were, may be considered as America's most famous men, and the relative measure of their

(1) Only 97 voted.

fame may be represented by the respective number of ballots which they received. As a preliminary to our investigation I have chosen to take these twenty-nine men and apply to them our test of ancestral use as it will appear from the ages at which reproduction occurred. My reason for choosing to begin with this list is because I find it already made up, and consequently it cannot be charged that it was selected with reference to the age of their parents at the time they were born. Another reason is that I can trace the ancestry of these men more completely than I can that of any similar group of men not specially selected with that object in view, and it is part of my plan to trace a few in an elaborate manner to serve as a basis for the larger group of men which I shall discuss in a succeeding chapter.

SOURCE OF STANDARD SCALE.

It is one thing to state that a child's parents were of certain specified ages when the child was born, and quite another thing to know what that statement means after it is made. It is therefore evident that before we can draw any just conclusions in regard to the birth-ranks of these men we must establish a standard by which to measure them, and that this standard must not only tell us the average age of parents when children are born, but must give us a number of subdivisions so that we may locate each individual at his proper place in the scale. To produce such a standard I have taken the "Redfield Genealogy" (edition of 1860), and have calculated the ages of parents for the recorded births in the eighteenth century. I have chosen the eighteenth century partly because the records for that century are fairly complete, and partly because the majority of these famous men were born during that century. The Redfields born at that time were mostly born in Connecticut, or in substantially the latitude of Connecticut, which is also ap-

proximately the latitude in which the majority of these famous men were born. If there be any difference, the Redfields were born slightly further north. These Redfields were neither eminent statesmen nor day laborers, but average examples of New England citizens. They were largely farmers, with a sprinkling of merchants, sailors and professional men. Many of them, like other Americans of the eighteenth century, married early and produced large families, and consequently their births extended over a wide range and exhibited nearly all possible combinations.

HOW STANDARD SCALE IS MADE.

In making up my standard for comparison I have taken only those cases in which the family record was complete, and have excluded every family in which one or more births could not be accurately determined. By adding a few births occurring in the first decade of the nineteenth century I managed to obtain the ages of the fathers for 240 births, and the ages of the mothers for 180 births. I then divided these births into ten equal groups, which I tabulated as follows:

TABLE I.

AGES OF PARENTS AT BIRTH OF THEIR CHILDREN.

(Ten per cent in each class.)

Fathers.	Class.	Mothers.
Under 24-6	a	Under 22-0
Between 24-6 and 27-1	b	Between 22-0 and 24-1
" 27-1 and 28-11	c	" 24-1 and 25-9
" 28-11 and 30-9	d	" 25-9 and 27-5
" 30-9 and 32-8	e	" 27-5 and 29-2
" 32-8 and 34-9	E	" 29-2 and 31-0
" 34-9 and 37-3	D	" 31-0 and 33-7
" 37-3 and 40-0	C	" 33-7 and 35-10
" 40-0 and 44-6	B	" 35-10 and 39-10
Over 44-6	A	Over 39-10

THE MEANING OF BIRTH-RANK.

This table shows that ten per cent of the children were born when their fathers were less than 24 years and 6 months old, that ten per cent were born after the fathers were 24 years and 6 months old and before they had reached the age of 27 years and 1 month, and that the other sections of ten per cent each came between the ages specified,—the last ten per cent being children of fathers over 44 years and 6 months of age. For mothers, ten per cent were born before the mothers were 22 years old, and ten per cent after they were 39 years and 10 months of age. The extreme ages of fathers range from 19 years to 65 years, and for mothers the range is from 16 years to 45 years. I have designated these classes by letters so that the earliest born ten per cent is represented by *a* and the latest ten per cent by *A*. The next per cent in order from either end of the scale is represented by *b* or *B* as the case may be, and so on, —corresponding sections being represented by corresponding small and capital letters. A person born when his father was 33 years old will be spoken of as being born in class E. I shall also speak of such a person as having the "birth-rank E" or the "birth-rank 33," the two terms being used interchangeably. John Smith [42] will means that John Smith was born when his father was 42 years old and consequently that John Smith's birth rank is 42.

SUBDIVISIONS OF SCALE.

From the nature of our investigation it will be evident that the two extremes of our scale are the most important, the intermediate portions being more or less indifferent or neutral. I have therefore subdivided the classes *a* and *A* as follows:

5	per cent	of	births	are	to	fathers over	51-0—A^2
2	"	"	"	"	"	"	57-0—A^3
5	"	"	"	"	"	under	23-0—a^2
2	"	"	"	"	"	"	21-4—a^3

SCALE TESTED.

Dr. Duncan[2] gives the ages of mothers for 16,385 births as determined at the Dublin Lying-in Hospital between 1850 and 1860, and also the ages of mothers for 16,301 births as registered in Edinburg and Glasgow in 1855. He also gives[3] a similar record for Finland and Sweden, with the exception that in the last case the births are the total for the whole population and amount to 100,057. Comparing these with the female record as I have determined it from the Redfield Genealogy, we have the following table:

TABLE II.

PERCENTAGE OF CHILDREN AT DIFFERENT AGES OF MOTHERS.

Ages	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50+
Dublin	4.65	29.67	32.40	23.29	7.38	2.42	.13	.03
Edinburg and Glasgow	2.30	22.62	30.89	23.61	14.76	5.15	.58	.03
Finland and Sweden	3.29	16.50	26.32	25.61	18.08	8.51	1.69	—
Redfields, 18th cen.	3.33	22.78	28.33	21.63	14.44	8.88	.57	—

From this table it will be seen that Ireland stands at the extreme of early reproduction and Finland and Sweden at the extreme of late production, while Scotland and America are intermediate and close together. Finland and Sweden being very cold climates and

(2) Fecundity, Fertility, and Sterility, p. 7.
(3) Ibid., p. 15.

the age of puberty being considerably affected by temperature, these countries present an exceptional condition which is not applicable to America and Europe in general. I shall therefore ignore them and make my comparison more particularly with Ireland and Scotland. I can do this better because the statistics for these last mentioned countries are more complete and reliable than for Finland and Sweden. The following table giving the ages of mothers for different percentage of children, shows that while the Redfield mothers of the eighteenth century began reproduction a little earlier than the Scotch mothers of the middle of the nineteenth century, the average age of reproduction was higher and was continued to a later age. In other words, the standard here adopted is somewhat high as compared to Scotland, and markedly high as compared to Ireland, and consequently it will operate against, rather than in favor of, the theory that eminent men should, as a whole, have birth-ranks above the average.

TABLE III.

AGES OF MOTHERS FOR DIFFERENT PERCENTAGES OF CHILDREN.

Proportion of children.	Redfields.	Scotland.	Ireland.
10 per cent under.....	22-0	22-4	21-2
50 per cent under.....	29-2	28-11	27-3
90 per cent under.....	39-10	39-6	35-0

TEST BY INSURANCE RECORDS.

The above comparisons have been made with different classes of mothers because the statistics were in a form that would enable me to do so, but I am able also to make a comparison between American fathers of the eighteenth century and Irish fathers from 1830 to 1841. Prof. Miles quotes from Walford's Insurance

Cyclopedia, Vol. III., p. 189, a series of tables showing the ages of fathers for the births of 977,446 children. From these tables I am able to calculate the percentage of children for different ages of Irish fathers which I have put into a table that will compare them with the fathers used in our standard. This table shows a very marked difference, and that the ages of Irish fathers and Irish mothers are almost identical. While it is a fact that where marriages are early there is less difference between the ages of husbands and wives than where marriages are late, I doubt if this table represents the whole truth. What is apparent, however, is that our adopted standard is a high one, and one that is higher than would have been the case if I had adopted the available statistics instead of obtaining my own from an original source.

TABLE IV.

PERCENTAGE OF CHILDREN AT DIFFERENT AGES OF FATHERS.

Fathers.	Ireland, 19th century.	Redfields, 18th century.
Under 17	—.39	
17 to 25	46.18	15.42
26 to 35	45.53	49.58
36 to 45	6.92	26.25
46 to 55	—.86	5.83
Over 55	—.12	2.92

MARRIAGES GROWING LATER.

It is a well recognized and often commented upon fact that, for the last century or more, marriages have been growing later and later, and in comparing my standard with the recorded marriages of Redfields during the first half of the nineteenth century I find that this is true of this particular group of persons. Remembering

that our comparisons were between reproductions a century apart, it will be seen that there is another reason for thinking that our standard is, if anything, abnormally high. To still further test the matter, I compared the average ages of the marriages from which our standard of births are taken with the ages recorded in marriage licenses issued in Chicago at different times during 1900, and I find that they are almost identical, although there is a difference of more than a century of time between them.

Though there are so many reasons for considering the adopted standard as being high, I have still decided to retain it because it is a definite and known standard of known accuracy, and because, if the men measured by it are found to be high in comparison to it, it will be known that they are absolutely high, and will be relatively high as compared to any standard that may be made from the mass of human beings.

INTERPRETATION OF MEASUREMENTS BY THE SCALE.

Having adopted a standard of birth-ranks, and having divided this standard so that it becomes a scale of equal divisions, the law of probabilities declares that if we take any miscellaneous group of men and find their birth-ranks, it will be found that they are pretty evenly distributed along the length of the scale. A deduction from this law is that if we take a selected group of men and compare their birth-ranks with a standard scale of birth-ranks, then if we find that there is an unusual accumulation at a certain part of the scale or an unusual absence of cases at some other part of the scale, this accumulation or this absence must be in some way connected with the manner in which that group of men was selected. This deduction is very old and well known. Aristotle recognized it when he held that anything which occurs regularly cannot be the result of

chance, but must occur because of some definite law. Since Aristotle's time, the law of probabilities has been demonstrated so many times that no one any longer questions it. Vast business enterprises and even gamblers depend upon the law of probabilities for their profits. Any one who wishes to test the law of probabilities can easily do so by throwing dice. Each die is a cube having its sides marked with from one to six spots so arranged that the sum of the opposite sides equals seven. If any one throws two dice he may get two aces, the sum of which is two; or he may get two sixes, the sum of which is twelve; but if he throws the pair ten times the sum will be very near seventy, or an average of seven. In one hundred throws the average would be still nearer seven, and in one thousand throws the average would never vary from seven more than a minute fraction.

THE SCALE AND THE LAW OF PROBABILITIES.

Having established a standard scale of birth-ranks and having twenty-five men[4] whose births we wish to apply to this scale, it follows from the law of probabilities that we should find two or three births in each one of the ten classes. It also follows that if we take the birth-ranks of the immediate ancestors of these twenty-five men we should also find their births evenly distributed along the scale. From the manner in which the scale was made and its comparison with what it would have been if made from other sources, it is evident that whatever deviation there is from an exactly uniform distribution, that deviation should be in favor of placing the larger number in the classes represented by the small letters

(4) Four of the twenty-nine have been omitted from consideration because of the impossibility of finding dates relating to their ancestors. This should not affect the result, because there is no reason why unknown persons should differ from known ones.

rather than in the classes represented by the capital letters. If there be no relationship between the mental ability of a child and the age of the father when that child was born, then, according to the law of probabilities, the men of the greatest intellects are just as likely to appear at one part of the scale as at another, and that there is nothing to cause two or more of superior intellectual capacity to appear close together. Conversely, if several men having intellects manifestly superior to others appear close together, and especially if they are grouped at one extreme of the scale, then that fact is explainable only by some cause outside of the law of probabilities. Furthermore, if it should appear that the mental greatness of these men was closely proportional to their relative positions on the scale, that proportionalism could only be explainable on the theory that the inherited mental capacity of a child depends upon the age of the parents at the time the child was born.

FAME VERSUS MENTAL GREATNESS.

Before passing from this branch of the subject I must call attention to the fact that fame is not always commensurate with mental greatness. If it were, then Tom Thumb and the Siamese twins would be considered as intellectual giants because they certainly were famous in their day. It is therefore evident that the relative positions of these men in fame is not necessarily their relative positions when we come to consider them purely in respect to their mental powers. In studying these men from the intellectual standpoint we must consider what they have done, and must eliminate from such consideration any halo of glory that depends for its luster on some spectacular achievement.

CHAPTER VI.

HALL OF FAME MEN.

In carrying out this inquiry into the ancestors of the Hall of Fame Men, I made for each person a diagram like the following one given for Beecher:

C.
H. W. Beecher,
b. 1813-6-24.

- Yale. D?
  Lyman Beecher,
  b. 1775-10-12.....
  - E?
    David Beecher,
    b. .....
    - A.
      Nathaniel Beecher...C.
      b. 1706-4-7.
      Joseph, about 1658
      Sarah Sperry.
  - 3rd. wife. e.
    Esther Lyman,
    b. 1749-2-17.....
    - D.
      John Lyman.....Ebenezer, b. 1682.
      b. 1717-5-28.
      Hope Hawley.
- c.
  Roxanna Foote,
  b. 1775-9-10.....
  - Lawyer. d.
    Eli Foote,
    b. 1747-10-30.....
    - D.
      Daniel Foote.....Nathaniel, b. 1682.
      b. 1717-2-6.
      Margaret Parsons.
  - B?
    Roxanna Ward,
    b. .....
    - C?
      Gen. Andrew Ward..Col. Andrew, b. 1669.

This shows that Henry Ward Beecher was born June 24, 1813, and was the son of Lyman Beecher, who was born October 12, 1775, and was graduated at Yale College. We thus see that the father of Henry was not only given an education that developed his brain in youth, but that he was more than thirty-eight years of age when his son was born, and consequently had had a great many years in which to use his brain, and the opportunity to transmit the effects of such use, if there is such a thing as use-inheritance. The date of birth of Lyman's father David is not given, so we cannot

know accurately what birth-rank Lyman takes, but we find that David's father, Nathaniel, was born April 7, 1706. This gives a trifle over 69 years and 6 months between Lyman and his grandfather, which period may be divided so as to locate one person in class D and the other in class E. It matters little, as far as our investigation is concerned, at what point the division is made, because there is a total of nearly seventy years, less two periods of growth from infancy to maturity. If the division be made unequally, what is subtracted from one person is added to the other. In such cases as this I have made the divisions nearly equal unless there was some collateral reason for doing otherwise. In the present case we find that Lyman was the son of David's third wife, so that the probabilities are that David was comparatively old when Lyman was born, consequently I have given the higher rank to Lyman. In his autobiography, Lyman Beecher tells us that his father David, though self-taught, was one of the best educated persons in New England, consequently we have another opportunity for use-inheritance by a long period of mental activity. Pushing the inquiry further, we find that David's father, Nathaniel, was born when his father Joseph was about 46, and I also find that Joseph was born when his father Isaac was about 38. In thus running back the male line of Henry Ward Beecher's ancestors, we find five successive births from fathers, all of whom had lived considerably more than the average number of years before their sons were born. The result was Henry Ward Beecher, a man whose mental greatness was of such a calibre that he seemed to be able to meet any emergency with the easy superiority that characterizes a man who is born with a great brain in contradistinction to one who achieves greatness only by extraordinary exertions. If it be conceded that there is such a thing as use-inheritance, then this examination into the

ancestry of Henry Ward Beecher gives a plain explanation of his great mental ability, while if we deny use-inheritance, then there is no explanation and we have to simply assume that in some mysterious manner there was a series of advantageous variations. In running through the female ancestry, we find Henry's mother, Roxanna Foote, as born in class *c* from her father, who was educated as a lawyer. If we assume that Foote's wife, Roxanna Ward, was two years younger than her husband, then there would be eighty years between her and her grandfather, Colonel Andrew Ward, which we may divide by placing General Ward in class C and Roxanna in class B. Tabulating the ancestry of Beecher as far as known and estimated, and making a diagram we have that shown in Fig. 4.

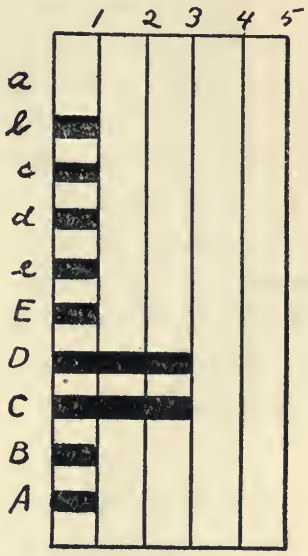


FIG. 4—ANCESTRY OF H. W. BEECHER.

Here we see that while there is a birth in each of the classes A and B, there is none in either of the corresponding classes of *a* or *b;* and in the classes *c* and *d* there is one each, while in classes C and D there are three each. On the law of probabilities these births should be distributed pretty evenly each side of the central dividing line, while as a matter of fact we have nine on the older side and three on the younger side.

OMITTED PERSONS.

It was my original intention to carry out this investigation for each person as completely as I have done for Beecher, but I soon

found this to be an impossibility with the records available. In fact, in the cases of Fulton, Clay, Cooper and Stuart I have not been able to take the first step, the dates of the births of their fathers being unknown. In the cases of Fulton* and Clay I have reasons for thinking that they rank high, but the data available are not sufficient for a fairly accurate estimate. The investigation is therefore restricted to twenty-five persons, for whom I have found a total of 137 births, or an average of five and one-half for each. A few of these births have been estimated after the manner illustrated in the case of Beecher, but I have made no estimate which was not warranted by the information at hand. The result of this is given in Table V, in which the first column gives the birth-ranks of the persons named; the next two columns those of the father and mother respectively; the next four columns those of the grandparents; and the letters beyond those of earlier generations, which are so scattered that I have simply stated them in series without designating who these persons were.

ABSENCE OF LOW BIRTH-RANK.

In reading down the first column we find a total absence of the letter *a*, while, according to the law of probabilities, there should be two or three persons in this class. On the other hand, we find five persons born in class A, three of whom come in sub-class A^2 and one in sub-class A^3. According to the probabilities of the case, there should be only one birth in the sub-classes instead of four, while the chances are even against any one being born in sub-class A^3. A diagram of these twenty-five famous men is given in Fig. 5.

*Robert Fulton was born in 1765. In the "History of the Bradlee Family," page 18, I find that Robert had a cousin, John Fulton, born in 1733. This would make Robert thirty-two years younger than his cousin, a difference that can only be explained by high birth-ranks.

SAMUEL JOHNSON [53]

MARIE ANTOINETTE [47]

If we could eliminate the five men born in class A, we would find the remainder pretty evenly distributed, though the absence of any one born to a young father would be unexplainable on the theory that the father took no part beyond transmitting what he received from his ancestors. These five men are, however, from

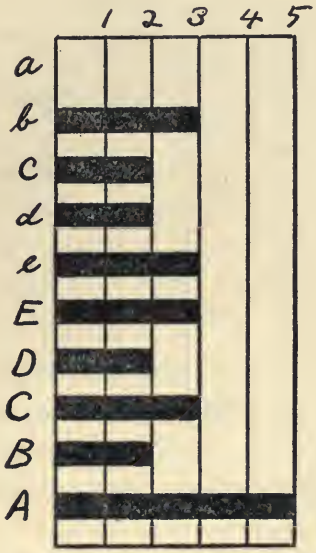


FIG. 5—DISTRIBUTION OF 25 HALL OF FAME MEN BY THEIR BIRTH-RANKS.

our standpoint of mental greatness, among the greatest in the whole list. If we arrange our list so as to rank these twenty-five men by letters, as is done in the table, we find that those in the higher rank are not only more numerous than those in the lower rank, but as a class they are mentally greater.

TABLE V.

Birth-ranks of the Hall of Fame Men and their Ancestors.

	Parents		Grandparents				
			Paternal		Maternal		Previous
	F	M	GF	GM	GF	GM	Generations
Audubon ..... A^3	A^3						
Franklin ..... A^2	A^3	A	A^3				
Irving ..... A^2	A^2						
Lee ..... A^2	c	C	C	E	C		ACCBDD
Farragut ..... A							
Adams ..... B	C	b	D	D	b	d	CE
Webster ..... B	a	e	A		e		DD
Beecher C	D	c	E	e	e	B	ACDDC
Mann C	B		E				D
Washington C	E	A^2	E		B		
Jefferson ..... D		e			C		dA
Story ..... E	b		B				c
Edwards ..... E	a	c	A	D		B	
Emerson ..... E	b	C	A	b			bA
Kent ..... E	b		B				c
Lincoln ..... e	A	B			B	D	
Longfellow ..... e	b	d	c		E		CB
Peabody ..... e	C	b	A		c	c	DcB
Hawthorne ..... d	B	b	B		A^2		AEC
Morse ..... d	C			C			d
Channing c	D	c			b	A	C
Grant c	A		d				bE
Gray ..... b	B	a^2	A		A		AA
Marshall ..... b	e	C					
Whitney ..... b	B		a^3				

If we read the lines of Table V horizontally, we find that an ancestor in class *a* occurs in the cases of only four of these famous

men, and in no case does one of them have more than a single ancestor born in class *a*. There are consequently only four class *a* births out of a total of 137, whereas, if they depended upon the law of probabilities, there should be thirteen or fourteen of them. On the other hand, seventeen of the twenty-five famous men have a class A ancestry, while in the case of seven of them there is

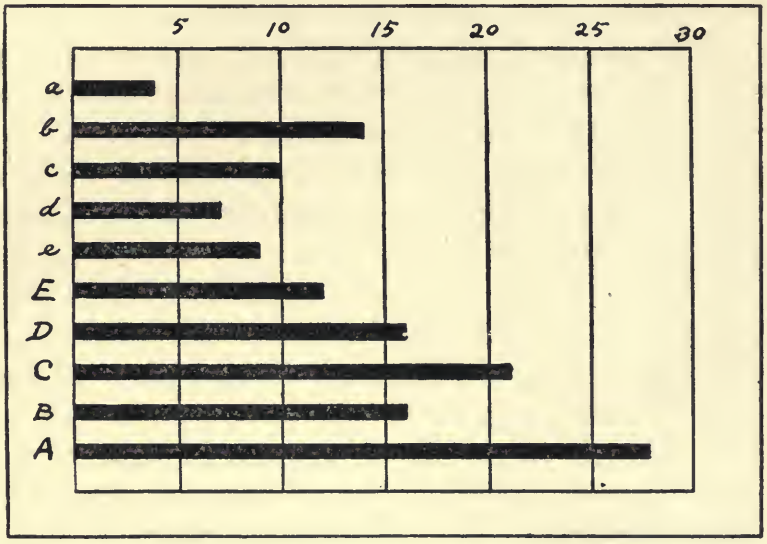


FIG. 6—DISTRIBUTION OF HALL OF FAME MEN AND THEIR ANCESTORS BY THEIR BIRTH-RANKS.

more than one class A birth. In all there are twenty-eight births in class A, or seven times as many as there are in class *a*. And further, there is only one birth each in sub-classes a^2 and a^3, while there are six in sub-class A^2 and four in sub-class A^3.

The whole series of birth-ranks given in Table V are condensed into the diagram shown in Fig. 6. This diagram shows very plainly the preponderance of births to old fathers when this group of men and their ancestors are considered together. It also shows a

fairly regular decrease from class A to class *a,* except for the peculiar prominence of class *b* and a somewhat less prominence of class *c.* At first sight this appears to be an exception to the rule that great men are the result of successive late reproductions, but a little consideration will explain the cause of it.

IRREGULARITY EXAMINED.

By tabulation of the births used to establish our standard I find that the average age of the father when the first child is born comes approximately at the dividing line between classes *a* and *b,* and that when sons alone are considered the majority of the eldest sons are born in class *b,* while lesser numbers are born in classes *a* and *c.* These fourteen persons in class *b,* therefore, are principally eldest sons, and by inspection I find that ten are sons and four are daughters. Now it happens that in New England, in the seventeenth and eighteenth centuries, the time and place of the births of all these sons except one, there was the custom, when the circumstances permitted, of selecting the eldest son for a college education. Except in comparatively rare instances, this was the only son so favored. From a limited investigation into this matter I find that eight of the sons born in class *b* had college educations. Of the other two births, one represented the age of the great-grandfather of John Adams, and the other the age of the great-great-grandfather of General Grant. I did not attempt to search into these. Of the four births in class *a,* three were sons, two of whom are known to have had college educations. Of the five sons born in class *c,* two had college educations.

IRREGULARITY EXPLAINED.

It must be conceded that a son having a college education, and thereafter devoting his energies to one of the liberal professions,

will, in middle life, be superior to a brother of his who did not have these advantages and who spent his life farming, and this will be true even though the brother were born with better natural intellectual powers. As a consequence, we frequently find our great men coming from a later son of the educated member of the family, and as a social custom made the eldest son the educated member, we see the reason for the prominence of class *b* line in Fig. 6, as compared to those of the classes *c, d* and *e*. The peculiarity of the diagram is, therefore, simply an illustration of the neglected factor of functional activity, and if there had not been a process of selecting the eldest son as the only member of the family to receive a college education, we may feel quite sure that births in classes *a, b* and *c* would have been very few, if not non-existing.

DANIEL WEBSTER.

Taking up the four individuals who have a class *a* birth in their ancestries we find that Daniel Webster was born January 18, 1782, and was the son of Ebenezer, born May 22, 1739; who was son of Ebenezer, born October 10, 1714; son of Ebenezer, born in 1667; son of Thomas, born in 1632. Thus, while the father of Daniel was born in class *a* and only lacked eighteen days of being in class *b*, the grandfather was born in class A. The father is therefore a class *a* link between births in classes A and B. The time elapsed between the births of the great-grandfather and Daniel is 114 years, which, divided into three parts, gives an average of 38 years, less a period of growth for each generation, for use. In this case, however, the use principally occurred with the great-grandfather and father, the latter of whom had a college education.

JONATHAN EDWARDS.

In the case of Jonathan Edwards we find substantially the same thing, he being born in class E, his father in class *a* and his grand-

father in class A. In this case the grandfather's wife (who was born in class D) was older than her husband, so that if the Rev. Timothy Edwards were reckoned from his mother, instead of from his father, he would be in class *b*.

ASA GRAY.

In the case of Asa Gray, the class *a* person is his mother, who was a daughter of Joseph Howard, born April 3, 1767. Thomas, the great-grandfather of Joseph, came to America in 1634. If we assume that he was only two years old when he came, then we would have three successive steps of 45 years, or three successive classes A, before the class *a* of Gray's mother. On the male side of the house we have Asa's father born in class B and his grandfather born in class A.

ELI WHITNEY.

In the case of Eli Whitney we find that it was the great-grandfather who was young when his son was born. Unfortunately I have not been able to locate a further generation, neither have I been able to obtain the records for the female branch, so that on the face of the returns Whitney ranks low.

We thus see that in no case is there a class *a* connected in succession with another class of low rank, except in the case of Asa Gray and his mother. Even in this case we have, against one person in class *a* and one in class *b*, four persons in class A and one in class B.

BENJAMIN FRANKLIN.

On the other hand, we have successive classes A in several cases, as in Audubon, Franklin, Irving and Gray. Of these Benjamin Franklin undoubtedly possessed the finest intellect ever produced on the American continent. Without the advantages of

schooling he became great as a writer, great as an editor, great as an inventor, great as a scientist, great as a diplomat, great as a statesman, and great as a councillor when the American Republic was struggling into existence. When we examine into his ancestry we find a most remarkable state of affairs. He was born January 6, 1706, and was the son of Josiah, who was born December 23, 1655. The grandfather, Thomas, was born in 1598, and, from what Franklin tells us in his autobiography, the great-grandfather must have been about seventy when Thomas was born. We thus have Josiah fifty-one when Benjamin was born, Thomas fifty-seven when Josiah was born, and the great-grandfather about seventy when Thomas was born. There are still two more steps to account for, as Franklin tells us that he "was the youngest son of the youngest son for five generations back." Franklin's mother was Abiah Folger, daughter of Peter Folger, born when her father was fifty years of age. Cotton Mather, in his *Magnalia Christi Americana,* designates Peter Folger as "a godly and learned Englishman." We have here linked together four persons born in class A and its sub-classes, A^2 and A^3. As a mere matter of probabilities, there is only one chance in 500,000 that a person could be born in as high a rank as Benjamin Franklin, and consequently only one chance in 20,000 that such a person should appear in this list of twenty-five famous men. In fact, the chances against such a thing occurring are very much greater, as my examination of the Redfield Genealogy shows that only about one class A person in twenty is born to a class A father.

JOHN JAMES AUDUBON.

John James Audubon, America's greatest naturalist, was born May 4, 1780, and was the son of John Audubon, who was born

in 1723. John the elder was the son of a poor French fisherman and was the twentieth child. We thus have Audubon and his father both in sub-class A^3. The chances are therefore 100 to one against such a person being in this list.

DAVID GLASCOE FARRAGUT.

David Glascoe Farragut, the ablest and brainiest of American naval officers, was born July 5, 1801, and was the son of George Farragut, who was born September 29, 1755, and consequently comes in class A. While I have the names of all of Farragut's grandparents, I do not have any dates for them, and unfortunately cannot carry his ancestry further.

WASHINGTON IRVING.

Washington Irving, born April 3, 1783, possessed one of those rare intellects that permitted him to reach the greatest heights of literature without apparent effort. He was the son of William Irving, a sailor, who was born in 1731. William was the son of Magnus Irving, who was born about 1675. We thus have both Irving and his father in sub-class A^2. The chances are sixteen to one against a person so born being found in this list.

ROBERT E. LEE.

Robert E. Lee is considered by many to have been a general of ability superior to Grant. However that may be, it is quite certain that outside of military life he was a great man. During later life he was the president of a college. The fact that a defeated general, and the exponent of a lost and discredited cause, should be selected as one of America's greatest men shows that intrinsically he was great indeed. He was born January 19, 1807, and was the youngest son of Col. Henry Lee, born January 29, 1756.

Unlike those we have just been considering, Lee was descended from a line of prominent ancestors.

GEORGE WASHINGTON.

George Washington was born February 22, 1732. He was the son of Augustine Washington, born in 1694; son of Laurence, born 1661; son of Colonel John, born in 1627. Washington thus comes in class C and his two immediate ancestors in class E. The mother of Washington, Mary Ball, was born in 1706, and was the daughter of Col. Joseph Ball, who was the son of Colonel William Ball. The date of Joseph Ball's birth is not given, but we find that he went to England to look after his father's estate there thirty-six years before his daughter was born, so he could not have been very young when that event transpired. It is a question how young a person would be sent across the Atlantic on such a mission in the seventeenth century, but if he were fifteen at that time, Mary would come in sub-class A^2, where she has been placed on an estimate. Neither is the birth of Colonel William Ball given, but we find that he was married in 1638, so there must have been over ninety years between his birth and the birth of his granddaughter. Joseph Ball is therefore placed in class B as an estimate. There is a record of the Balls running back eight generations which gives the dates when the different persons lived, but does not give the dates of their births. Taking the difference between the estimated date of birth of the first Ball and the date of Mary's birth, and dividing by eight, we find that the average period between births for this family is about forty years. This is an unusual length of time for a series of generations, and tested by our standard would indicate that only one person in more than 168,000 would be born that length of time

from the eighth preceding ancestor. It is probable, however, that the larger period of time was accumulated in Mary's immediately preceding ancestors. In whatever way we look at it, Mary Ball had quite a remarkable birth ancestry, and from the theory of use-inheritance should have been quite a remarkable person. That she was a remarkable person history tells us, and popular opinion credits the greatness of Washington, not to inheritance from his father, but to inheritance from his mother. It is the mother of Washington of whom we hear, not the father.

ABRAHAM LINCOLN.

The same thing is true of Lincoln. While the father, Thomas, was born in class A (estimated), he appears to have been shiftless and of not much practical use, though a man of considerable intelligence. The mother, Nancy Hanks, was the youngest of eight children, and both of her parents were the youngest of considerable families. The distance between Nancy Hanks and her grandfather places both her and her father in class B, while collateral evidence places her mother in nearly, if not quite, as high rank. We thus have three, and perhaps more, steps of high rank on the mother's side, while the high rank is known not to extend more than one step on the father's side, though the length of the next preceding step is unknown.

WILLIAM E. CHANNING.

In the biography of Channing we find the same tendency to give much credit to the mother, and when we examine the ancestry from the birth standpoint we can see a reason for it. Channing's maternal grandmother was Ann Remington, born in class A^2, and daughter of Judge Jonathan Remington, who was born in class C.

There were also on the same side of the house two Harvard graduates and a signer of the Declaration of Independence. What the record of this signer is I have been unable to determine.

FEMALE INFLUENCE.

This influence of the female side of the house for good or ill should be borne in mind, because, as we will see when we come to investigations involving only the male side, it will be the explanation of many seeming inconsistencies. Thus a man born in class A from his father, but whose mother is the product of successive classes *a*, would take lower rank, *i. e.*, be of less mental ability, according to the theory of use-inheritance, than some other man born in class B or class C, but whose mother was the product of successive classes A. The amount of mental activity also has its bearing on the matter, but as this can rarely be known we have to depend upon age, which is nothing more than time in which mental activity can be carried on. In whatever way the matter be viewed, it is quite certain that a man of forty-five has used his brain more than the same man has at twenty-five. To deny this would be to assert that he never once used it between the ages of twenty-five and forty-five. Such a thing might be true of a Rip Van Winkle, but it could hardly be true of any one else.

JOHN MARSHALL.

We see this matter of mental activity and female influence both exercised in the case of John Marshall, one of the two cases in which both the persons named and the father have their birth-ranks represented by small letters. John Marshall was born September 24, 1755, and was the son of Col. Thomas Marshall, born April 2, 1730, who was the son of Capt. John Marshall, born

about 1700. My record goes no further than this, so that I do not know what Captain Marshall's rank was. Colonel Marshall was a well-educated person, had one of the finest libraries in Virginia, and gave a great deal of his personal time and attention to the education and training of his son John. Colonel Marshall's education was self-acquired and consisted of a "good knowledge of surveying, mathematics, astronomy, history, poetry and general literature." It is very probable that his severest mental discipline and exertions were in the years immediately preceding the birth of his son John. His wife was Mary Keith, the sixth child of Rev. James Keith and Mary Isham Randolph, a descendant of William Randolph of Turkey Island. I do not have the records of Mr. Keith nor his wife, though we know that she came from a family which had previously acquired mental ability.

HENRY WADSWORTH LONGFELLOW.

H. W. Longfellow, the other person having successive small letters to characterize his ancestry, was born when his father lacked twenty-six days of being thirty-one years old. Taken as a whole, Longfellow's birth-rank is lower than that of any other person in the list, but against this we have among his ancestors no less than four graduates from Harvard College. From the theory of use-inheritance this would imply that early mental activity takes the place, in a measure, of many years of brain effort. That it does not do so completely is readily seen by comparing Longfellow with any of the men who rank high from the birth standpoint. While we may concede that Longfellow was a great poet, such a concession does not imply that he is comparable in mental endowments with a Franklin or a Webster.

HALL OF FAME MEN BY GROUPS.

Without going through each ancestry in detail, we may take them up in groups. If we add together the ages of the fathers of these twenty-five famous men and divide the sum by twenty-five, we find that the average of the ages of the fathers was thirty-six years, six months and twenty-two days, which is nearly four years above that of the whole population, and is equivalent to class D. If we add together the whole series of births and divide by their number, we find the average of 137 to be thirty-five years, six months and twenty-nine days, or nearly three years above the average for the whole country. It is only proper to say, however, that a small part of these 137 births are estimated from the best information at hand, but in making such estimates I have purposely made them as low as appeared reasonable so as to avoid the error of exaggeration. Whatever the error be, it is so small in the aggregate that it could not affect the average more than a few days or a month at most.

If we arrange the list by the average ages of all the ancestors of each man, instead of by the fame of the men, as in the first instance, or by their individual birth-ranks, as in the second instance, we have the arrangement shown in Table VI. The most notable thing in this list is the relative rise of Lincoln and Gray and the fall of Adams. Another notable feature is the uniformity of average ages of all ancestors as shown in the last column. From this column it is seen that in seventeen cases the average for all is above the average for the country, and that only eight are below the average. Furthermore, those above the dividing line of average age extend through all grades to the highest birth-rank, while those below remain close to the line of division. The range is

from 22 years above the line to only 2⅔ below. We also see that those below are, for the most part, those for whom the records are incomplete.

TABLE VI.

HALL OF FAME MEN BY AVERAGES OF KNOWN ANCESTRAL BIRTH-RANKS.

		No. of births.	Aggregate years.	Av. age at birth.
1	Franklin	4	219	54.75
2	Irving	2	108	54
3	Audubon	2	108	54
4	Farragut	1	45	45
5	Lincoln	4	157	39.25
6	Washington	5	195	39
7	Lee	10	387	38.70
8	Hawthorne	8	309	38.60
9	Mann	4	149	37.25
10	Story	1	36	36
11	Beecher	11	393	35.72
12	Webster	7	249	35.57
13	Gray	7	248	35.50
14	Emerson	7	243	34.70
15	Jefferson	3	104	34.66
16	Peabody	11	381	34.60
17	Edwards	6	207	34.50
18	Longfellow	8	262	32.50
19	Channing	7	226	32.29
20	Grant	4	130	32.25
21	Adams	8	258	32.24
22	Kent	4	128	32
23	Morse	4	127	31.75
24	Marshall	4	124	31
25	Whitney	3	90	30

COLLEGE MEN AMONG ANCESTORS.

The mid-position in this list is held by Asa Gray. Among the ancestors of the twelve persons above the center, there are known to be only seven college men, while in the ancestors of the twelve below there are known to be 23 college men, or at least men known

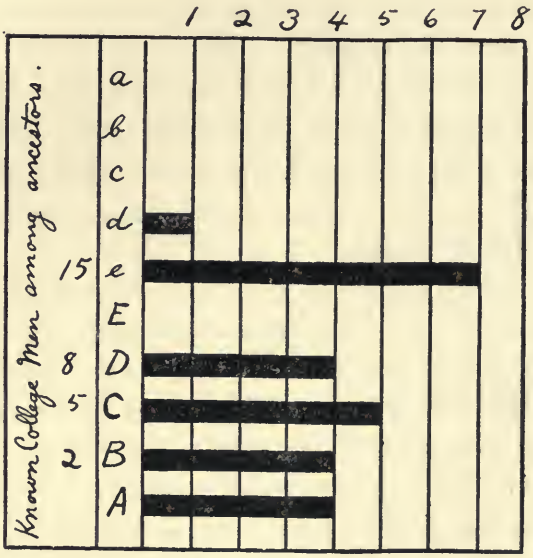


FIG. 7—AVERAGE ANCESTRY OF TWENTY-FIVE HALL OF FAME MEN.

to have had liberal educations. Making a diagram (Fig. 7) for table VI, we see that the number of college men among the ancestors is in inverse proportion to the ages of the ancestors at the birth of their offspring. The natural inference is that the mental activity arising from a college education given to an ancestor is a substitute in inheritance for age and experience. That it is not a full

substitute is seen from the fact that the greatest brains of all are not descended from college graduates but from ancestors who lived a great many years before their sons were born. Of about 150 known male ancestors of these 25 famous men, about one in five received a liberal education qualifying him to practice medicine, law or divinity. At the time these men lived not more than one in a hundred had such an education, hence it is apparent that a man's chances of becoming famous are increased twenty to one by having an educated ancestor.

No matter how much we analyze the relationship of these men to their ancestors, each point of view presents a situation that accords perfectly with the theory of use-inheritance, while many of them are inconsistent with, and unexplainable by, any theory that denies use-inheritance.

It would be an impossible task to arrange these twenty-five men in the order of their mental greatness, because no man is competent to properly estimate them. They have originally been arranged by ballot according to fame, and we have arranged them first by their own birth letters, and second by their combined ancestry. That the original arrangement is not satisfactory is apparent from the fact that fame is not necessarily commensurate with mental endowments, though there is certainly an approximation between the two. That neither of the other arrangements is satisfactory will be evident from the fact that a man's greatness depends,

First, upon his own mental activity, because no amount of hereditary endowment can make a man great if he does not exert himself, and

Second, upon the four factors arising out of the mental activity and age of each of the two parents, the eight factors similarly aris-

ing from his four grandparents, and the correspondingly more numerous factors arising from his more remote ancestors.

RELATIVE IMPORTANCE OF FATHER AND MOTHER.

Partly because the father is usually older than the mother, partly because he is usually the more mentally active of the two, and partly because characters acquired by one sex are usually transmitted more fully to the same sex than to the other sex, the father is more important in the mental heredity of a man than is the mother. On the other hand, the law by which characters are often transmitted in a dormant condition from a maternal grandfather to a grandson may make the mother an important factor, provided that her father was such.

To get a somewhat better view of these twenty-five men they have been grouped in table VII by a combination between their ranks from their own letters and their birth-ranks from all ancestors, and also by a combination embracing these two factors and the third factor of fame. The first of these groupings improves the "letter" grouping by bringing in the effect of more remote ancestors, and improves the "all ancestors" grouping by giving more importance to the immediate ancestors. The grouping by three elements improves the other combination by bringing fame to rectify, in a measure, the more or less fragmentary character of the "all ancestors" element. Fame also recognizes the mental activity of the individual, an element that is entirely absent from our ancestral investigations. On the other hand Fame brings in the error of recognizing what is spectacular in contradistinction to what is purely mental greatness. It is also somewhat influenced by prejudice, and by a lack of appreciation of the kind of work with which those who determine fame are not familiar.

TABLE VII.

By age and letters.		By age, letters and fame.	
1	Franklin.	1	Franklin.
2	Audubon.	2	Washington.
3	Irving.	3	Irving.
4	Farragut.	4	Webster.
5	Lee.	5	Farragut.
6	Washington.	6	Audubon.
7	Webster.	7	Lincoln.
8	Mann.	8	Lee.
9	Lincoln.	9	Jefferson.
10	Beecher.	10	Emerson.
11	Story.	11	Mann.
12	Jefferson.	12	Beecher.
13	Emerson.	13	Edwards.
14	Adams.	14	Hawthorne.
15	Hawthorne.	15	Story.
16	Edwards.	16	Longfellow.
17	Peabody.	17	Grant.
18	Gray.	18	Peabody.
19	Longfellow.	19	Adams.
20	Kent.	20	Marshall.
21	Channing.	21	Morse.
22	Grant.	22	Kent.
23	Morse.	23	Gray.
24	Marshall.	24	Channing.
25	Whitney.	25	Whitney.

EXTREMES OF GROUPS.

There is not much difference between these two groupings, and it would probably be difficult to say which was the better when considered from our standpoint. On the whole it may be taken

for granted that the grouping which contains the greatest number of elements is as nearly accurate as it is possible to make it. In the grouping by combined "letters" and "all ancestors" we find Emerson occupying the mid-position. If we compare those above Emerson, as a group, with those below, as another group, we cannot help being struck by the fact that those above are, as a class, mentally greater than those below. If we compare all five groupings with each other we find five men who never fall below the center position and four who never rise above the center. If we compare these two minor groups with each other, there will not be the least hesitancy in determining which group is made up of men of the greater native mental endowments.

High in five groups.	Low in five groups.
Franklin.	Peabody.
Washington.	Kent.
Irving.	Channing.
Webster.	Whitney.
Farragut.	

CHAPTER VII.

GREAT MEN OF ANCIENT TIMES.

Before we proceed to investigate the ancestry of great men of all ages from all countries, it is proper that an explanation be given of the method by which results are arrived at. In some cases the date of the birth of the great man is given and that of his father is also given, in which event we have all the data necessary to locate exactly the great man's birth-rank. In a great many cases, however, the father's birth is not given, but there is such collateral evidence that will enable us to locate it pretty accurately and thus arrive at results that are without sensible error. The manner in which these estimates are made may be best illustrated by an example.

METHOD OF ESTIMATING.

In the Cyclopedia I find that de Jussieu is the name of a French family of natural philosophers, who have been styled the "botanical dynasty" of France. The founder of the family, whose birth is not recorded, had a son Antoine, born in 1686, a son Bernard, born in 1699, and a third son whose name and birth are not given. This unrecorded brother had a son Antoine Laurent, born in 1748, and another but unrecorded son. This last unrecorded person had a son, Laurent Pierre, born in 1792. The problem is to construct an ancestry for Laurent Pierre de Jussieu, the date of the birth of not a single ancestor of whom is given. To do this a diagram is constructed as follows:

de Jussieu,
born between 1639 and 1666—say 1663.

Antoine, b. 1686. | X-(1706?) | Bernard, b. 1699.

Antoine Laurent, b. 1748. | X-(1749?)

Adrian, b. 1797. [49] | Laurent Pierre, b. 1792.

As the original de Jussieu was probably not less than 20 when his son Antoine was born, and probably not more than 60 when Bernard was born, we have his birth located somewhere in the 27 years between 1639 and 1666. If the unrecorded son were born before 1686 or after 1699, then the birth of the original de Jussieu would be restricted within narrower limits. But as this would require an unnecessary assumption we can, for the present, presume that he was an intermediate son. Having determined that the original de Jussieu was born between 1639 and 1666, he can, with perfect fairness, be assumed to have been born midway between these extremes, or, in 1652-3, and we may figure from this date to the birth of Laurent Pierre in 1792. To avoid an error, however, that might lead to exaggeration, I assume that he was as young as reasonable, say between 22 and 25, when Antoine was born. If we assume that he was not older than 23 when his son Antoine was born, then we have his birth located in 1663, a date as unfavorable to the theory of great age as is reasonable for us to assume. Then taking the difference between 1792 and 1663

we have 129 years as the least reasonable length of time elapsing between the birth of the founder of the family and that of Laurent Pierre. Dividing this by three we get an average of 43 years, which would give us three successive generations born in our class B. Applying these figures we find that the first unrecorded person was probably born about 1706, or later than Bernard, and the second unrecorded person probably about 1749. Inserting these dates in the diagram we find that they accord well with the known date of birth of Antoine Laurent. We know that Adrian, the son of Antoine Laurent, is in class A, because his father was 49 when he was born. We thus have in the de Jussieu family four births in class B and one in class A. Under such circumstances I have not hesitated to rank these persons in this way because I know that they cannot rank lower, while there is a possibility and even a probability that some of them rank higher. To bring these persons as low as class C would be to make Antoine born when the founder of the family was 13 years old or less, an assumption that is not only unreasonable but absurd.

RELATIVE BIRTH-RANKS IN LARGE FAMILIES.

In looking through biographical sketches, when no definite dates are given, we have to seize on such expressions as "eldest son," "youngest son," "third child," etc. Unaccompanied by information as to the size of the family, such expressions tell us very little, but when they are accompanied by the statement that the family consisted of 10, 12 or 15 persons, then they are very persuasive. To determine just what such expressions mean I had recourse again to the Redfield Genealogy. By tabulating a large number of families I found that in families of five, fifty per cent of the youngest children were equally divided between classes A and B; in families

of seven, seventy-five per cent of the youngest were in classes A and B; in families of nine there were no youngest born lower than class B; and in families of eleven or more there were no youngest born in anything but class A. In families of larger sizes, up to eighteen, I found substantially the same thing, *i. e.*, that seventy-five per cent of the seventh children, whether the youngest or an intermediate, were born in classes A and B, and in no case was an eleventh child born as low as class B. Consequently when I find that Loyola was the youngest of eleven children I do not hesitate to mark him as having been born in class A, while as a matter of fact he may belong in sub-class A^2 or sub-class A^3.

These illustrations will give an idea of how estimates have sometimes been made when actual facts are not known. I have, however, been careful not to make estimates except where the facts warranted them, and when estimates have been made I have endeavored to err on the side of reducing the age of the father rather than increasing it. In certain special cases I have used special modes of estimating. In a number of such cases I will call attention to the fact of the estimate and explain how the result is reached.

GREATEST MEN IN BIBLE HISTORY.

Turning first to Biblical history, we find four men standing out more prominently for wisdom and intelligence than any others. These are Joseph, Moses, David and Solomon. Joseph was the eleventh son (not child) of Jacob, who was the son of Isaac when he was advanced in years, and Isaac was born so late in the life of his parents that his mother, Sarai, laughed to scorn the idea that she was still young enough to have a child. According to the Bible chronology, Abraham was 99 when Isaac was born; Isaac was 59 when Jacob was born; and Jacob was 92 when Joseph was

born. Whatever may be thought of the accuracy of these figures, there can be no doubt whatever that these generations were slowly moving ones. When we look further back than Abraham we find six or eight rapidly moving generations of nobodies. In other words, we find that the Biblical record of ages corresponds exactly with the Biblical estimate of greatness. As there does not appear to be anything in the history itself requiring that this should be so, we may conclude that it is an accurate, or at least a relatively accurate, statement of facts as they existed. As it corresponds exactly with the theory of use-inheritance as here explained, I certainly have no reason to question its accuracy.

REMARKABLE ANCESTRY OF MOSES.

Moses was the son of Amram, who was the son of Kohath, who was the son of Levi. From the birth of Levi to the birth of Moses was 185 years, which divided by three gives 61⅔ years for each generation. Amram married his aunt, consequently the mother of Moses must have been the daughter of a very old man. Moses was three years younger than Aaron, and his sister, at the time of his birth, was old enough to be trusted with the very delicate diplomatic mission of interviewing the daughter of Pharaoh. Whatever may be the actual figures for the ancestry of Moses there can be no doubt but he takes a high birth-rank.

Levi was the brother of Joseph and takes the birth-rank of [81] from his father Jacob. The previous ancestry we have already traced back in the case of Joseph, so that we have for Moses six generations in which not a single one has a birth-rank less than [59]. This is a most extraordinary ancestry and is not paralleled by any other known record. While these figures are extraordinary they are not actually past belief. The elder Cato had a son when

he was eighty, as was the case of Leslie, the British theological author, and "Old Parr" is said to have had two children after he had passed eighty years of age. The father of Fox, the statesman, had a birth-rank of [78], and Amelie Rives, the authoress, had a birth-rank of [71]. Nor is there any reason for doubting the substantial accuracy of these ages. Moses was a finely educated man who lived in an age and a country in which there was an educated class, and if he wrote the records so as to deceive posterity he did something which is at variance with every other act of his life. Nor is there any conceivable reason why he should do such a thing. It is not at all necessary to assume that the records of the immediate ancestors of Moses are at all parallel to the Mosaic records of the misty past as given in the Book of Genesis. In the absence of detailed information we might correspondingly write English history as follows: Plantagenets lived an hundred and thirty and one years and begat Tudors; and Tudors lived an hundred and eighteen years and begat Stuarts, etc. In addition to this remarkable ancestry on the paternal side of Moses, we have a case of in-breeding through the marriage of Amram to his aunt, and the consequent bringing of this remarkable ancestry into the maternal side.

ESTIMATE OF MOSES.

Accompanying this unparalleled ancestry we have in Moses an intellect surpassing anything that the world has ever seen. We talk glibly of the impossibility of organizing the colored men and transporting them to Africa, but if such a thing is impossible now, how much more impossible would such a plan have appeared if proposed before 1860? And yet freeing the Israelites from Egyptian bondage and removing them to beyond the Red Sea was

not one whit less difficult than would have been the same operation applied to the American negro before the Rebellion. But given the Hebrews liberated, what other character in all history could unaided guide and control a mob of a million and a half of liberated slaves? But apart from these achievements, the Mosaic laws are the finest adaptation of morality to existing circumstances ever known, and the decalogue is unequalled by anything ever written by the hand of man.

SOLOMON.

Solomon was born when his father David was 53 years old, and David was the youngest of eleven sons of Jesse. If Jesse had any daughters at all, David must have come in the sub-class A^3. According to the generally accepted theories of heredity the great wisdom of Solomon was largely inherited from his father David, and was increased in the son by a mysterious sort of "advantageous variation." By an equally mysterious sort of disadvantageous variation the greatness of Solomon was not perpetuated in his son Rehoboam. According to the theory here advocated, the wisdom of Solomon was due partly to the fact that David was born with a well-organized brain, and partly to the fact that he lived many years and acquired much wisdom before Solomon was conceived. Going back another step, the theory explains David's inherited brain as due to the fact that Jesse lived long and developed his brain before David was conceived. In other words, the theory furnishes a plain, reasonable, and easily understood explanation for what has been considered mysterious and wholly inexplicable. If asked why Solomon's wisdom was not passed along to the next generation, it is only necessary to point to the fact that Rehoboam, the son and heir of Solomon, was conceived when Solomon was

only 16 years old, and consequently inherited only the immature development of his father. Consider Solomon as wise as we may, we cannot conceive him as being very wise at the age of 16. There is nothing mysterious about this, no "advantageous" or "disadvantageous" variation, but a plain result arising from a very plain cause.

CONFUCIUS.

Nearly 2,500 years ago there lived in China a man by the name of Shoo-leang-heih, who was noted for his strength and courage, who had served with distinction as a soldier and who had been appointed chief magistrate of the province of Tseaou-y. When advanced in years he found himself a widower with nine children, all girls—his only son having died in infancy. Although already an old man he decided upon marrying again in the hope of having a son to continue the family in the male line. Acting on this impulse, he addressed himself to the head of the house of Yen, requesting one of his daughters in marriage. Yen was loath to give one of his daughters in marriage to so old a man, but, as Shoo-leang-heih was too great and powerful a person to be ignored, he called his three daughters before him and stated the case. Finding that the two elder daughters maintained silence to even the proposition of marrying a chief magistrate, the youngest daughter spoke up and said that she would do her father's bidding. From this very old man, Shoo-leang-heih, and the youngest daughter of another old man, sprang Confucius, the greatest man in Chinese history and one of the greatest men who ever lived. This does not tell us how old Shoo-leang-heih was at the time of his son's birth, but the probabilities are that he was considerable over sixty and perhaps over seventy years of age. Time has to be provided for him to acquire distinction as a soldier, to be appointed

chief magistrate, to marry, to have ten children, to become a widower and to marry again. In a country where people move as deliberately as they do in China this must have required a good many years.

LAO-TSE.

Contemporary with Confucius was Lao-tse, a Chinaman in some respects greater even than Confucius. There is in Chinese literature an account of an interview between these two great philosophers in which Confucius appears at a disadvantage. The teachings of Lao-tse were purely moral and they more nearly resembled those of Jesus than did those of any other man. Lao-tse's father was not married until seventy years of age, and the accounts state that his mother was a very old woman.

BUDDHA.

At a date not far from when Confucius was born, there was born in India the greatest man India ever produced. "The facts of Buddha's mortal life may be briefly told. His father had married sisters, Mahámáya and Maháprajápati. Mahámáya, having come to her forty-fifth year, was about to be delivered of her first child, and, in accordance with the Hindu custom, had started for her father's home. On the way she rested under a satin tree, and there gave birth to her boy. Here legend steps in with marvels." *

This places Buddha in sub-class A^3 from his mother. I do not have the age of his father, but the probabilities are that he was advanced in years, otherwise he would have been apt to neglect a 44-year old wife for the charms of some younger female.

* Sir Edwin Arnold.

We have confirmation of this in Arnold's *Light of Asia,* in which the father is spoken of as being an old man.

MOHAMMED.

Mohammed, born in 570, was the son of Abdallah, born in 545, consequently Mohammed comes in class *b* and, with the exception of Napoleon, is the only really great man born so low in the scale. When we look further into his ancestry we find that Abdallah was the tenth son of Abd al Muttalib, born before 499, son of Hashim, who was the youngest son of Abd Menaf, who was the youngest son of Cossai. We also find that Hashim was advanced in years when he married Salma, who was a woman of much character and of mature years, who had been previously married and who had two sons. Although Mohammed was born in class *b,* his father comes in class A, and perhaps is one of the sub-classes, and all of the other known births are also of high rank. We have only to assume that his mother was also well born to have all the elements necessary to account for his greatness in spite of the comparative youth of his father. That Abdallah was more than ordinarily developed for his years we learn from the statement that he was a merchant on his own responsibility, and that he died two months after the birth of Mohammed.

GREECE AND ROME IN ANCIENT AND MODERN TIMES.

In Southern Europe, at the present day, men and women mature early, marry early, have children in early life, and are worn out at an age when they should be in robust health. While this is what happens now, such was not the case when Greece and Rome produced the men who have been the wonders of the world during the past 2,000 years. The difference between the mental ability of the modern Greek and Italian, and that of those who flourished

in the days of Pericles and Cæsar, is not more sharply marked than is the difference between the ages of reproduction now and then.

For several hundred years Sparta was governed by the laws of Lycurgus. These laws took children from their parents and reared them in a gymnasium. At the age of thirty the men were permitted to marry. The Spartan training related only to the physical, and as a consequence they developed the physique. The mental development being neglected, the only great men produced under the Lycurgan system were great generals.

History tells us that in Athens the men usually married at the age of thirty-five. In contradistinction to the practice in Sparta, the Athenian youths were educated for generations, and the result was that during the latter part of several hundred years of such education we find the majority of the men who made Greece famous.

In examining the ancestry of famous Greeks I have been much hampered by the lack of data. For Socrates I can find only that he was the son of an artist and a mid-wife. In many other cases I have the names of a long line of ancestors, but no dates that will give the information I seek. I have, however, been able to find enough to give a pretty clear idea of what occurred.

ALEXANDER THE GREAT.

Alexander the Great is perhaps the most famous of Grecians, but that is quite a different thing from being the man of greatest mental ability. That in some respects he was mentally great there can be no doubt, but the history of his excesses, his vanity, and the circumstances under which his life ended show that he lacked that stability which characterizes true mental greatness. He was

born in 356 B. C., and was the son of Philip II of Macedon, who was born 382 B. C. He therefore comes in class *b*. When contrasted with his father there can be no doubt but that Philip was the greater man mentally. It was Philip who taught Alexander the art of war, who invented the celebrated Macedonian phalanx, who by skill, ability and diplomacy raised Macedonia to supremacy in Grecian affairs, and who furnished all of the material which Alexander afterwards used in his conquests. Philip had already planned, and partly organized, the Persian invasion that his son subsequently carried out, and if he had not been assassinated at his daughter's wedding it might have been Philip the Great instead of Alexander the Great.

PHILIP OF MACEDON.

Philip was the son of Amyntas II, who was the son of Alexander I, son of Amyntas I. We are not informed when Amyntas II was born, but we learn that he contested the right to the throne forty-seven years before his son was born. Whether Philip be placed in class A or one of the sub-classes A^2 or A^3 will depend upon how young Amyntas II was when he made this contest. It will not do to make him very young, as that would remove him an unreasonable distance from his grandfather, because, when he did subsequently become king, it was 106 years after his grandfather had ascended the throne. If Amyntas II was ten years old at the time of this contest, Philip would be in sub-class A^3, and he is placed there as a reasonable estimate.

ARISTOTLE.

Aristotle was born 384 B. C., and was the son of Nichomachus, friend and physician in ordinary to King Amyntas II. The "physician in ordinary" to a king is not likely to be a young man,

especially in a country in which there were many wise old men, and when the king is an old man it is practically certain that his physician was not a young man. When we learn that this physician was also the personal friend of the king, it is reasonable to assume that they were about the same age. As Amyntas II was in the neighborhood of sixty when Aristotle was born, the most reasonable place to locate Aristotle is in sub-class A^3. Any other assumption would do violence to known facts. For an estimate of the greatness of Aristotle I cannot do better than to quote from Myers' Ancient History. "As Socrates was surpassed by his pupil Plato, so in turn was Plato excelled by his disciple Aristotle, 'the master of those who know.' In him the philosophical genius of the Hellenic intellect reached its culmination. It may be doubted whether all the ages since his time has produced so profound an intellect as his." Plato called him the "Mind of the school," and when he was absent would say, "Intellect is not here to-day."

ALCIBIADES.

Alcibiades, the great Athenian general, was born about 450 B. C. He was son of Cleinias, who greatly distinguished himself in the naval battle at Artemisium in 480 B. C. We do not have the date of Cleinias' birth, but as the battle of Artemisium was fought thirty years before the birth of Alcibiades, and as young Athenians were never sent on foreign military service before twenty years of age, he could not have been less than fifty at the time of his son's birth. As the probabilities that a man will "be greatly distinguished" before he is twenty-five are rather remote, we can safely assume that Alcibiades belongs in sub-class A^2.

PERICLES.

Pericles, the greatest Athenian statesman, was born 495 B. C., and was the son of Xantippus and Agarista. I have spent much

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time trying to obtain the birth-rank of Pericles, but with only partial results. I have the names of ten of his ancestors and some dates connected with their lives, but nothing that will give a near approximation to dates of births. I find, however, that six generations averaged between thirty-six and forty years. I also find that Agarista's aunt, Coesyra, was married in 554 B. C. If we assume that she was twenty-one at that time, and give the date thus obtained as a probable date for the birth of her brother Hippocrates (the father of Agarista), then we have eighty years to divide between a father and a mother in the ancestry of Pericles. If this division be made to correspond to the Athenian marriages of which I have obtained records, then we would have about thirty for his mother, and fifty for his father and maternal grandfather. This would place Pericles in class A or sub-class A^2, but there is so much hypothesis about this that it is possible that he was born in class B or even class C. I have, therefore, not ranked him in the lists I have given, and only explain the case to show the difficulties in obtaining accurate information, and to show that he takes some rank much above the average.

Archidamus II became king of Sparta in 469 B. C. Archidamus V became king in 240 B. C. Between these two there are six generations and 229 years, which gives an average of thirty-eight years for each step, or more than five years above the average in the United States 150 years ago.

PTOLEMY PHILADELPHUS.

Ptolemy II, surnamed Philadelphus, was the greatest of the Ptolemys. He was born in 309 B. C., and was son of Ptolemy I, who was born in 367 B. C. He therefore comes in sub-class A^3. Being of Greek descent, he is naturally included at this point.

In all I have looked for the ancestry of more than a hundred of the great men of Greece, but those given are the only ones about whom I have been able to obtain any definite information. There is an exception to this in that I have found the rank of a number of persons who exist in history only because they were sons of great men. In every such case I have found that they were born during the earlier years of their father's lives. As they are all nobodies, it is not necessary to give a list of them. They are mentioned here because their existence gives negative evidence in support of the theory of use-inheritance.

Although the list of Greeks here given is short, enough has been given to show that the age of reproduction 2,200 to 2,500 years ago was very different from what it is today, and from this showing we have an explanation of the marvelous Greek intelligence.

AUGUSTUS.

Augustus Cæsar, the first Emperor of Rome, was born in 63 B. C., and was undoubtedly the greatest man, from the mental standpoint, ever produced in the Roman world. Merivale says: "The establishment of the Roman empire was, after all, the greatest political work that any human being ever wrought. The achievements of Alexander, of Cæsar, of Charlemagne, of Napoleon, are not to be compared with it for a moment." Octavius, surnamed Augustus because of his intellect, a name hitherto sacred to the gods, found a republic crumbling to fragments and left it an empire, the greatest and most powerful of ancient history. He accomplished with peace and apparent ease that which Julius Cæsar dared not approach, and for which he was assassinated on simple suspicion. The tact, skill, diplomacy and mental ability that could accomplish this are not to be lightly considered.

I do not have the date of birth of any of the ancestors of Augustus, but I find that his great-grandfather was present at the battle of Cannæ, 216 B. C., and was one of the few who escaped alive, If this ancestor were eighteen at that time, then his birth would be located in 234 B. C., and we have $(234-63)\div3=57$ years each for three generations to Augustus. The great-grandfather could hardly be younger than eighteen, and very likely he was older, in which case the steps from father to son would average more than fifty-seven years each. To contemplate such a distance I will ask the reader how many cases he knows of a son being born to a father fifty-seven years old, and if he ever heard of such a thing happening twice in succession, to say nothing of three times.

OTHER FAMOUS ROMANS.

Julius Cæsar was born 100 B. C. Of his ancestors I have nothing, but I find that his son Cæsarion was born when Cæsar was fifty-three years old, which simply illustrates the fact that the Romans reproduced late in life.

Scipio Africanus Major was born 243 B. C. I do not have the birth of any of his ancestors, but going back to his great-grandfather I find that the distance between the times when the father, the grandfather and the great-grandfather became consuls averages forty years.

Sulla was dictator in 81 B. C. His grandfather was prætor 105 years previous, which would make the average distance between generations fifty-two or fifty-three, assuming that the ages at which they held office were the same. They might differ widely, yet Sulla would rank high in our scale.

One Cato was consul, 195 B. C. Three generations later another Cato was prætor, in 54 B. C., making an average of forty-seven

years between generations. One Cato had a son after he was eighty years of age.

Pliny the elder was born in A. D. 23, and Pliny the younger (son of the elder's sister) was born thirty-nine years later. If the sister was younger than her brother she would rank high from her father; if she was older, then Pliny the younger would rank very high from his mother. I may remark here that I have observed that Greek and Roman men were often ten, twenty and even thirty years older than their wives.

The Grecchi were not the least famous of the old Romans. Sempronius Grecchus had one son born when he was forty-six and another of greater ability when he was fifty-five.

Marcellus Claudius was the name of the most illustrious plebeian family of the Claudia Gens. For seven generations the time between generations averaged slightly over forty years, or more than seven years greater than our standard average.

Seneca was born a few years before the Christian era and committed suicide A. D. 65 at the order of Nero, who feared him. "A few years" probably means less than ten. If it means more, then Nero must have ordered a very old man to commit suicide. The father of Seneca was born 61 B. C., and consequently Seneca must come in sub-class A^2 or sub-class A^3.

More illustrations might be given, but these are sufficient to show what it was that produced the great men of Rome, and it is only necessary to consider the marriage customs of the present day to see why Rome does not produce them now.

CHAPTER VIII.

GREAT MEN OF MODERN HISTORY.

In treating of the great men born since the beginning of the Christian era I shall take up in detail those who, for some special reason, require special mention. The others will be given in tables with their birth-ranks stated. In doing this there is no pretense that all of the great men who deserve mention are included. In fact, such an effort would be futile, because of the impossibility of drawing any hard and fast line to determine who should be included and who should not. As a consequence I have probably overlooked a good many men who are greater than some of those I have included in the lists. I have purposely omitted a good many hereditary monarchs who have become famous in the world's history, because it is difficult to know how much of their greatness was due to the circumstances of their reigns, to contemporary statesmen, and to the generals who fought their battles. For the same reason I have discriminated against the herditary nobility, because position, wealth, and family influence often enable men to achieve a fame to which they would be utterly unable to aspire if it were not for these advantages. As a consequence there are omitted from class A and B a number of kings and noblemen who might be included in them. Their inclusion would prove nothing, because there is another possible explanation of their greatness. I have made an exception, however, in the cases of some men who, like Alfred the Great and Peter the Great, were so pre-eminent that it is plainly evident that their greatness is independent of their positions.

ALFRED THE GREAT.

Alfred the Great was undoubtedly the greatest and wisest of English rulers. He was born in 849, and was the son of Ethelwulf, who was probably born before 800. Ethelwulf was a studious man and would probably have entered holy orders if he had not been an only son, to prevent which action he was made King of Kent in 828. We read that "Ethelwulf the old king died in 858." If "the old king" means a man of sixty or more, then Alfred takes rank in sub-class A^2.

LORD BACON.

Sir Francis Bacon, born 1561, is usually credited with having the greatest intellect of any man born in the British Isles. He was the youngest son of Sir Nicholas Bacon, who was born in 1509, and who was consequently over fifty-two years of age when his son was born. Bacon's mother was thirty-three when he was born, and she is said to have been the best and most profoundly educated woman in all England. Bacon, therefore, inherited the effect of many years of brain use by his father, and the effect of extraordinary brain activity by his mother.

SHAKESPEARE.

William Shakespeare, born 1564, is naturally associated with Bacon because of the efforts made to show that Bacon was the real author of what are known as Shakespeare's plays. Unfortunately I am not able to obtain much accurate information about Shakespeare's ancestors, because if I could it would throw much light on the Bacon-Shakespeare controversy. He was the son of John, who was the younger son of Richard. John left home in 1551, so that he could not have been less than thirty-four or

thirty-five when the poet was born. The last known of him was in 1601, so that there is a possible age-range from thirty-five to forty-five. The grandfather, Richard, died about four years before Shakespeare was born, and, as the family is known to have been a long-lived one, we can assume two steps of about forty years each in Shakespeare's immediate male ancestry. That the grandfather was probably pretty old may be inferred from the fact that his will was dated seventeen or eighteen years before his death. Shakespeare's mother was Mary Arden, the eighth and youngest child of Robert Arden, who was of a younger branch of the Arden family. From my age table I find that seven-elevenths of eighth children are born in class A, the other four-elevenths being divided between classes B and C. The chances are, therefore, nearly two to one that Shakespeare's mother was born in class A. We also find that Robert Arden was mentioned in an indenture in 1501. If he were fifteen at the time (a probable age) we would have seventy-eight years between the birth of Robert Arden and that of William Shakespeare. Dividing this so as to place Mary Arden in class A, we would have thirty-three years for the mother and forty-five years for the maternal grandfather. I also find that husbands average three or four years older than their wives, which would make Shakespeare's father about thirty-six or thirty-seven in 1564. This corresponds well with the previous estimate that he could not very well have been less than thirty-four or thirty-five. The result of this is that Shakespeare was probably born in class C or D, the father in class A or B, and the mother in class A. If this estimate be reasonably accurate, we have all of the elements to account for Shakespeare being a great man, provided his parents were mentally active. The meagre accounts that we have of John indicate that he was a man having

his own ideas on subjects, and was not averse to coming into conflict with the town authorities when it suited his business interests to do so. As to the mental ability of Mary Arden, we have some information in the fact that, though the youngest of the family, she was, in 1556, made the executor of her father's will. After eight years more in which to exercise and use this mental ability she became the mother of William Shakespeare.

THE HERSCHELS.

The Herschels, astronomers, though famous, were persons whose mental ability was greater than their fame. Sir John Herschel, born in 1792, was son of Sir William, who was born in 1738, who was son of Isaac, born 1707, youngest son of Abraham, son of Hans, who quitted Moravia early in the seventeenth century on religious grounds. Caroline Herschel, born 1750, was sister of Sir William. If Hans "quitted Moravia early in the seventeenth century" on his own responsibility, he must have been born more than a hundred years before his grandson Isaac. That he was alive at all early in the seventeenth century would make the father and grandfather of Sir William take high rank, though Sir William himself ranks only in class *e*. Sir John ranks in subclass A^2, as his father was fifty-four when he was born, and Caroline ranks in class B, as her father was forty-three when she was born.

THE DARWINS.

In looking for the ancestry of Charles Darwin, born 1809, I found that he was the son of a physician and a grandson of Dr. Erasmus Darwin. After seeing the same statement in three or four different places, I became curious to know who this physician was. I then found that he was Robert Waring Darwin, born in

1766, and that Dr. Erasmus was the fourth son of Robert, who was the second son of William, who was the eldest son of William, Sr., born in 1620. This gives 111 years between Erasmus and the first William, which, divided by three, gives an average of thirty-seven years in the ancestry of Dr. Erasmus. But eldest, second and fourth sons are not born from the same age of parents. Having recourse to my tables and dividing this 111 years propor-

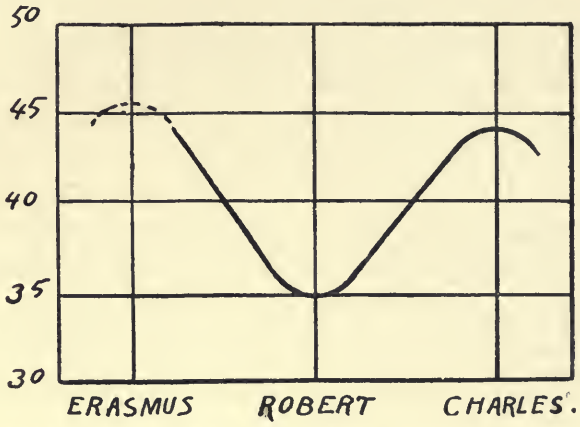


FIG. 8—DIAGRAM OF THE DARWINS, SHOWING BIRTH-RANKS FOR THREE GENERATIONS.

tionally, I found the probable periods to be thirty-one, thirty-five and forty-five years respectively. This would place Erasmus Darwin in class A, and may be considered a fairly accurate estimate. Robert Waring being forty-three, places Charles Darwin in class B; Erasmus being thirty-five, places Robert in class D; and we have just estimated Erasmus in class A. Taking these ages and drawing a diagram (Fig. 8) for them, we have a curve that represents the birth-ranks for three generations. If we should draw a curve representing the mental greatness of these three men, it would be practically the same line. The only fault to be

found with it is that Charles ranks lower than Erasmus, while he should rank higher, if anything. But in here comes another element which has so far been ignored. The wife of Robert and mother of Charles was Susannah Wedgwood, daughter of Josiah Wedgwood, of pottery fame, who was born in 1730 and who was the thirteenth child and youngest son of Thomas, born in 1687. The maternal grandfather of Charles thus comes in class B, while the seventy-nine years from 1730 to 1809 also places Susannah in high rank. We thus have in Charles Darwin a very unusual accumulation of years on the maternal side of the house that does not, and naturally cannot, appear in the diagram.

JOHN HUNTER.

John Hunter, born 1728, was England's greatest surgeon and physiologist, and an author of note. He was the youngest of ten children and was born when his father was 65 years old, so that it is quite evident that old men may have prominent sons, and that there is plenty of opportunity for many of those who read these pages.

WILLIAM PITT.

William Pitt, the younger, was born in 1759, and was the son of an almost equally famous William Pitt, born in 1708. The elder Pitt was son of Robert, who was son of Thomas, who was a youngest son. The mother of the elder Pitt was a youngest daughter.

OLIVER CROMWELL.

Oliver Cromwell, born in 1599, was the fifth child of Robert, who was the youngest son of Sir Henry. The mother of Cromwell was descended from the youngest son of Alexander, lord steward of Scotland. Charles I, whom Cromwell displaced, was

also descended from Alexander, but Cromwell was three generations nearer Alexander than was Charles I. Three generations in a total of eight, from Charles I back to Alexander, makes a very great difference in the length of time elapsing from one birth to the next. Galton in his *Hereditary Genius,* speaking of the descendants of Oliver Cromwell, remarks that the Cromwell blood seemed to have been less potent than was to have been expected. Cromwell had two sons, one born when he was twenty-seven and the other when he was twenty-eight. It requires a very good quality of mother to keep up great mental ability in sons born to such a young father.

CUVIER.

The greatest French scientist was Cuvier, who was born in 1769. Not only was he the greatest Frenchman from the mental standpoint, but he had the standard heavy-weight brain of the world. His father was the youngest of two sons and did not marry until he was fifty years of age, and Cuvier was the second child.

LAMARCK.

Although Cuvier is credited with being the greatest of Frenchmen, there are many men who consider Lamarck to have been a clearer-headed thinker than Cuvier. He may be considered as the real founder of evolution, and he is the author of the laws to which this work relates. He was born in 1744. His father was born in 1702, and was consequently forty-two when Lamarck was born. The dates of births of previous generations are not given, but I find that the grandfather of Lamarck's father was "a captain by rank and bought the estate of Saint-Martin" 110 years before his grandson was born. As this officer could not very well purchase an estate before he was born, we have the physical possibilities

reduced to the two preceding generations being not less than an average of fifty-five years each.

HUMBOLDT.

Humboldt was born in the same year as Cuvier, and what Cuvier was to France that Humboldt was to Germany. In some respects he was even greater, because no man ever had such a profound and trained intellect. During his life he was recognized as an authority on practically every known science. His father was born in 1620, and consequently was forty-nine years old when Humboldt was born.

NAPOLEON.

Napoleon Bonaparte was also born in the same year as Cuvier, and when his father was only twenty-three. He therefore is a remarkable exception, and is the most prominent man whom I have been able to find born of so young a father. That he was a man of great ability cannot be questioned. His ability, however, seems to have been only of a military order. He made several literary efforts, but they were the most dismal sort of failures. Although a great commander, he did not seem to be a great statesman. Military success caused his ambition to become greater than his judgment, led him into many blunders, and finally resulted in his downfall. If he had had anything like the ability of Augustus, or even Peter the Great, he would have maintained himself to the end as Emperor of France. Unfortunately I can find nothing in the ancestry of either his father or his mother, but we know that both were persons of great ability. The father was well educated, and was a general in the army in active campaigning for a year or two before the birth of Napoleon. The mother accompanied her husband in his campaigns, and Napoleon came

very near being born in camp. As it was the future emperor is said to have been born on a rug in chapel on Sunday. From these circumstances we know an important point in Napoleon's ancestry. A man acting as a commander in active service necessarily has his mental faculties keyed up to the highest pitch. With his wife accompanying him in battle, as she is said to have done, she must also have been exercising her brain to its fullest capacity. We thus have both father and mother using their brains and sharpening their wits so as to develop the mental power to the utmost pitch to which they were able to attain at their ages in life. If there were in this no question of ages of parents at the birth of the child, then Napoleon would be the finest example of use-inheritance of which we have any record. As the matter stands, we have an illustration of the fact that great mental activity may produce a great brain from comparatively young parents, but that the utmost strain of mental activity for a short period is not a full equivalent for a less activity extending over a long period.

CHAPTER IX.

GREAT MEN OF THE WORLD.

In the tables included in this chapter there is given a list of about six hundred of the great men of the world's history. If we add to these names those given in the family histories of Chapter XI, and a few which will be found in the appendix, but which have been omitted from the tables, the number will be raised to about one thousand. If the ancestors be included, the number of persons will be increased to over two thousand. An inspection of the names given in the tables will show the range which my inquiry has taken. In making up my list of names from which these tables have been produced, my object has been to sweep within the list enough of the great intellects of the world to make sure that there may be selected from it a hundred or more persons who are so pre-eminently great that it will be impossible to find outside of the list another hundred or so of men of equal greatness.

EXPLANATION OF TABLES.

In making up these tables I have not adhered strictly to the lines of division as previously established, but have divided them at the nearest equal division of years and have placed at the head of each table the percentage of total births that normally come within the division. I have also, in calculating these tables, ignored the months, and have simply taken the years of births of fathers and sons. This allows for a possible discrepancy of a little less than two years, so that a person given as having a birth-rank of thirty-five may in reality have a birth rank of thirty-four or thirty-six.

A discrepancy of this amount, however, does not affect the general result, as one or two years more or less would not materially affect the offspring, unless it occurred at about the time of coming to maturity or was accompanied by great variations of activity. I have also given the birth-ranks in figures in all cases where the figures have been obtainable. The first figures given after a name represent the birth-rank of the individual; succeeding figures, when given, represent the birth-ranks of father and grandfather. The birth-ranks of mothers are not given in the tables, but in a number of cases they may be found in the appendix. In cases in which the birth-rank is approximately but not accurately known, I have used letters and have aimed to err on the side of reducing rather than increasing the age of the father. It is therefore probable that some of those given in the second section of class A men really belong in the first section, and it is not improbable that a few in the first section may belong in the second section. It is believed, however, that any errors arising through using letters would be rectified by a greater movement upward than downward.

An inspection of the first section (Table VIII) of the class A men shows that it includes many of the greatest men in all the world's history—men who are comparable only to other men in the same section. The second section (Table IX) is also composed of men of very great mental ability, but while there are men in it who are greater than some of those in the first section, the group, as a whole, does not average so high as the first section. Similarly, when we inspect the class B men (Table X), we find in it a few men who might properly change places with some of those in both sections of class A, yet the average is a distinct drop in mental greatness.

TABLE VIII.

BIRTH-RANKS OF 51 AND OVER.

Represents 5 per cent of total births.

Abbas . . . . . 67 . . A
Alcibiades . . . . . A^2
Alfred the Great . . A^2
Aristotle . . . . . A^3
Arnauld 52
Audubon . . . . . 57 . . A^3
Augustus . . . . . A^3 . . A^3 . . A^3
Bacon 52
Bernouilli . . . . . 69?
Boyle 60
Buddha . . . . . A^3
Bunsen, C. K. J. . . A^2
Bunsen, R. W. . . . A^3
Calhoun 55
Carpzov, J. B. . . . A^2
Cassini, J. 52
Coleridge 53
Confucius . . . . . A^3
Cuvier, G. . . . . A^2
Cuvier, F . . . . . A^3
David . . . . . A^2
Dibdin . . . . . A^3
Doddridge . . . . . A^3
Fletcher . . . . . A^2
Franklin, B. . . . . 51 . . 57 . . A^3
Gracchus, C. S. . . . 51
Hall, R . . . . . A^2
Handel . . . . . 63 . . 41
Howard (Effingham) . . . . . 60 . . 33
Hunter, John 65
Hunter, Wm. 55
Irving, W. . . . . 52 . . 55
Johnson, Sam . . . 53
Joseph . . . . . A^3 . . A^3 . . A^3
Loa-tse . . . . . (70+x)
Lee, R. E. . . . . 51 . . 27 . . 38
Leibnitz . . . . . A^2
Leslie 80
Manutius 62
Merian, Miss 54
Moses . . . . . A^3 . . A^3 . . A^3
Naumann, Moritz . 57
Naumann, Karl . . . 56
Philip . . . . . A^2
Pisano, A. 70
Pitt 51
Ptolemy II 58
Seneca . . . . . A^2
Solomon . . . . . 52 . . A^2
Tasso 51

DUMAS [41]

SIR WALTER SCOTT [42]

WASHINGTON IRVING [52]

COLERIDGE [53]

PETER THE GREAT [43]

CROMWELL [43]

GUSTAVUS ADOLPHUS [44]

CHATEAUBRIAND [A]

TABLE IX.

BIRTH-RANKS, 45 TO 50.

Represents 4.17 per cent of total births.

Arkwright . . . . . A
Assing . . . . . A
Bancroft 45
Barrington, D. . . . 49
Bulwer 47
Bulwer-Lytton . . . 49
Burritt . . . . . A
Carnot, L. H. . . . . 48 . . 34 . . 48
Carpzov, A. B . . . . . 47 . . 50
Cato . . . . . A . . . A . . . A
Celsius, O. . . . . A
Chateaubriand . . . . A
Coligny 49
Combe, G. . . . . A
Cooper, J. F. . . . . A
Dante . . . . . A ?
Darwin, E. . . . . A
Davis, ... A
Ellsworth 46
Eyck, Van . . . . . A
Farragut 46
Fish 50
Gainsborough . . . . A
Gladstone . . . . . 45 . . 32
Holmes 46
Humboldt, A. . . . 49
Humboldt, W. . . . 47
Jussieu 49
Law, Sr 47
Lee, Arthur . . . . . 50 . . 44
Livingston, E. . . . 45 . . 31 . . 34
Lowth 49
Loyola . . . . . A
MacMahon . . . . . A
Marie Antoinette . . 47 . . 32
Milne-Edwards . . . A
Milton 45
Nasmyth 50
Owen, R. . . . . 50 . . A
Palmerston 45
Parker . . . . . 49 . . 32
Pope . . . . . 47 . . 45
Putnam . . . . . A
Romilly 45
Sidney, H. . . . . 46 . . 32 . . 36
Silliman . . . . . A
West . . . . . A
Wharton . . . . . 50 . . 35
Wilberforce, S. . . . 46
Wolcott 47

TABLE X.

BIRTH-RANKS, 41 TO 44.

Represents 8.75 per cent of total births.

Adams, J. . . . . 43 . . 38
Bismarck 44
Buckland 42
Buckle 42

Canning, C. J.....42
Carpzov, J. B.....42..50
Carpzov, F. B....42..42..50
Celsius, A. 43
Chenier, M. J.....41
Cibber 41
Compton 42
Cromwell .....43?
Dana, F. .....43..37..43
Dana, R. H.....44..43..35
Darwin, C. .....43..35..A
Dumas, père.....41..52
Edison 43
Elizabeth .....42..37
Forbes 41
Fox .....44..78
Gracchus, T. S....42
Gustavus Adolphus44..54
Herschel, Sir J...44..31..A
Herschel, Miss ...43..A
Ismail Pasha 41
Jay, W. 44
Jenkinson 43
LeConte, Jos. 41
LeConte, J. L.....41
Lamarck ...42..(110+x)÷2
Lee, R. H.....42..44
Lee, Lightfoot ...44..44
Machiavelli 41
Mather 43
Niebuhr 43
Morton 41
Paine, R. T.....42
Peter the Great...43
Pugin 43
Reynolds 42
Schopenhauer 42
Scott, Walter 42
Vernet, A. C. H..44..25
Villiers, C. P....43..50
Villiers, G. W. F..41..50
Walpole, H.....41
Webster, D. .....43..25..47
Wedgwood.....43..27
Wesley 41
Wilberforce, R. I..43

TABLE XI.

BIRTH-RANKS, 38 TO 40.

Represents 10 per cent of total births.

Adams, C. F.....40..32..43
Bach .....40..32
Baltard, V. 40
Barrington, W. W.39
Barrot 38
Beecher 38
Brontë 39
Burns 38
Burr 40
Carlyle 38
Carpzov, S. B....40..42..50
Cavaignac 40
Chaloner 40
Chatterton 39

Chenier, A. M....39
Disraeli 39
Erskine .....40..38
Field..... 38
Goethe .....39..53
Goldsmith.....38
Jeffeys 40
Klaproth 40
Kotzebue, P. 40
Law, Jr. .....40..47
Lee, Henry .....38..45
Mann .....40..40..34
Martel 40
Peel 38
Pisano, G. 40
Rembrant.....40
Stevens, R. L.....39
Story, W. W.....40..36
Visconti, Jr. 40
Washington .....38..33
Watt .....38..56

TABLE XII.

BIRTH-RANKS, 35 TO 37.

Represents 10.83 per cent of total births.

Brunel 37
Carnot, Sadi ....36..48..34
Cassini, C. F.....37..52
D'Alembert 37
Evarts 37
Field, S. J.....35
Huber .....36..37
Jefferson 35
Kemble, Fanny ...36..54
King 37
LeConte, John ...36
Lessing, G. E.....36..47
Livingston, Wm..37..32
Lopez 37
Louis XIV 37
Lowell .....37..39
Malthus 36
Melanchthon 35
Morton .....35..25
Mozart 37
Nelson .....36..26
Newton 36
Owen, D. D.....36
Richelieu 37
Schiller .....36..43
Sheridan, T. 37
Sherman, J. 35
Silliman, J. .....35..A
Stewart 36
Story, J. 36
Sumner 35
Swedenborg 35
Trevithick 36
Trollope .....35?

TABLE XIII.

BIRTH-RANKS, 33 AND 34.

Represents 9.58 per cent of total births.

Berryer 33
Boswell 34
Carnot, L. N. M. . 34 . . 48
Carpenter 33
Cassini, H. G. . . . . 33 . . 34 . . 37
Cassini, J. D. . . . . 34 . . 37 . . 52
Clinton, DeW. . . . 33 . . 46
Dana, J. D. . . . . 33 . . 36 . . 47
Edwards . . . . . .22 . . A
Emerson . . . . . .34 . . 26 . . A
Isadore St. Hilaire. 33
Huygens 33
Joule. 34
Kent . . . . . .34 . . 25
Landseer 34
Mendelssohn, F. . . 33 . . 47
Mill 33
Mirabeau 34
Peabody . . . . . .33 . . 36 . . 46
Porter, Admiral . . 33
Prescott . . . . . .34 . . 36
Priestley . . . . . .33 . . 39
Regnault, Jr. 33
Ruskin . . . . . .34 . . 25
Staël, Mme. de . . . 34
Wellington . . . . . .34 . . 45

TABLE XIV.

BIRTH-RANKS, 31 AND 32.

Represents 10 per cent of the total births.

Adams, J. Q. . . . . 32 . . 43 . . 38
Agassiz 31
Beethoven . . . . . .31 . . 27 . . 54
Broussais 31
Buonarroti 31
Burnouf 32
Byron . . . . . .32 . . 33 . . 54
Chevreul 32
Galileo 31
Herschel, W. . . . . 31 . . A
Lesseps 31
Lincoln. . . . . .31 . . 45
Longfellow . . . . . 31 . . 27
Lubbock 31
Macauley . . . . . .32 . . A
Moltke . . . . . .32 . . 38
Moore, Sir J. 32
Pepys 32
Poe . . . . . .31 . . 36
Raphael 32
Saussure 31
Sherman, Gen. . . . 32
Smith, Sidney . . . 32
Tromp, Van 32
Vernet, J. E. H. . . . 31 . . 44 . . 25

TABLE XV.

BIRTH-RANKS, 29 AND 30.

Represents 11.25 per cent of total births.

Brahe 29	Hugo 29
Channing . . . . . .29..36	Lyell 30
Carpzov, B. . . . . .30..50	Marlborough 30
Dollinger 29	Morse . . . . . .30..35
Faraday . . . . . .30..40?	Muller, Max 29
Hamilton, W. . . .30	Naumann, E. . . . .30..57
Hawthorne . . . . .29..44..40	Owen, R. D. 30
Helvetius . . . . . .30..55	Sheridan, R. B. . . .30..37

TABLE XVI.

BIRTH-RANKS, 27 AND 28.

Represents 10.83 per cent of total births.

Bryant . . . . . .27..36..29	Decatur 28
Carus, V. J. . . . . .28..25	Grant . . . . . .28..46
Charlemagne . . . .27..25..40	Kotzebue, M. 28
Charles XII. . . . . .27..33	Livingstone, R. R.27..31..34
Cockburn . . . . . .28..45	Swift . . . . . .27..45..A

TABLE XVII.

BIRTH-RANKS, 25 AND 26.

Represents 8.33 per cent of total births.

Alexander . . . . . .26..A[2]	Mohammed . . . . . .25..46..A
Bunyan 25	Saxe 26
Dickens 26	Sidney, Sir P. . . . .25..47..40
Forster 25	Walpole, R. 26
Gray, Asa . . . . . .25..40..48	Wellesley . . . . . .25..45
Kotzebue, Otto. . .26	Whitney . . . . . .25..44
Locke . . . . . .26..32	Willis 26
Marshall 25	

TABLE XVIII.

BIRTH-RANKS UNDER 25.

Represents 11.25 per cent of total births.

Bonaparte 23
Bruce . . . . . 21 . . 43
Buffon 24
Constantine . . . . 22?
Dumas, fils . . . . . 21 . . 41 . . 52
Frederick . . . . . 24 . . 31 . . 37
Hannibal 23
Hastings 24
Lafayette 24
Mather, C. . . . . 24 . . 43
Napier . . . . . 16 . . 21
Perry 24
Racine 24
Stevenson, R. 22
Vane 24

TABLE XIX.

Bache . . . . . 64÷2 . . 38
Beecher, L. . . . . 69÷2
Canning, G. . . . . 67÷2
Canning, S. . . . . 83÷2
Colfax . . . . . 63÷2
Copernicus . . . . . (77+x)÷2
Dudevant . . . 103÷3 for female
Fielding . . . . . (125+x)÷3
Gibbon . . . . . 71÷2
Harrison . . . . . 60÷2
Hume, David . . . (71+x)÷2
Lessing, K. F. . . 115÷3 . . 47
Montalembert . . . 96÷2
Montmorency . . . 103÷2
Savonarola . . . . . 68÷2
Shaftsbury . . . . (70+x)÷2
Smollett . . . . . 73÷2
Sulla . . . . 105÷2, see appendix
Tennyson . . . . . 59÷2
Wollaston . . . . . 107÷2

TABLE XX.

Ampère . . . . . lived 61 years, orphan at 18.
Anderloni . . . . . had brother 18 years older.
Astor . . . . . had brother 11 years older.
Augustine . . . . . lived 75 years, orphan at an early age.
Baird . . . . . lived 64 years, orphan at 10.
Basil . . . . . lived 50 years, orphan as a youth.
Becket . . . . . see appendix.
Bell . . . . . father's second son was 11 years older.
Bentley . . . . . by second wife.

Benton ..... lived 76 years, orphan at 8.
Blackstone..... posthumous, had brother much older.
Blainville ..... lived 73 years, orphan at an early age.
Böckh ..... had brother 8 years older.
Boëthius ..... lived 50 years, orphan as a child.
Buckingham ..... by second wife, orphan at 13.
Burke ..... see appendix.
Calderon ..... lived 81 years, orphan at 8.
Cartwright ..... was third son.
Castelar ..... was an orphan at 7.
Cavour ..... was a "younger son".
Cervantes ..... was youngest of four sons.
Chalmers ..... was 6th of 14 children.
Champollion ..... had a brother 13 years older.
Chase ..... lived 65 years, orphan at 7.
Chrysostom ..... lived 60 years, orphan in infancy.
Clay ..... lived 75 years, orphan at 4.
Cobden ..... lived 61 years, orphan at an early age.
Condorcet ..... lived 51 years, orphan at 4.
Copernicus ..... lived 70 years, orphan at 10.
Cranmer ..... lived 67 years, orphan at 14.
Cromwell ..... see appendix.
Dalton ..... born 11 years after father's marriage.
Daubenton ..... lived 84 years, orphan at 20.
Davy, J..... lived 78 years, orphan at 4.
Demosthenes ..... lived 63 years, orphan at 7.
Descartes ..... youngest son of a younger branch.
Douglass ..... lived 48 years, orphan at 2 months.
Emmet ..... had a brother 16 years older.
Erasmus ..... lived 69 years, orphan at an early age.
Eugene ..... fifth and youngest son.
Everett ..... father was pastor 12 years before son's birth.
Fenelon ..... by second marriage "contracted in mature years".

Ferguson .....youngest son of a numerous family.
Forbes, David.....had a brother 13 years older.
Forbes, J. D.....fourth and youngest son.
Fremont .....lived 77 years, orphan at 5.
Froebel .....see appendix.
Fronde .....his father's fourth son was 8 years older.
Fulton .....lived 50 years, orphan at 3.
Gallatin .....lived 88 years, orphan in infancy.
Garrick.....father was 29+X; X= about 10.
Garrison .....mother was 28.
Gifford .....lived 69 years, orphan in childhood.
Gordon .....was fourth son.
Hale .....lived 67 years, orphan at an early age.
Hamilton, A.....see appendix.
Hamilton, W. R...fourth child.
Hampden .....lived 49 years, orphan in childhood.
Harvey .....second child by second wife.
Henry .....see appendix.
Holbein .....father was between 37 and 47.
Hood, T.....lived 47 years, orphan at 12.
Howard, J.....lived 64 years, orphan at 17.
Hughes .....youngest of 3 sons.
Hume, Jos.....lived 78 years, orphan at 9.
Hunt, Leigh.....see appendix.
Huss .....burned at 46, orphan at an early age.
Iturbide .....executed at 41, orphan at 15.
Jackson, A.....posthumous, lived 78 years.
Jacquard.....lived 82 years, orphan at 20.
Jenner .....lived 74 years, orphan at 5, was youngest.
Joan of Arc.....fifth child.
Jones, Owen.....see appendix.
Jones, Sir W.....lived 48 years, orphan at 3.
Jonson .....posthumous, lived 63 years.
Juarez .....lived 66 years, orphan at an early age.

Lamb .....had a brother 12 years older.
Lamennais .....was fourth of six children.
Lea .....see appendix.
Liszt .....lived 75 years, orphan at 16
Luthur .....see appendix.
Marcellus .....see appendix.
Marion .....youngest of seven children.
Martineau, H.....was the sixth of eight children.
Martineau, J.....youngest brother of Harriet.
Mehemet Ali.....lived 80 years, orphan at an early age.
Mendoza .....see appendix.
Miller .....by second wife.
Murillo .....lived 65 years, full orphan at 10.
Murray .....was fourth son.
Neander .....was the youngest child.
Neipce .....see appendix.
Paoli .....had a brother 9 years older.
Patti .....youngest by second marriage.
Pestalozzi .....lived 81 years, orphan at 6.
Petrarch .....see appendix.
Powers .....was 8th of 9 children.
Proctor .....was fourth and youngest son.
Renan .....had a brother 14 years older.
Romanes .....was third son.
Rubens .....see appendix.
Rumford .....lived 61 years, orphan at 1.
Scipio .....see appendix.
Shakespeare .....see page 134.
Sheridan, Gen.....was the third child.
Smith, Adam.....see appendix.
Spinoza .....see appendix.
Stephens, A. H....see appendix.
Thomson .....had a brother 8 years older.
Vandyke .....was seventh of 12 children.

Vernet ..... see appendix.
Voltaire ..... his only brother was 10 years older.
Wagner, R..... lived 70 years, orphan in infancy.
Wallenstein ..... lived 51 years, orphan at an early age.
Whitefield ..... lived 56 years, orphan as a child.
Wordsworth, C.... see appendix.

TABLE XXI.

BIRTH-RANKS LOOKED FOR BUT NOT FOUND.

Anderson	Fitch	Mendoza
Arago	Fourier	Metternich
Baird	Fresnel	Molière
Balzac	Gambetta	Montaigne
Bentham	Garibaldi	Nägeli
Bernadotte	Gauss	Ohm
Berzelius	Gay-Lussac	Oken
Boccaccio	Geoffery St. Hilaire	Paine, T.
Bonnet	Grotius	Pascal
Bruno	Gutenberg	Rankine
Cæsar	Hahnemann	Rousseau
Calvin	Haydn	Schlegel
Candole	Helmholtz	Seward
Canova	Homer	Spencer
Chaucer	Huxley*	Stradivarius
Cicero	Hypatia	Talleyrand
Columbus	Kant	Thackeray
Comte	Keats	Titian
Cope	Kepler	Tyndall
Davy, H	Kingsley	Verdi
Defoe	Knox	Vinci
Diocletian	Laplace	Virchow
Dujardin	Lavater	Volta
Ericsson	Leverier	Wren
Fichte	Linnæus	Wycliffe

*Since found. See appendix.

COMPARISON OF TABLES.

As we read down the list from table to table of those whose birth-ranks are given, it is often difficult to distinguish the relative rank of one of them as compared to the next adjacent one above or below, but when we compare any two groups in which the birth-ranks are separated by ten years, the difficulty disappears, and we can readily see that the figures are a relatively accurate representation of the difference between them. When we come to the last three groups of those provided with birth-ranks, and particularly to the group having birth-ranks under twenty-five, we find many men who have achieved world-wide fame, but men who cannot be strictly said to have acquired that fame because of great mental endowments. As previously pointed out, fame is not necessarily commensurate with intellectual greatness.

LOMBROSO ON MILITARY COMMANDERS.

In an article on "Megalomania,"[1] Professor Lombroso says: "Now that historians have dropped their reverence for mere conquerors, the megalomania of these kings becomes perceptible. They were one and all afflicted with insane big-headedness; insane big-headedness directed their every action; this nervous malady overruled their intellect and finally superseded it. You will say, surely Alexander was possessed with a powerful mind. So he was; but remember that as a child he dreaded the possibility of his father's conquest of the world, that as a man he carried war into India, which could have been of no use to him, and that his empire went to pieces even before his death. . . . . Charles XII of Sweden acted even worse than Louis XIV. . . . This fool invaded the interior of Russia, and after he succeeded in annihi-

(1) Chicago Tribune, April 21, 1901.

lating 80,000 Russians with his 8,000 Swedes, his insane big-headedness would not allow him to utilize the advantage this victory gave him. When a semi-prisoner in Turkey he had the effrontery to tell his Parliament he would send one of his boats to Sweden to preside at the sittings of the nation's elect; with three hundred, afterwards with fifteen, soldiers he undertook to declare war against Turkey, and when finally he returned to Sweden he tried to force his notions upon Russia.

"From a warrior and statesman, Napoleon became the greatest megalomaniac the world ever produced. When master of Europe he essayed to conquer India and Asia, and of necessity failed in an undertaking which was far too tremendous for the capabilities of one nation and one individual. Napoleon used to say, 'Europe is but a small mole-hill. Great empires can only be founded in the Orient, where 600,000,000 of people live. There one may execute great reforms.' When he formulated these ideas Napoleon was clearly a megalomaniac; his genius had degenerated into insane big-headedness. Taine was right when he said of him that he regarded the world as a great picnic, where the man having the longest arms fared best. He used the dignitaries of the crown and his generals as flunkies, and as his big-headedness increased treated other monarchs and their ministers in the same fashion. The unthinking may judge him, for that reason, a great man, notwithstanding the fact that the glory of this megalomaniac was bought by the lives of millions, at the cost of two invasions of foreign armies, while resulting in France's utter downfall. These were the consequences of Napoleon's political activity and the fruits of egotism which had 'genius' for handmaid."

This is what Prof. Lombroso has to say of one man out of each of our last three groups, and the same remarks apply by implication

to several other men in the same groups. But it will be noticed that Prof. Lombroso does not make any such remarks about any individual in the three groups included in classes A and B, which are five times as numerous as those in the last three groups. As I am not personally responsible for the times at which the fathers of these men conceived their sons, it cannot be charged that I selected and arranged them with the view of applying Prof. Lombroso's criticism to them.

COMPARISON BY NUMBERS.

Taking those whose birth-ranks I have recorded, we have 354 eminent men. Although only 9.17 per cent of all births are to fathers over 45 years of age while 11.25 per cent are to fathers under 25, we have 128 persons who were sons of old fathers as against fifteen who were sons of young fathers. By calculation I have shifted the lines of division between the groups of men so as to cause these lines to fall at the ages of our standard scale, and the result of this calculation is shown in Fig. 9.

This diagram shows a gradual increase in the number of eminent men as the fathers grow older, and a very pronounced increase at the extreme age. Even if we did not have these men standing up in a row before us so that we could compare the quality of one group with the quality of another, the mere matter of numbers would be very emphatic. The diagram also shows the peculiar prominence of class *b* which we previously noticed in Fig. 6. An inspection of the last three groups shows that they contain a good many men who were heirs to titles and authority, and it is almost certain that their eminence is due to inherited position rather than to inherited intellect. In the last two of these groups this class of men is more numerous than in the third group, and if the men of

doubtful right in a list of great intellects should be eliminated, the diagram would run down regularly to the end, leaving a less number of persons in classes *a* and *b* than in class *c*. It is furthermore evident that a number of men, like the younger Dumas and Robert Stephenson, did not achieve their eminence by their unaided efforts,

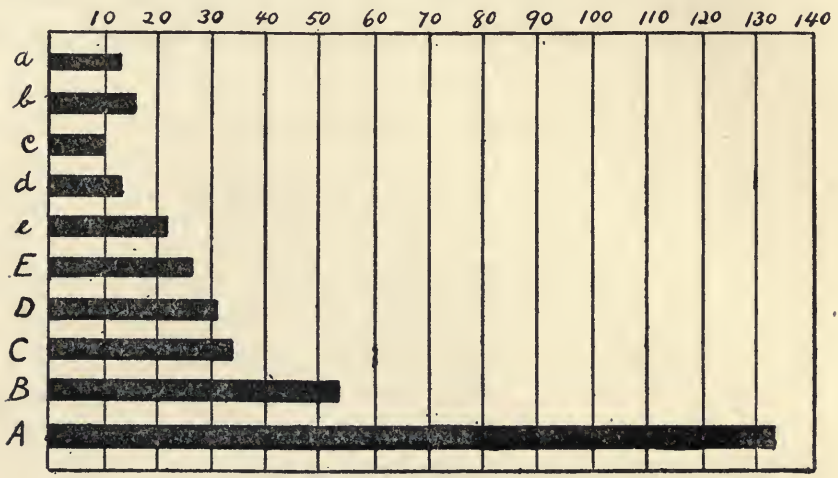


FIG. 9—DISTRIBUTION OF 354 GREAT MEN BY THEIR BIRTH-RANKS.

but largely in consequence of the opportunities given them by their fathers.

The elder Dumas had a birth-rank of 41. He may be considered as an eminent man, but we find him placed in juxtaposition with men still more eminent. If we were to estimate father and son by the number of square inches given to their biographical notices in the Cyclopedia, we would find the elder to be five times as eminent as his son.

REVIEW OF INCOMPLETE TABLES.

Passing from the groups of men for whom the birth-ranks have been definitely determined, we have in table XIX a small group of

men about whom our information is restricted to the sum of the birth-ranks for two or more generations. An inspection of this table will show that the lower of our ten classes cannot be recruited from them in either number of individuals or in men of great ability.

In table XX we have a list of 114 men in regard to whom the information is still more limited. This information, as far as it goes, indicates that their fathers were old when they were born. The mere fact that a man, who lived to be old, was an orphan at an early age is not, of itself, proof that he was a son of an old man, but where a good many such cases are taken together, the facts are good circumstantial evidence that the fathers were old in a good many instances. It certainly would be a queer commentary on the laws of inheritance and circumstantial evidence if it should not prove that more than one-half of these persons had birth-ranks above 35. It is quite evident that we cannot expect to fill the vacancies in the lower of our ten classes from this group of men.

In table XXI we have a list of men whose birth-ranks I have looked for but have not found. This does not mean that the birth-ranks of all of them cannot be found, but that I have not been able to find them with the facilities at my command or without an amount of research which I was unwilling to give. Besides, I could see no useful results to be obtained by a large amount of additional labor after it became evident that the process would be slow and attended with meagre results.

CAN THE TABLES BE EQUALIZED IN NUMBERS AND QUALITY?

The question then is: If we could obtain the birth-ranks of all of these unknown men, would enough of them fall in the lower classes to even up these classes in numbers and mental ability?

There are several reasons for saying that they would not. In the first place, the law of probabilities, as applied to ordinary individuals, would divide these unknown men pretty evenly throughout our ten classes, leaving the results the same as they are now. In the second place, the same law, as it has been shown to apply to selected groups of great men, would divide these unknown men in about the same ratio in which the known men have been divided, thus further increasing the higher classes at the expense of the lower. In the third place, we already have in the ten ranked classes, and in the two groups immediately succeeding them, nearly one-half of our entire list definitely located above the average birth-rank, hence the evening process would require that almost the entire list of unknown persons should fall in the lower classes. This is a combination which no one will for a moment presume to be possible. And in the fourth place, even if the entire unknown list should fall in the lower classes, it does not contain enough men of transcendent mental greatness to offset the men in classes A and B.

There remains the one question: Can there be found, outside of the 800 or 900 men here recorded, enough men born in the lower classes to expand these classes to one hundred men each, and at the same time bring the mental standard of these classes up to the average of the one hundred recorded in class A? I will leave this question to be answered by anyone who thinks that he can do this, in the meantime feeling confident that it cannot be done.

PROOF BY TEN GREAT MEN.

In fact we might rest our case on ten great men taken from ten different countries. If I look among the Hebrews for the greatest man ever produced among them and find Moses, the law of prob-

abilities says that there is only one chance in ten that I find him born in class A and only one chance in fifty that I find him born in sub-class A^3. If I look to China for the greatest Chinaman, it is again only one chance in ten that I find Confucius born in class A, one chance in fifty that I find him born in sub-class A^3, one chance in one hundred that I find both Moses and Confucius born in class A, and only one chance in twenty-five hundred that I find them both with the birth-ranks as high as A^3. If I then go to India for the greatest man produced there, the chances rise to one in a thousand in one case and to one in one hundred and twenty-five thousand in the other. If I continue this process, picking out the greatest known intellects in Greece, in Rome, in Egypt, in England, in France, in Germany and in America, the chances rise to the enormous total of one in five hundred millions of millions, a number which is equal to three hundred thousand times the total population of the earth. And yet these figures ignore the compounding arising from successive generations born in class A, and depend only upon the birth-ranks of the individuals themselves. Surely this can be no longer considered a question of probabilities. We must hold with Aristotle that what occurs regularly cannot be the result of chance, but must be dependent upon some law, and that that law says that the mental ability of the offspring is dependent upon the age of the parent at the time of reproduction.

TEN MEN FROM TEN COUNTRIES.

Aristotle, A^2.
Augustus, A^3, A^3, A^3.
Bacon, A^2.
Buddha, A^3.
Confucius, A^3.
Cuvier, A^2.
Franklin, A^2 (A^3, A), A^3
Humboldt, A.
Moses, A^3 (A^3, A^3), A^3.
Ptolemy II, A^3.

PROOF BY ONE MAN ALONE.

I have said that we might rest our case on ten men alone. We may go even farther and rest it upon one individual of this ten, as on Augustus or Moses, or better yet on Franklin, because the dates for Franklin are known and may be verified. Franklin takes the birth-rank of 51, his father takes the rank of 57, his mother ranks 50, his paternal grandfather has a rank that is probably over 65, and there are two other generations of known high rank to be accounted for. Now, I find that successive births in high ranks are much more rare than successive births in low ranks. In the genealogy from which our standard is taken, I find only a single case of two successive generations in the male line in class A and no case of three generations successively so born. On the other hand I found numerous cases of two successive generations born in class *a*, and out of a small group taken at random I found one case where class *a* extended over three generations. This is from the same source from which the classes were established, and shows that early reproduction is much more fertile than late reproduction, especially in the second and third generations. From these considerations, from what I have previously shown to be the case in Ireland and Scotland, and from what will appear later as to what occurs in the different countries of the world, I have satisfied myself that for each case in which both father and son take birth-ranks of 50 or over, there are literally hundreds of cases in which the father and son both take birth-ranks of 25 or under. If we extend this from two generations to three generations and include one on the mother's side—all being 50 or more—then the number of persons of corresponding low rank to one of such high rank increases tremendously. If the birth of a son of great intellectual

power be simply the result of chance, then, according to the law of probabilities, it should be possible to find thousands of persons who are the mental equal of Franklin and who have birth-ancestries equally far at the other extreme of the scale. But such thousands cannot be found, nor is it possible to find, out of the millions of persons so born, a solitary individual who approaches, even in a remote degree, the intellectual power of Franklin. Rare as are birth-ancestries as high as that of Franklin, they are not rare in our class A men. His is exceeded by those of Augustus, and Moses, and, if we could get at the truth of the matter, we would probably find it exceeded in a number of other cases.

CHAPTER X.

MENTAL APTITUDES.

Let us assume a son who is strong, healthy, active, and of rather more than average mental ability, and let us trace his life history. As he approaches twenty years of age he observes, in a number of points, his superiority over his associates, and because he can see and appreciate that which is his own better than he can that which is peculiar to some other person, he often imagines superiority when none actually exists. Because of his youth and his comparative inexperience, he fails to realize the relatively vast store of knowledge hidden in the brain of some unobtrusive but much older man. Because of his health, strength and activity, he delights in physical exercise, keeps track of the ball games, and knows all about the prize-fighters whether he knows who is President of the United States or not. As a consequence, our young man, from twenty to twenty-five, is very much a bundle of conceit and aggressiveness.

CHANGE IN CHARACTER DUE TO CHANGE IN AGE.

As he approaches thirty he attends the theater and concerts oftener, and begins to take more interest in literature, art, music, poetry, and those things which appeal to the sentiments and sense of the beautiful. As the second stage advances, the stage of conceit and aggressiveness gradually wears away until, at the age of thirty-five, the objectionable features of it have practically disappeared. At this age he dresses well, cares much for appearances, and is the embodiment of artistic taste.

As he approaches forty he interests himself more and more in practical affairs. He has got over working for fame and is now working for the dollars. He looks less at the beautiful and more at the useful and profitable. He begins to take more interest in local, state, or national politics. He uses his influence toward municipal improvements, better police protection, and regulation of the saloons and the unruly members of society. During his forties he has largely forgotten the conceit, turbulence and aggressiveness of his own youth and condemns that in his son.

When in his fifties, he has passed the heat and passions of youth and looks more at the moral and philosophical side of questions. He takes an interest in scientific questions provided they rise above curiosity and purely academical interest. Wise statesmanship, the good of the world, the good of mankind and philanthropy engross his attention.

This life history does not represent that of any particular individual, and is probably not exactly true in any case. In one person conceit and aggressiveness may continue throughout the larger part of his life, and wise statesmanship and philanthropy may never appear. In another person the artistic sense may appear early and continue late. In still another, the practical nature and acquisitive propensities may be the dominating influence throughout life. Still our assumed individual may be considered as typical, and as representing, more or less closely, the general drift of character of all individuals. He stands for man in the aggregate, and in one generation is the father of the next generation.

EFFECT OF THESE CHANGES ON OFFSPRING.

Having more or less perfectly, or imperfectly, established our typical father, and having traced the changes of his character dur-

ing the different stages of his life, it remains to be seen what effect these changes in character will have on his offspring produced during these different stages. Under a strict interpretation of the laws of use-inheritance, we should expect that the sons of early manhood would be active, aggressive and egotistical; that the children born when he was between thirty and forty would exhibit a tendency toward the musical, the artistic, the beautiful; that the sons produced when he is between forty and fifty would be practical men of affairs, business men, manufacturers, lawyers and statesmen; and that the sons born after he has passed fifty years of age would be philosophers, moral reformers and philanthropists.

In testing this *a priori* reasoning by our tables of birth-ranks I find it very largely correct, and that the mental aptitudes of the child are strongly influenced by the age of the parent at the time of the child's birth. To illustrate this point I have drawn off from the tables, four groups of men who may be considered typical of these respective characters.

MORALITY, PHILOSOPHY, PHILANTHROPY. BIRTH-RANKS OVER 51.	STATESMANSHIP. BIRTH-RANKS 41 TO 50.
Aristotle.	Bismarck.
Arnauld.	Canning.
Bacon.	Carnot.
Boyle.	Cato.
Buddha.	Chateaubriand.
Confucius.	Cromwell.
Franklin.	Gladstone.
Hall.	Gracchus.
Leibnitz.	Gustavus Adolphus.
Moses.	Machiavelli.
Seneca.	Peter the Great.
Solomon.	Webster.

MUSIC, POETRY, ART AND LITERATURE. BIRTH-RANKS 31 TO 40.	MILITARISM AND AGGRESSIVENESS. BIRTH-RANKS LESS THAN 31.
Bach.	Alexander.
Beethoven.	Bonaparte.
Mendelssohn.	Charlemagne.
Goethe.	Charles XII.
Schiller.	Decatur.
Shakespeare.	Frederick.
Angelo.	Grant.
Raphael.	Hannibal.
Rembrandt.	Hastings.
Carlyle.	Pompey.
Goldsmith.	Saxe.
Macaulay.	Scipio.

The first group, consisting of men having birth-ranks of 51 and over, is distinctly moral and philosophical in its character, and is typical of the character of old men. They are all sons of old men, some of them sons of very old men.

The second group consists of men having birth-ranks from 41 to 50. They are all statesmen and men of practical intelligence and usefulness. I might have made up this group of twelve from men who have become eminent in the practical arts and sciences, but as this class is slightly less numerous than statesmen at this birth-rank, and as it is somewhat more difficult to classify them, I have omitted them entirely from this branch of my discussion. By tabulation, however, I find that they run closely parallel with statesmen, but are a little more evenly distributed throughout the scale. Another reason for excluding them is that the practical arts and sciences cover a wider range than statesmanship and are consequently less typical of character.

The third group, consisting of men having birth-ranks from

31 to 40, is distinctly typical of what may be generally classed as fine arts. They are musicians, painters, poets and authors. They represent that which is artistic and beautiful, and are most appreciated by men between the ages of thirty and forty.

The fourth group consists of strictly military men and is representative of the active, aggressive, ambitious and conquering character. In a previously given quotation, Professor Lombroso has characterized three of these men as megalomaniacs, *i. e.,* men whose insane bigheadedness has carried them away from good common sense to a desire to conquer and rule the world.

NUMERICAL COMPARISON.

To discover how far these mental characters determine the number of men as well as their quality, I have tabulated all of those for whom I have been able to obtain birth-ranks and I find 236 who fall in one or another of these classes. Such a tabulation, however, is somewhat difficult, and is liable to errors because there is sometimes an uncertainty as to just how a particular individual should be classified. Thus I find one man ranked as a general, as a statesman and as a philosopher. In such a case I assume that his military career was due to the circumstances of his early life, that later events brought him in contact with the political affairs of his country and compelled the exercise of statesmanship, but that philosophy was strictly a choice. Consequently I classify such a man under the head of philosophy. To guard as much as possible against errors creeping into such a tabulation, I repeated the tabulation several times, permitting a considerable period of time to elapse between the tabulations. While these tables differ more or less in detail, they are all identical in general results. The table which appears most accurate, and which was

prepared with the most care, is given below. It will be seen that it makes little difference whether the lines be read horizontally or vertically, the result is substantially the same in either case. Thus, under the head of Morality and Philosophy, the men are most numerous when the birth-rank is high and least numerous when it is low. Also, taking men with the highest birth-rank, it will be seen that such men are more liable to become eminent in philosophy than in military life, and that the further they go away from philosophical and moral subjects the less liable they are to become eminent. Conversely, men with low birth-ranks achieve their best success in military life and their least success when following philosophical studies.

MENTAL APTITUDES OF 236 MEN.

	Birth-ranks.				
	51 and over.	41-50	31-40	Under 31	Total
Morality, theology, philanthropy, philosophy	**21**	15	7	5	48
Statesmanship and law	10	**33**	27	6	76
Fine arts, music and literature	9	25	**36**	11	81
Military	3	4	8	**16**	31
Total	43	77	78	38	236

CUSTOM VERSUS NATURAL ABILITY.

While the table shows very plainly, by numerical quantities, that the cast of character has a relationship to the birth-rank, it does not tell the whole truth. A little comparison of extremes will

make this clear. The three military men with birth-ranks over 51 are the British rear-admirals Barrington and Popham, and the American general Robert E. Lee. The five at the other extreme are the theologians Channing and Cotton Mather, the philosophers Helvitius and Locke, and the religious reformer Mohammed. I found Barrington because he happened to be one of four brothers, and I accidentally ran across Popham when looking for something else. Whatever may have been the mental ability of Barrington and of Popham, it is quite safe to say that the general public is not as familiar with their names as with the names of Nelson [36], Van Tromp [32], and Decatur [28]. The case of the Barringtons illustrates how custom reverses the natural mental aptitudes of sons, yet custom has not been powerful enough to reverse the general results of our table. It has, however, operated to spread out the figures more uniformly than would be the case if natural talents were given full play. The Barringtons consisted of four brothers, the eldest, W. W. [39], followed the usual English custom and became the statesman of the family; the second, Daines [49], was a journalist; the third, Samuel [A^2], entered the navy and became a rear-admiral; and the fourth, Shulte [56], became a prelate. If we are to judge by the square inches of space given to the biographical sketches of each of these four brothers, the statesman and the rear-admiral were much less eminent than the other two brothers. In the light of what our table tells us it seems likely that if the eldest and third sons had changed occupations it would have been for the mutual advantage of both, to say nothing of the advantage to the world. I do not have the exact birth-rank of Popham, but I find that he was the twenty-first child of his father, and, like English younger sons in general, probably took to military life because it was the only thing open to him.

GRANT AND LEE COMPARED.

General Lee was a man of great ability and was the best military commander in the Southern Confederacy. We can probably obtain the best estimate of his traits of character by comparing him with his great opponent, General Grant. While Grant was distinctly a warrior, he was also known as a man of peace, but when we analyze Grant's campaigns we find every one built strictly on the lines of aggressiveness. His objective was the enemy's headquarters, and his controlling principle was to attack the enemy whenever and wherever he could be found. On the other hand, Lee's tactics were not of the aggressive character, but of the kind that seeks to manœuvre into a position from which he could dictate terms, and the sole object was the defense of his native state. It is true that he could be aggressive, as was shown in the battle of the Wilderness, but such aggressiveness was not any part of his general plan of campaign. It was simply the readiest means for checking his opponent. In youth Lee was sent to West Point, and during his early life he was a skilful military engineer in charge of a number of important constructions. Upon the secession of Virginia from the Union, Lee said in his resignation sent to General Scott: "Save in defense of my native state, I never desire again to draw my sword," and he made the same statement in several other letters written about the same time. This is the principal military commander in the list of men having birth-ranks over 51, and shows a cast of character very sharply distinguished from that of a Napoleon or an Alexander.

THEOLOGIANS WITH LOW BIRTH-RANKS.

Of our theologians at the other extreme, we find Channing [29] with a birth-rank very close to our dividing line leading to the

Fine Arts, and we find him described as of the "poetic order." In the theological disagreement between the liberals and orthodox we find him the aggressive leader of the liberals. It is said that the lessons of his mother, the death of his father, and the influence of a revival took him into theology. Although our table classifies him with the philosophers, we find little in this that would identify him with Aristotle, Bacon, Buddha or Confucius.

Our other theologian, Cotton Mather [24], is principally eminent for a great mass of publications of doubtful value, and for his connection with the witchcraft persecutions. He furnished much of the evidence which caused the executions, and among other things he discovered [?] that the devils were familiar with Latin, Greek and Hebrew, but were less skilled in the Indian languages. Even after public opinion changed, he never expressed regret for the innocent blood that had been shed. This is in strong contrast with his father, Increase Mather [43], who condemned the witchcraft proceedings.

It has been said that Locke's "whole life was a warfare against the enemies of freedom in speculation, freedom in worship, and freedom from every unnecessary political restraint." While this is hardly enough to identify his character with that of our military men, it separates it from that of Confucius, whose sole aim was to teach philosophy and morality.

The case of Locke, however, is peculiar in that his mother was more than nine years older than her husband, consequently if his birth-rank be calculated from his mother, or from the mother and father combined, he would not appear in this group at all.

Of Helvetius [30] I have not been able to obtain enough information to warrant me in making any comment. His father, however, has a birth-rank of 55.

CHARACTER OF MOHAMMED.

Of our five men there remains only Mohammed, who is ordinarily classed with Buddha, Confucius and Moses because he is the founder of a great religion, but in cast of character he is removed from these men by an almost infinite distance. Instead of teaching and practicing peace and good will toward men, we find him spreading his doctrines by means of the sword. During the first years of the Hegira he proclaimed war against unbelievers and commenced with attacks upon caravans of pilgrims. He was continually engaged in aggressive warfare, and even attempted to overthrow the Byzantine Empire. Evidently Mohammed was more nearly like Alexander than he was like Buddha or Confucius.

If we should extend this inquiry it could easily be shown that Handel [63] was principally famous for his church music; Dante [A] and Milton [45] for their great moral and religious epics; Swift [27] for his attacks upon the politicians of his day; and so on through a large number of other persons who are more or less removed from our established centers. But the multiplication of examples is unnecessary. Enough has been given to show that the cast of character as well as the mental capacity is very strongly influenced by the age of the father at the time of the child's birth.

GROUP OF POETS EXAMINED.

Comparatively early in my investigation I drew off from my lists the names of eight poets for the purpose of studying them in their relationship to each other. At the time this short list was made, these persons were the only poets whose birth-ranks I then had. Because I had obtained some outside opinions in regard to

these persons before I had the birth-ranks of others who might have been added, I have retained the group as it was originally made. I am not sure that I am right in placing Dante first in the order of birth-ranks, but the indications are that he belongs in this place.

EIGHT POETS IN ORDER OF BIRTH-RANK.

1	Dante	$(120+x)\div 3$
2	Pope	47
3	Milton	45
4	Goethe	39-53
5	Burns	38
6	Schiller	36-43
7	Byron	32-33-54
8	Longfellow	31-26-27

In Dante we have a poet of the moral, religious and philosophical type. In Pope we have a poet whose writings are all of the moral and philosophical character with hardly anything of the religious. In Milton we have the grand religious epics similar to the case of Dante. We also have descriptive poems and poems of sentiment. Outside of poetry Milton was a statesman and the foremost champion of English liberty. With Goethe we have the philosophical, the dramatic, the lyrical, pastoral poems, ballads and oriental songs. With Burns we have poems of sentiment, of love, of sorrow and of religion. From Schiller we have dramatic poetry, descriptive poetry and ballads, the whole of which are characterized by high intellectual and moral culture. With Byron we have descriptive poems and poems of passion. With Longfellow we have poetry almost purely descriptive and depending for its charms on beauty of expression. Comparing the mental aptitudes and characteristics of these men with those of our hypothetical ancestor

at his different stages of life, we find almost an absolute correspondence. Whatever changes in their order might be made that would bring them into closer accordance with our hypothetical changes of character, such changes would certainly be small.

POETS ESTIMATED BY PUBLIC EDUCATORS.

When we come to compare these men as to their relative mental ability instead of in the relationship of their mental aptitudes we find a somewhat different state of affairs. To get a fair estimate I arranged these eight poets in alphabetical order and asked a number of prominent educators to rearrange them according to their intellectual greatness. An average of these estimates places these men in the following order:

EIGHT POETS IN THE ORDER OF THEIR GREATNESS.

1	Goethe	39-53
2	Dante	(120+x):3
3	Milton	45
4	Schiller	36-43
5	Byron	32-33-54
6	Burns	38
7	Pope	47
8	Longfellow	31-26-27

The most marked change in this arrangement as compared to the previous one is the rise of Goethe and the fall of Pope. The other changes are comparatively insignificant and are not more than would be expected from comparatively small differences in the mental activity of their parents. It remains to be seen if we can find a sufficient explanation for these two changes.

GOETHE AND POPE.

In the ancestry of Goethe we find that the grandfather had, from a source which we can only surmise, as biography is silent on the point, sufficient mental ability to raise himself somewhat above the class from which he sprang, and that he was fifty-three years old before his son was born. This son, the father of Goethe, was a very severe student and applied himself with great energy to his own education. When he was at the age of thirty-nine, and consequently after great mental training, his son, the poet, was born. The mother of Goethe was quite young herself, but she was the daughter of an educated official when he was thirty-eight, and through this source we would have transmission by sex. In addition to this Goethe was endowed with a magnificent physique and was given the best possible education. We thus have in the heredity of Goethe all of the factors that tend toward development as very high except the birth-rank 39, which is only moderately high. It is therefore quite evident that the figure 39, taken by itself, is not a fair estimate of Goethe when comparing him with other persons.

In the case of Pope I cannot find the birth-rank of his father, but I find that his mother was the daughter of a man forty-five years of age. In transmission by sex, this [45] is as potent an influence as it would be if it were the father's instead of the mother's birth-rank. Although Pope is placed low in the scale of these eight poets, it is clear that if we should consider him purely from the intellectual standpoint he would be placed in a somewhat higher position.

We know, however, that Pope was handicapped by physical infirmities which he inherited from both parents, and which made

DANTE [A]

POPE [47]

MILTON [45]

GOETHE [39]

BURNS [38]

SCHILLER [36]

BYRON [32]

LONGFELLOW [31]

it necessary for him to have assistance in dressing himself and even in walking. Hence we have one factor in his heredity that is smaller with him than with any other of the eight persons.

SCHILLER, BURNS AND SHAKESPEARE.

With Schiller we find that his father had a birth-rank higher than he did, a fact that would tend to raise him in the scale of mental capacity. With Burns we find that his ancestors had limited educational facilities, a fact that would act to bring him down in the scale.

Taking the two arrangements together, we find that a man's birth-rank is a very accurate gauge of his mental aptitude, but only a partially accurate gauge of his mental ability. We also find that when we add to the birth-rank the other factors that enter into a man's heredity, the combination of these factors gives us a remarkably accurate gauge of his mental powers.

Among poets comes Shakespeare, and I have previously shown that his birth-rank is somewhere between 31 and 40, and probably about 35 or 36. I have also shown that the birth-ranks of both of his parents are probably over 45. If there be any truth whatever in what our tables tell us, then this ancestry is the ideal one for producing such a character as Shakespeare. We have mental power developed in both parents by virtue of both being children of old grandparents, and in at least one case the accumulation extends back still another generation. We then have a case of in-and-in breeding from these two with the production at the time of life which produces the literary and poetical character. This ancestry is very similar to those of Goethe and Schiller, except that the mother was older and the mother's birth-rank was higher with Shakespeare than with either of the other two.

CHAPTER XI.

EMINENT FAMILIES.

Mr. Galton has given much attention to the inheritance of mental ability, especially in its relationship to great men. On page 74 of *Hereditary Genius* he gives a diagram of the eminent relatives of the most eminent men in one hundred families. This diagram shows that the closer the relationship is to an eminent man the greater are the probabilities that the related person will also be eminent. The principal part of this diagram may be tabulated as follows:

To the most eminent men of one hundred families,

Of the sons 36 per cent are eminent;
Of the fathers 26 per cent are eminent;
Of the brothers 23 per cent are eminent;
Of the grandsons 9.5 per cent are eminent;
Of the grandfathers 7.5 per cent are eminent;
Of the nephews 4.75 per cent are eminent;
Of the uncles 4.5 per cent are eminent.

THE FACTS AND THEIR MEANING.

Mr. Galton gives us these facts, but he gives us no explanation beyond the one that mental ability is hereditary. The sons of eminent men do not suffer from lack of educational opportunities nor social disadvantages. There is every reason why they should have become eminent if they had had the quality out of which eminence is created. In fact, with the opportunities that such sons have, "many a mute, inglorious Milton" would have achieved fame.

Most of the men who have filled large pages in the history of

the world have been men of more than ordinary ability, but many have been men who would not have been famous if they had not had social, political or military advantages such as come to few persons. It will be quite evident that when a man has such opportunities in this world as usually fall to the sons of great men it takes less mental ability to become eminent than when he has to achieve greatness by the force of his own mental powers. Why then, it may be asked, is it that only 36 per cent of the sons of eminent men succeed while 64 per cent fail? The answer is, of course, the mothers are not equal to the fathers, and it is consequently not to be expected that the sons will be better than an average of the two. There is much truth in this answer, but it is not a full answer, because of the sons of the same parents some become eminent and others do not. We will find a more complete answer in the ages at which these great men have produced their sons, and to this end I have analyzed a number of cases in which families have maintained their eminence through several generations.

THE BACH FAMILY.

This is a German family of musicians, and is the most celebrated for the number of its eminent men and the great length of time which it has maintained its eminence. There have been more than fifty eminent musicians in it, and their history covers a period of more than 200 years. The founder of the family was Veit Bach, who, about the year 1600, was driven out of Presburg, Hungary, by religious persecutions, and settled, with his family, in Germany. He had received a musical education, and was noted for his skill upon the guitar. The date of his birth is not given. His eldest son, Hans Bach, also received a musical education, and

was the progenitor of the larger number of those who became eminent as musicians. Hans died in 1626, and he either died young or his sons were born late in his life as will appear from the following diagram.

Veit Bach, d. 1619.

Hans Bach, b. about 1563; d. 1626.

Johann (1604) | Christoph (1613) [50?] | Heinrich (1615)

Johann A. (1645) [41] — Johann B. (1676) [31]

Georg C. (1642) [29] | Johann A. (1645) [32] — Johann Sebastian (1685) [40]

Johann C. (1643) [28] | Johann M. (1660) [45]

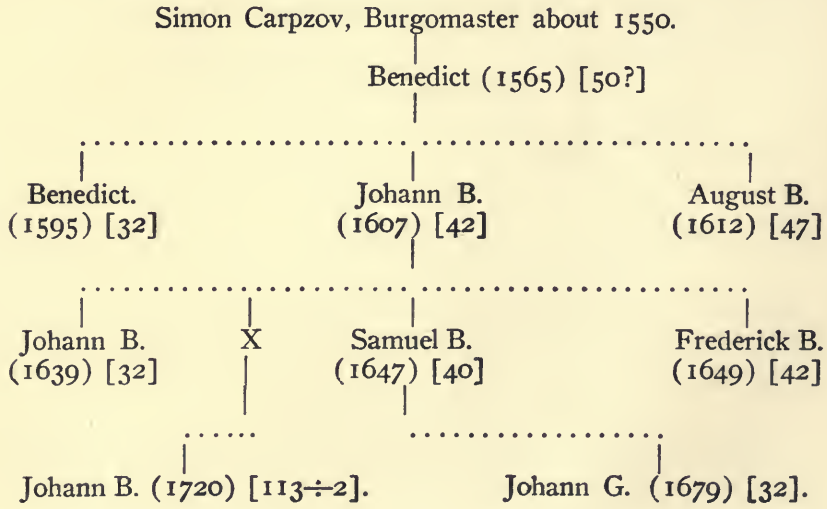
Johann E. (1722) | Wilhelm F. (1710) [25] | Karl P. E. (1714) [29] | Johann C. F. (1732) [47] | Johann C. (1735) [50]

Of these, Johann Sebastian (1685) [40] was "in some respects the greatest musician that has lived." His ancestry is medium, tending toward the old, which would make it conform with what I have shown as to the characters at different ages. His sons Wilhelm and Karl represent the earliest reproduction of those who are chronicled as being especially eminent. Their mother happens, however, to have been a daughter of Johann M. (1660) [45], who was Johann Sebastian's first wife. This appears to be an illustration of inheritance by sex, as Johann M. was, in many respects, a remarkable musician. Johann C. F. (1732) [47] and Johann C.

(1735) [50], tenth and eleventh sons respectively of Johann Sebastian, are noted as being the most eminent of their generation, as they are also the sons of the greatest reproductive age. Johann A. (1645) [41] is said to have been the "most noted" musician in his branch. If we take the entire series of which we have a record we find the average father's age to be 36 years.

THE CARPZOV FAMILY.

This is a family of learned Germans, more intellectual than the Bach family but less famous because law, theology and philosophy are less popular than music. The founder of the family was Simon Carpzov, who was burgomaster of Brandenburg about 1550. As a man is not likely to hold such a position before the age of 35, the rank of his son is presumed to be about [50]. Without counting this one, however, we find that the average father's age of all of those who are recorded is 42 years.



As this is a very unusual average, and as it is known that there were a number of other Carpzovs than those detailed in the Encyclopedia Britannica, it is only reasonable to suppose that the less eminent members of the family were those who were born during their fathers' early lives. Simon Carpzov, the founder of the family, was descended from a Spanish family by the name of Carpezano which was driven out of Spain by religious persecution early in the sixteenth century.

THE CARNOT FAMILY.

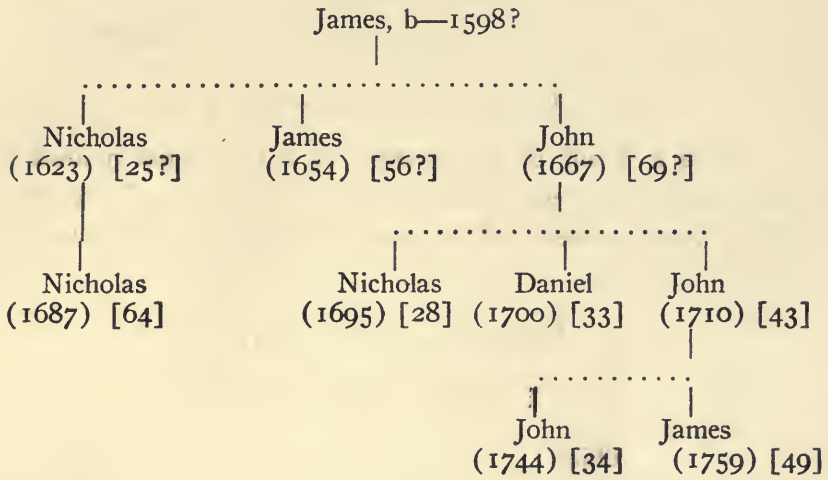
This is a family of French statesmen, the last of whom was president of the French Republic, and was assassinated in 1894. The average father's age for the six individuals is 39 years. It will be noticed that the line of eminence continues from that son of Claude Carnot (1719) [48], who in his turn had a son, Lazarre H. Carnot (1801) [48], born in late life. If we take the average of the line that continues to the president, we find it to be 41 years.

Edme Carnot (1671)
|
Claude (1719) [48]
|
Joseph F. (1752) [33] | Lazarre N. M. (1753) [34] | Claude Marie (1755) [36]
|
Lazarre Hippolyte (1801) [48]
|
Sadi N. L. (1837) [36]

THE BERNOUILLI FAMILY.

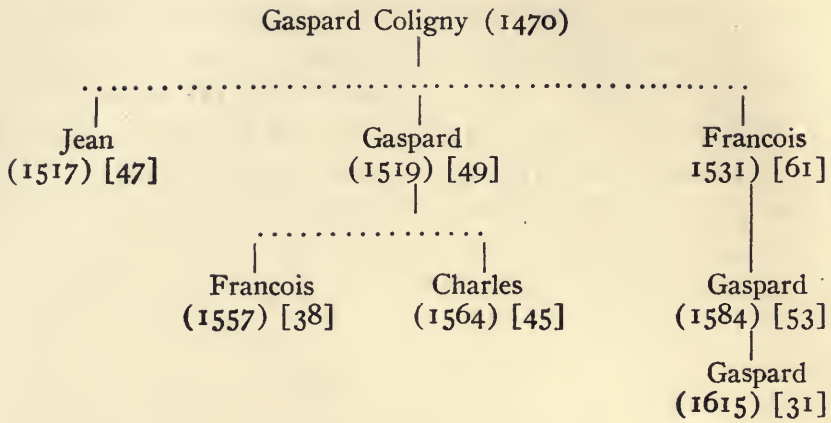
This is a French family of famous mathematicians. It begins with three brothers, in which we have the surprising difference in

ages of 44 years between the eldest and youngest. The eldest, who must have been born in his father's early life, had eleven children, of whom we have the record of only the one born when his father was 64. The youngest, who was the most famous and was classed with Newton and Leibnitz, had three sons, and the line of eminence was continued to the third generation only through the youngest of these. We have the birth-ranks of six of these individuals, and the average for the six is 42 years.



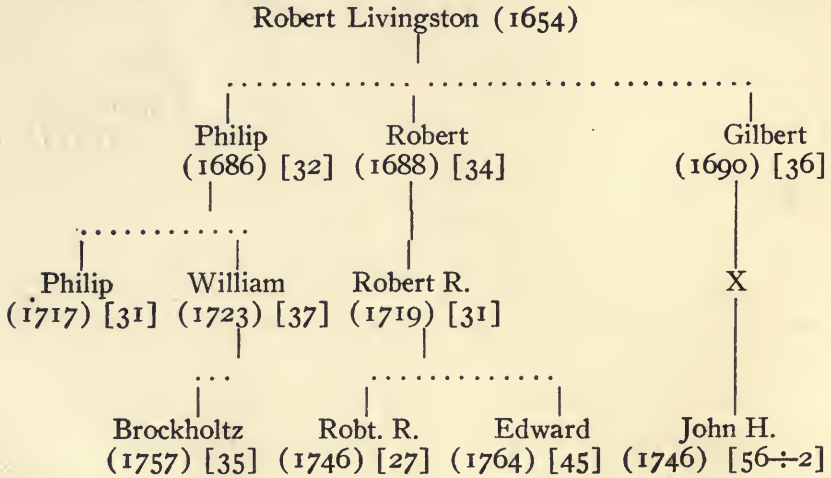
THE COLIGNY FAMILY.

This is a French family of statesmen and soldiers. The line begins with Gaspard Coligny, born 1470, who had three sons. The second of these, Gaspard (1519) [49], was the leader of the Huguenots. Here again we see the line continued through the slowest moving generations. The average for the seven known persons is 46 years.



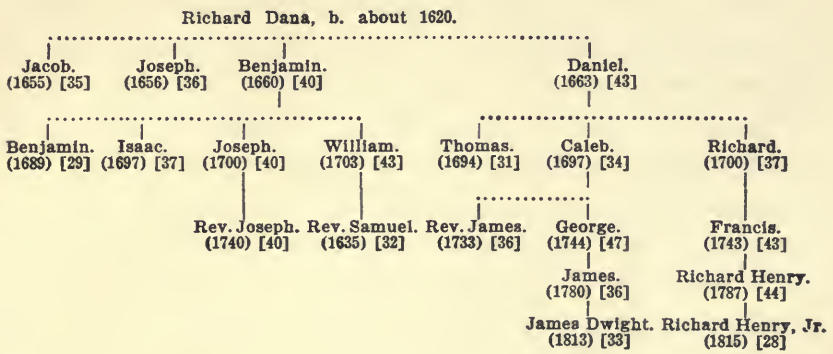
THE LIVINGSTON FAMILY.

This is a family of Americans who have become eminent in several lines. Of these William [37] and Edward [45] were more eminent than the others and they are the ones with the highest birth-ranks.



THE DANA FAMILY.

This is another American family which has furnished many eminent members. Here again we see the lines of eminence continued through the younger branches of the family, *i. e.,* through the late reproductions. Of the four brothers in the second generation, the two elder brothers have left no immediate descendants of whom we have record. The third brother had six descendants, of whom four may be considered eminent, while to the youngest brother are traced ten descendants, and among these ten are found the most eminent. The same general results may be traced in the Adams family, in the Lee family of Virginia, and among the Darwins, the Herschels, the Cannings, and the Sidneys.



THE BLISS FAMILY.

This family is not taken up for its eminence but for the purpose of determining which one of a man's grandsons is most likely to become a prominent citizen. The Bliss family was chosen for this purpose because the published genealogy of the family is unusually complete and is arranged for easy reference. For convenience the different members of the family will be represented

by the numbers used to designate them in the genealogy rather than by their names.

The family begins with three brothers who emigrated to America in the seventeenth century. These three brothers all had families, among the children of whom were seven grandsons of the English progenitor. These grandsons constitute a group, and when the word "group" is used in this connection it will mean an assemblage of persons who are all grandsons of one man, and who trace their descent through two or more brothers. They are in fact cousins bearing the same surname. These seven cousins were born between 1600 and 1645, and the only prominent individual among them was No. 19, the last born in point of time.

No. 20 had eight grandsons, the first born in 1673 and the last in 1702. The sixth was a lieutenant and the last was a captain. No. 29 had eight grandsons, the fourth being a "curious mechanic" and the last had "M. D." and "Hon." tacked to his name and was the founder of the school system of Connecticut. No. 32 had nine grandsons, the first born in 1704 and the last in 1734. The prominent ones were those born in 1727 and 1734. No. 44 had eight grandsons, of whom the fourth, fifth and seventh were prominent. No. 46 had fourteen grandsons, of whom the sixth, eleventh, thirteenth and fourteenth were prominent. These fourteen persons were sons of five brothers and three of the four prominent ones were sons of the only one of the five brothers who received a college education.

INFLUENCE OF THE COLLEGE GRADUATE.

No. 53 was a youngest son. He had a birth rank of [59] and his father had a birth rank of [42]. Of the seven grandsons of No. 53, the first one, and last two were prominent. The first was a

judge and the last was a general. The judge graduated at Yale and was the only one of the seven having the benefit of a college education. No. 130 was the son of No. 53 and was the father of the judge and the general. He had eighteen grandchildren, of whom the first three, the seventh, the fourteenth and the eighteenth were prominent. The first three born were all sons of the only person in the previous generation who received a college education and they represent the only case I have found in which the first three of any group all became prominent. They are a forcible illustration of the fact that the controlling factor is not the relative amount of time elapsing between generations but the aggregate amount of intellectual effort exerted in previous generations prior to reproduction. While being sons of a college graduate is the only path by which the first three of a group became prominent, it is not uncommon to find the last three prominent without any college education in the previous generation. This is the case with the grandsons of No. 68 and No. 84.

OTHER FAMILIES.

An examination similar to that made of the Bliss family was also made for the Crosby, Chapman, Eddy and other families. The general results were that when the first born of a group of cousins became a prominent individual there was almost invariably present one or more of three conditions:—first, all of the cousins were born at near the same date so that comparatively few years elapsed between the first birth and the last birth; second, the first born had advantages of education that the others did not have; and third, the first born was the son of a college graduate while others were not. When the last born of a group of cousins was prominent these conditions were more often absent than present. It is natural

that they should be, as these conditions applied to only a small portion of the population during the early history of America.

From the various families 47 groups of cousins (grandsons) containing 503 persons were tabulated by groups according to the order of their births. The smallest group had six individuals and the largest group had twenty-six. In the 47 groups

Of the first born	6	were prominent.
Of the second born	12	were prominent.
Of the third born	12	were prominent.
Of the third from last	19	were prominent.
Of the next to last	22	were prominent.
Of the last	20	were prominent.
Of the first born half	53	were prominent.
Of the last born half	93	were prominent.

These results show the distinct advantage arising from a child being born a long time after his grandfather was born. If we should eliminate from our table all of those who were sons of college graduates it would show a much greater disparity between the earlier born and later born portions, from which fact it must be evident that a college education in a previous generation materially affects the child's opportunities of becoming prominent.

THE CONDE FAMILY.

This is the name of a younger branch of the Bourbon family and is inserted here by way of illustration and not because its members were eminent for mental achievements.

One of these is called the great Condé, but it is not number 3 nor number 8, as might be presumed, but number 4. A little explanation will show the reason for this. The first Condé was the youngest brother of Antoine de Bourbon, and we may assume that

he had a comparatively high birth-rank. In addition to this we find that these brothers came from the youngest branch of the ducal family. We thus see that number 4 was the termination of four or five generations, in all but one of which the birth-rank was high. In number 3 there was a considerable accumulation from number 2, and as number 3 was active and slightly above the average age when number 4 was born, number 4 was an advance on number 3. The accumulated mental power of number 4 was run down to a

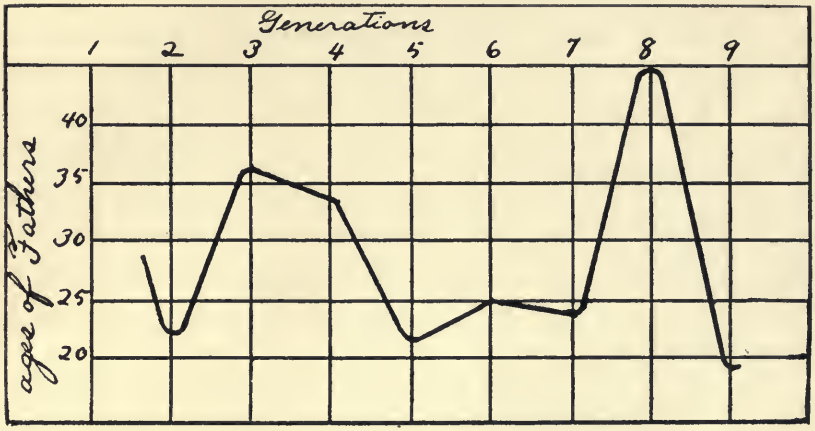


FIG. 10. BIRTH-RANKS OF THE CONDES.

low ebb by three successive births at early ages, with the consequence that one birth at a late age did not suffice to re-establish it. Number 3 and number 8 are, however, ranked next to number 4 in greatness, and much above the other members of the family. Number 7 is the least important of all of them, and he is the termination of three successive early reproductions. The one of next least importance is number 9, who was born when number 8 was only nineteen.

From these we may draw the general conclusion that two gen-

erations of late reproduction may support one generation of comparatively early reproduction, but that two generations of early reproduction are fatal to the maintenance of eminence. That two generations of late reproduction will not always accomplish this result we can readily see by studying some of the sons of great men.

GREAT MEN AND THEIR SONS.

Solomon, commonly called "the wisest man," was a late reproduction and inherited his ability from his father, David, who was also a late reproduction. According to the usual interpretation of the laws of inheritance, his son should also have been a wise man, but we do not hear that Rehoboam was a second Solomon. An inspection of the Bible chronology shows us that Rehoboam was born when Solomon was seventeen years of age. Rehoboam could not be the recipient of use-inheritance from Solomon, because at that age Solomon had not exercised his wisdom, and whatever Solomon acquired after his son was conceived could not possibly affect that son.

We learn that Buddha was a late reproduction, and also that his only son was born before he went forth on his mission. After leaving home he spent six years in one place, unknown lengths of time in two or three other places, and forty-five additional years in teaching. He died at about the age of eighty. From this it is quite evident that the son was born when Buddha was quite young.

BIRTH-RANKS OF GREAT MEN AND OF THEIR SONS.

GREAT MEN.		SONS.
	Ampere	25
A	Arkwright	23
49	Bulwer-Lytton	25
	Champollion	22

GREAT MEN.		SONS.
53	Coleridge	24
43?	Cromwell	27
A^3	Dibdin	26
	Draper	24
51	Franklin	23
	Hunt	26
44	Jay	28
	Kean	24
43	Mather	24
43	Peter the Great	18
43	Pugin	22
52	Solomon	17
	Stephenson	22

The accompanying table gives the birth-ranks of a number of the sons of great men, and also that of the men themselves when known. This distinction is sharp and follows the difference in mental ability. In his *"Hereditary Genius,"* Galton remarks that the Cromwell blood does not seem to have been as potent as was to have been expected. While we do not know Cromwell's birth-rank exactly, we know that he was a fifth child and that he belonged to a slowly moving line extending back five generations to a common ancestor with Charles I., whose line to the same ancestor was eight generations. We also know that his mother was 39 when he was born, and that his father was the second of four brothers, all of whom sat in Parliament before Cromwell's birth. We have seen that a birth-rank of 27 will sometimes produce eminent men, but as an ancestry as slowly moving as that of Cromwell is somewhat rare, it is not at all probable that his wife was as well endowed. Champollion had a brother thirteen years old, and Hunt was the youngest of a large family.

EFFECT OF PRIMOGENITURE.

The English aristocracy is governod by the law of primogeniture, which is a strict selection of the eldest of the eldest to inherit the title. Great care and pains are always taken to train and educate the heir to fill the position to which the law entitles him. When he grows to man's estate he has wealth, social position and political influence to assist him in any career he may choose. From this class England draws the majority of those persons who hold official positions at home or abroad. Many of these men have become prominent, some have become eminent and a few have become great, but in no case has the English nobility produced great men from the eldest of the eldest when that means successive reproductions at 25 years or less. In every case in which the nobility has produced a great man, or a man of more than ordinary ability, such production has been either an exceptional case of late reproduction or a break in the line of succession that brings in a collateral and younger branch. This is not because of any lack of early reproduction on the part of the nobility. A glance at "Burke's Peerages" will show that there is a plentiful supply. While I have not tabulated these men I have satisfied myself that a large part, if not the majority, of these eldest sons are born before the fathers are 30. I observed quite a number of cases in which the father was less than 25, and some in which he was less than 20. If, after all of the centuries during which the law of primogeniture[1] has held sway, and all of the advantages accruing to the men benefited by it, the English nobility cannot produce a great man except in the rare in-

(1) Primogeniture was recognized by the Hebrews, the Greeks and the Romans. In France it first appeared when the Capets came to the throne, but was abolished in 1789. In England it was first established at the time of the Norman conquest.

SEBASTIAN BACH [40]

CALIFORNIA INDIAN

stances in which their system fails to operate, where are we to look for the advantages of early reproduction? Perhaps we may look for it in the compensation that gives the material advantages to that member of the family least able to contend with the adversities of life. The trouble with primogeniture is, however, that the compensation is disproportionate to the mental differences. In any given family that does not extend from very early to very late reproduction, there is usually very little, and often no recognizable, difference between the eldest and the youngest. Except in cases of extreme difference it is only through successive generations that great results are reached. A single case of comparatively early reproduction does not eliminate the accumulation of several generations on both sides of the house, as we see in Alexander, Mohammed, Swift, Lincoln and Gray. Neither is a very great man produced in a single generation, but it requires two or three generations and more than a century of time.

CHAPTER XII.

RACES OF MEN.

Galton, in his *"Hereditary Genius,"* earnestly advocates early marriages as a means of rapidly multiplying the better class of the population, and thus raising the general standard of mental ability. He also advocates it on the theory that an early age of reproduction causes more generations to be alive at the same time, and gives more chances for "advantageous variations." Along with this he gives elaborate calculations showing mathematically the advantages of following this system. Also along with this plea for early reproduction and the mathematical demonstration of its desirability, he gives a table of eminent men and the family rank in which they were born in comparison to their brothers.

GALTON'S TABLE OF RELATIVE BIRTHS OF EMINENT MEN.

Only sons	11 per cent.
Eldest sons	17 per cent.
Second sons	38 per cent.
Third sons	22 per cent.
Later sons	12 per cent.

This table shows that 17 per cent of his eminent men (judges in this case) were eldest sons, 38 per cent were second sons, and 22 per cent were third sons. It may be considered as axiomatic that the number of second sons born does not exceed the number of eldest sons, and also that the fathers are older when second sons are born than when first sons are born. Where "eldest son" means elder of two sons as well as eldest of a number of sons, as it does

in this case, it is equally axiomatic that the number of eldest sons exceeds the number of third sons. Yet Galton does not perceive the inconsistency of advocating early reproduction and giving a table, compiled by himself, showing that eminent men are drawn in a much larger measure from late than from early reproduction.

AGE AT MARRIAGE.

The same plea for early reproduction as giving more opportunities for advantageous variation is made by Haycraft in his *"Darwinism and Race Progress."* Along with this plea he gives a table showing the average ages at time of marriage of different classes of people. This table is made up from the Forty-ninth Report of Births, Deaths and Marriages in England for 1884-5, and is as follows:

AVERAGE AGES AT MARRIAGES (ENGLAND, 1884-5).

OCCUPATION.	BACHELORS.	SPINSTERS.
Miners	24.06	22.46
Artisans	25.35	23.70
Shop Keepers	26.67	24.22
Professional Classes	31.22	26.40

This table shows a direct proportion between the intelligence of the classes and the ages at which they marry, yet, knowing that great men come principally from the educated classes, the man who gives this table takes a gloomy view of the matter and urges the professional and independent classes to compete with English miners in age of marriage.

Galton and Haycraft are not alone in advocating early reproduction as a means for improving the race. The same thing may be found repeated again and again, either by direct advocacy or by

implication, in the majority of the works on heredity, and the same inconsistency between advocacy and facts may often be found between the same covers.

OPPORTUNITIES FOR ADVANTAGEOUS VARIATIONS.

Advantageous variations occur in all parts of the world and among all races of men and animals. If it be true that early reproduction offers more opportunities for such advantageous variations, then we should look for such variations, and consequently the greatest men, because selection preserves advantageous variations, among those races of people who furnish the greatest number of such "opportunities." These people are the Digger Indians, the Fuegians, the Andamanese, the Bushmen, and some other of the degenerate and degenerating races. That I might be accurate in this matter I have carefully looked up the marriage customs of various races, as far as they relate to the age of reproduction, and will give examples of them in detail to make it clear what relationship they bear to each other.

THE ESKIMOS.

Though the Eskimo has a rude sort of intelligence from the savage standpoint, he is wholly illiterate and capable of only a very limited education. Extreme cold, like extreme heat, is said to cause early maturity, and boys and girls marry as soon as the husband is able to support a family. As hunting seals is the principal occupation, this usually occurs when the boy is about 15 or 16. The mothers nurse their children until about four years of age. Thus, while reproduction begins at a very early age, three or four children would carry the parents to a period between 25 and 30. The average age at reproduction is therefore some time between 20 and 25, probably about 23 or 24.

THE DIGGER INDIANS.

The Digger Indians of California are said to be the most degraded of all American races. They are not particular about their diet. If game or fish are not easily obtained, roots, or worms, or anything will do. Before the Spaniards came to America these Indians had no domestic animals, and have none now except a miserable breed of dogs. The girls usually marry at 13 or 14, though often as early as 12. They soon cease to have children, and rarely have more than five. The average age for reproduction is, therefore, about 19 for the women and 20 to 22 for the men.

THE FUEGIANS.

The Fuegians are the most miserable and degraded race in South America, and are comparable only to the Digger Indians of North America. They live in the rudest manner, wear almost no clothing, and subsist by hunting and fishing. "As soon as a youth is able to maintain a wife by fishing or bird-catching, and has built or stolen a canoe, he captures and carries off a bride." As these simple things are what he is taught from earliest infancy, and as there are no restraints on his reproductive propensities, he must begin pretty early, and the average age of reproduction is probably the same as with the Digger Indians.

THE PATAGONIANS.

In strong contrast with the Fuegians are the Patagonians, a race of people who are their close neighbors and near relatives, if we are to believe what ethnology tells us. The Patagonians are ranked as a high race of Indians, being intelligent, skillful and athletic. Marriage by force is unknown. The consent of the damsel

must be secured, and presents are exchanged between the groom and the bride's father. All this takes a certain amount of time, and must delay the date of marriage to an age two or three years later than with the Fuegians. The women are chaste, and as a consequence are able to produce children a good many more years than is possible with those that lack chastity. The fact that these two races, closely related to each other, should differ so remarkably in intelligence calls for some explanation. This explanation is furnished by the theory of use-inheritance in the difference between the ages at which they reproduce, and consequently the difference in the amount of time which the parents have to use and develop their mental powers before their children are born.

THE ANDAMAN ISLANDERS.

The inhabitants of the Andaman Islands are perhaps the lowest of all human beings. Living under a tropical sun, they arrive at maturity at a very early age. Their principal clothing is said to be a coat of clay to protect the skin from insects. They have no laws, religion, or village government. Marriage custom or morality there is none. They live together in communities of from fifty to eighty, and each woman is the common property of any man who may want her. With no marriages, no contests for exclusive possession, and no sense of virtue, reproduction naturally begins at the first physical opportunity. Flower calls them an "infantile" negro type[1]. They have names for only "one" and "two," though with the aid of their fingers they can count to ten. Since the British occupation they are dying out, and their place is being taken by a mixed breed. Here we have in the early reproduction of the

(1) Jour. Anthrop. Inst., 1879, pp. 132-133.

Andamanese all of the asked-for elements to produce rapid multiplication and advantageous variation that must necessarily be preserved by selection, yet these people are disappearing before the advance of the slowly reproducing Englishmen.

THE BUSHMEN.

The Bushmen are classed by ethnologists as a degenerate branch of the Hottentots, and are said to be to South Africa what the Digger Indians are to North America. Their food is anything that comes handy—worms, snakes, and roots being as acceptable as anything else. The men are not over five feet high. The women soon get wrinkled and excessively ugly, 30 or younger being the extreme limit of fair looks. The marriage relationship depends upon the will of the husband, and lasts as long as it suits his fancy. There is said to be no word in their language to express the distinction between married and unmarried women. All this tells the story of early reproduction and degeneracy.

THE HOTTENTOTS.

The Hottentots, though a low race, are relatively superior to their cousins, the Bushmen. The morality of the Hottentots is said to be fairly good. They have no marriage ceremony,—the husband simply purchasing a wife and taking her home. The necessity of making a purchase implies that the would-be-husband must accumulate some property before he can secure a wife, a circumstance that requires more time than is the case where the man simply helps himself without stopping to furnish a *quid pro quo*.

With the exception of the Patagonians and the Hottentots, which are inserted because of their relationship and by way of contrast, these races are the lowest of the low and are dispersed over

all parts of the world. In each case we either know that reproduction begins at about the age of 12, or that the circumstances are such that it begins at the earliest age nature will permit. With these races might also be classed the Negritos of the Philippine Islands and the Indians of Central America, and those scattered along the Amazon and Oronoco. In all of these the act of reproduction begins at a very early age.

THE AUSTRALIANS.

The Australians, though a low race, are said to be "far above the Fuegians." Their method of securing a wife is to find some female unprotected, knock her senseless with a club, and then, seizing her by a leg, arm or the hair, drag her home through the woods. To carry her would be too much consideration. An Australian thinks nothing of cutting, slashing or killing his wife for the most trivial affair. As a result it is rare to see a woman who is not covered with scars, and they usually live only a few years. The women are less numerous than the men, and are eagerly sought after. As it requires considerable prowess to secure a wife in this way, and as older men would have an advantage over youths, reproduction by the men is carried to a much later age than by the women. Just what, it would be difficult to estimate, but it must certainly be much later than with the races previously mentioned. Hartwig, speaking of the Australians, says:[2] "The old men manage to keep the females a good deal among themselves, giving their daughters to one another," and Broca says[3] that Australian women rarely conceive after the thirtieth year, an age which is the mid-position of our standard.

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(2) Wild Animals of the Tropics, p. 109.
(3) Phenomena of Hybridity, p. 58.

In the Australians we have all of the immorality of the Bushmen or the Fuegians, and much more of actual savagery, yet they are much more intelligent and have much heavier brains. There is between their superior intelligence and their social customs no conceivable relationship except the circumstances that bring about a later age of reproduction on the part of the father. Selection, if it acts at all, acts only to select those men who have had more years in which to use their brains, and not those which are simply advantageous variations.

AFRICAN TRIBES.

The M'pongwes are an ignorant, lazy and generally good-for-nothing tribe located on the Gaboon river, near the equator in West Africa. "Girls are frequently married at ten, mothers at fourteen and old women at twenty." A few hundred miles north of the Gaboon is Bornu, a large and semi-civilized kingdom on the western side of Lake Tchad. In Bornu, marriage is later than elsewhere in Africa, and usually occurs when the girl is 15 or 16.

SOUTH AMERICAN TRIBES.

In the northern part of South America the Indian tribes are little better than the Diggers. They are degenerating and gradually dying out. Chastity is unknown and reproduction begins at about the earliest possible age. "With the Moxos and the Chiquitos, premature marriages were such a settled order of things that there were no celebates above the age of fourteen for the men and twelve for the women. The Jesuit missionaries in South America had completely adopted the native custom, and they often married young girls and boys of ten and twelve years."[4] One tribe, however, the Acawoios, is superior to its neighbors. They practice agriculture,

(4) Letourneau, The Evolution of Marriage, p. 107.

tame wild animals and keep many pets. They are skilled canoeists and are the best makers of the ourali poison and the blow pipe. Early marriages are forbidden and the women are virtuous.

THE POLYNESIANS.

The Polynesians inhabit the numerous small islands of the Pacific. They are said to be mentally superior to any of the races so far mentioned. Living under a tropical sun, they mature at a very early age. Chastity not being one of their virtues, reproduction begins as soon as Nature permits.[5] Right at this point comes in a peculiarity that distinguishes the Polynesians from all other races. They practice infanticide, or at least have practiced it in the past, and the manner in which they practiced it was to kill the first three children born. Sometimes more would be killed up to eight or ten, but the first three seems to have been the general standard of practice. The result of this simply amounts to a postponement, of from three to ten years, of the time of actual reproduction. Here we have a race of people living under the same external conditions as the inhabitants of the Andaman Islands, equally if not more licentious in their practices, and commencing reproduction at an equally early age, but differentiating themselves by killing off all of the early product and retaining only the later. If it be said that the licentiousness and early reproduction of the Andamanese is due to their low intelligence and not the low intelligence of these practices, then what is the explanation of the vastly higher intelligence of the Polynesians who indulge in the same practices?

(5) Ratzel, in his History of Mankind, page 277 of the translation of Butler, says that if a Polynesian girl of ten or twelve has not found a husband she becomes the paramour of a man who keeps her until she can find some one to marry her. Letourneau, in his Evolution of Marriage, quotes the surgeon Roblet as saying that French sailors, when in Tahiti, were frequently offered girls of eight years, "and," he adds, "they were not virgins."

ANCIENT AND MODERN EGYPTIANS.

Rameses II, the greatest of the known pharaohs, was the son of Seti I when he was a comparatively old man. How old I have not found out, but circumstances would indicate that Seti I was about 50 when his son was born. Ptolemy II, previously mentioned, was also the son of an old man. From the fact that the Greeks and Romans reproduced late in life and were more or less associated with the Egyptians, we may safely assume that the ancient civilization of Egypt was also characterized by late reproduction. The present practice is far from being of that character. Marriage among the fellahs is a private affair and not a public ceremony. The men marry mere children, who are very rapidly worn out. When tired of his wife, the husband sends her home without formality. The Egyptians are known to be a race that is degenerating from a higher plane, and we can see the cause of it in the early age of reproduction.

INDIA.

The same thing may be said of the people of India, the early marriages of which are notorious. Not all Hindus marry early, and as the men retain health for many years, there are some births at comparatively late age. The aboriginal tribes of India (those which inhabited the land before the arrival of the Hindus) are a much lower class. Chastity is generally not a part of their morality. Among the aboriginal Warali, boys marry at 16 or 17 and girls at 12 or 13.

NORTHERN AFRICA.

The Touaregs of the Sahara and the Kabyles of Algeria are neighbors. Among the Touaregs the women know how to read and write, and it is to them that we owe the preservation of the

Lybian and the ancient Berber writing. They seldom marry before the age of 20. The Kabyles are very much inferior in every respect, and it is their practice to marry their girls at the ages of 8 to 12.

EAST AFRICA.

"The Masai of East Africa are a proud race, with strict laws and aristocratic organization, and they guard the purity of their maidens with jealousy; their neighbors, the Wakamba, are a scattered and subject-race, which is indifferent to the morality of their girls, who stroll about without a rag on."

CENTRAL ASIA.

The Afghans marry at 18 to 20 for men and 16 to 18 for women. In Kafirstan the men marry between 20 and 30 and the women from 16 to 17. In Thibet the ages are 20 to 21 for men and 15 to 20 for women.

THE CHINESE.

The Chinese encourage early marriages, and it is said that a bachelor of 20 is an object of contempt. We have previously found that Confucius was the son of a very old man, but the descendants of Confucius have been more rapid in their generations. There have been more than 80 of them since his time, which would make the average period between generations about 28 to 30 years. Heredity, as ordinarily interpreted, would say that the descendants of such a great man should also be great men, but we can see in the rapidity of their generations the reason why they are not.

REVIEW OF THE RACES.

In general it may be said that wherever there are no restraints

upon the sexual propensities, as with the Digger Indians, the Fuegians, the Andamanese, the Wauraus of the Guianas, the Bushmen, and the tribes along the Gabbon river, there we find reproduction taking place at the earliest possible age, and the lowest grade of intelligence. Where we find some special circumstances or customs that delay the age at which reproduction takes place, as with the Patagonians, the North American Indians, and the Polynesians, there we find a considerably higher grade of intelligence. Where we find the custom of marrying late in life, as was customary with the Greeks and the Romans, there we find a very high grade of intelligence. And where we find a fortuitous succession of very late births, there we find the very great men of the world's history. In other words, the longer the time in which the individuals have in which to use, develop and strengthen their brains before reproduction begins, the greater and more powerful are the brains of their descendants. By referring to page 51 it will be seen that this is but a slightly different statement of the laws as formulated by Lamarck nearly a hundred years ago.

CHAPTER XIII.

DEGENERACY.

Degeneracy is a term used to express a tendency toward a development less perfect or less advanced than that which is normal or healthy. Among the lower animals it is usually used to designate certain forms of parasitism in which a previously active animal attaches itself to a "host" and then degenerates into an animal capable of existing only as a parasite. In man the word degeneracy is used to express any retrograde condition, such as a deformity, or any congenital weakness of body or mind. Thus, idiots, insane and weak minded persons, epileptics, and the criminal and pauper classes are designated as degenerates.

In some experimental studies into the causes of degeneracy,[1] which were continued for a period of five years, Charin and Cley innoculated rabbits with the bacillus of blue pus and its toxins. The results were not uniform, but the most frequent results were sterility, abortion, or immediate death of the progeny. Occasionally the offspring survived, and in rare instances they were healthy. Two rabbits were born of a couple of which the male alone was innoculated with a sterilized culture. Five rabbits were born of these two, of which two were normal, a third was deformed and died in a few days. In the remaining two the ears were mere fragments and one leg of each was much shorter than the other, and ended in a stump without foot or toes. In other cases the bones were shortened and provided with enormous ends.

(1) Transactions de l'Institute Pasteur, 1896.

TRANSMISSION OF ACQUIRED DISEASES.

This shows that hereditary degeneracy may arise in rabbits, from disease acquired by ancestors, and that the degeneracy may take any one of a variety of forms. The same results occur with man when the parent acquires disease or suffers from accidents. Talbot gives[2] a large number of cases of degeneracy occurring among children born after the parents had become inebriates, four after the father had been sunstruck, two where the mother had suffered from a railroad accident, two cases where parental nervous exhaustion came from typhoid and typhus fevers, and two others from nerve exhaustion. He also quotes[3] a case reported by Kiernan in which father and mother (both of healthy stock) were overcome by sunstroke which resulted in changing the characters of both. The children born before the sunstroke were healthy, but a year subsequently the woman had triplets, one of which died from convulsions soon after birth. The second, a girl, became an epileptic at the age of two, a prostitute at 16, and chronically insane at 20. The third triplet became a puberty lunatic at 16. Of three other children subsequently born, two became epileptic and one a moral imbecile.

HEALTHY AND UNHEALTHY DEVELOPMENT.

A deduction from the theory of use-inheritance, especially in view of what has been shown in regard to mental aptitudes, is that degeneracy as well as intellectual strength should appear most commonly in the children of old parents. But this fact does not give any warrant, as has been assumed by several writers on heredity, for linking great mental ability with degeneracy as kindred abnormalities, because one is the result of healthy development and the other

(2) Degeneracy, p. 106.
(3) Degeneracy, p. 139.

is the result of unhealthy development. We have plenty of instances in which degenerate children have come from feeble, exhausted or nervous parents, but we have no such instances in cases where the parents, grand-parents and great-grand-parents have all retained full health and vigor during the entire reproductive period. The cases given substantiate this deduction, and innumerable other cases of the same character might be added. One will be sufficient as it differs from the others in that it shows the effect of age without any accompanying evidence of injury or sickness.

Talbot states[4] that Kiernan has had under observation the case of a Nova Scotian mother of Scotch extraction who bore children till the age of 63. The children born before the age of 50 were all normal and lived to an average age of 60. There was no birth between the ages of 50 and 56, but at the latter age a son was produced who had ear, jaw and skull stigmata, and who became a periodical lunatic at 25. A year later was born a son who was a six-fingered idiot. The next three children became paralytic idiots in infancy. The next was a periodically sexual invert female. The last child was an epileptic.

These last cases of degeneracy show the results arising from the physical decay of old age and are precisely what the law of use-inheritance would call for. There are, however, certain cases of degenerate families which require additional explanation and, for this purpose, I cannot do better than to commence with the following example:—

THE "ISHMAELS" OF INDIANAPOLIS.

Oscar C. McCullock, speaking of the descendants of a pauper family named "Ishmael," in the city of Indianapolis used the following language:

(4) Degeneracy, p. 91.

"We start at some unknown date with 30 families. These came mostly from Kentucky, Tennessee, and North Carolina. Of the first generation—of 62 individuals—we know certainly of only three. In the second generation we have the history of 84. In the third generation we have the history of 283. In the fourth generation—1840-1860—we have the history of 644. In the fifth generation—1860-1880—we have the history of 179. In the sixth generation—1880-1890—we have the history of 57. Here is a total of 1,750 individuals. Before the fourth generation—from 1840 to 1860—we have but scant records. Our most complete data begin with the fourth generation, and the following are valuable. We know of 121 prostitutes. The criminal record is very large—petty thieving, larcenies chiefly. There have been a number of murders. The first murder committed in this city was in this family. A long and celebrated murder case, known as the "Clem" murder, costing the state immense amounts of money, is located here. Between 1868 and 1888 not less than $5,000 has been paid for 'passing' these people from place to place, each township officer trying to throw off the responsibility. The records of the city hospital show that—taking out surgical cases, acute general cases, and cases outside the city—seventy-five per cent of the cases treated are from this class. The number of illegitimacies is very great. The Board of Health reports that the number of stillborn children found in sinks, etc., would not be less than six per week. Deaths are frequent and chiefly among children. The suffering of the children must be great. The people have no occupation. They gather swill or ashes; the women beg, and send the children around to beg; they make their eyes sore with vitriol. In my own experience I have seen three generations of beggars among them. I have not time here to go into details, some loathsome, all pitiable. One

evening I was called to marry a couple. I found them in a small room with two beds. In all eleven people lived in it. The bride was dressing, the groom washing. Another member of the family filled a coal-oil lamp while burning. The groom offered to haul ashes for the fee. I made a present to the bride. Soon after I asked one of the family how they were getting along. 'Oh, Elisha don't live with her any more.' 'Why?' 'Her husband came back and she went to him. That made Elisha mad, and he left her.' * * * *

M'CULLOCK'S DEDUCTIONS.

"A few deductions from these data are offered for your consideration. First, this is a study into social degeneracy, or degradation, which is similar to that sketched by Mr. Lankester. As in the lower orders, so in society, we have parasitism, or social degradation. There is reason to believe that some of this comes from old convict stock which England threw into this country in the seventeenth century. We find the wandering tendency so marked in the case of 'Cracker' and the 'Pike' here. 'Movin' on.' There is scarcely a day that the wagons are not to be seen on our streets; cur dogs; tow-headed children. They camp outside the city and then beg. Two families as I write have come by, moving from north to south and from east to west 'hunting work,' and yet we can give work to a thousand men on our gas trenches.

"Next, note the general unchastity that characterizes this class. The prostitutions and illegitimacies are large; the tendency shows itself in incests and relations lower than the animals go. This is due to the deprivation of Nature, to crowded conditions, to absence of decencies and cleanliness. It is an animal reversion which can be paralleled in lower animals. The physical depravity is followed

by physical weakness. Out of this come the frequent deaths, the stillborn children, and the general incapacity to endure hard work, or bad climate. They cannot work hard, and break down early. They then appear in the county asylum, the city hospital, and the township trustee's office.

"Third, note the force of heredity. Each child tends to the same life, reverts when taken out."[5]

RAPID REPRODUCTION OF CRIMINALS AND PAUPERS.

In 1820 Indianapolis had only fifteen families, so these thirty families must have come at some later date. From 1820 to 1890 is only 70 years, yet at the latter date there is the criminal or pauper history of 57 persons in the sixth generation. Mr. McCullock says he has personally known three generations of beggars among them, and his details give less than 20 years to a generation. This is early reproduction accompanied by low mentality, vice and pauperism, and is in marked contrast with the case of Franklin in which there was robust health, great mental power and a period of 108 years from the birth of Franklin back to the birth of his grandfather.

THE "JUKES."

Another and more famous family of criminals and paupers is given by Dugdale.[6] In this case the first generation is not definitely located, but the second generation consists of five sisters who were born some time before 1770. Within a little more than 100 years from this time there had been registered 540 criminal and pauper descendants from these sisters, and the total number of their descendants was estimated at about 1,200. The first birth in the third

(5) Quoted by Jordan: Foot-Notes to Evolution, p. 304.
(6) The Jukes.

generation was in 1784 and was the illegitimate son of "Margaret, the mother of criminals." This son (Gen. 3) had, when at the age of 15, a son (Gen. 4), who, between the ages of 24 and 51, had nine children (Gen. 5) by a syphilitic harlot. The mother of these nine children had two bastard children before her marriage and finally died in the poor-house of syphilis. Seven of these nine children were under 16 years of age when their mother died, and were left in the poor-house to grow up and form poor-house associations. The eldest son of this syphilitic mother was sent to Sing Sing for rape on his niece (age 12) and, while he was there, his wife had a bastard son. The next three sons all married harlots, and the other four were criminals, paupers and syphilitics. A daughter of this woman acted as a procuress for her own eldest son of a girl of 12, whom he was subsequently forced to marry.

REGISTERED "JUKES."

Generation 2.....	5 persons	Generation 5.....	224 persons
Generation 3.....	34 persons	Generation 6.....	152 persons
Generation 4.....	117 persons	Generation 7.....	8 persons

RATE OF REPRODUCTION AMONG THE "JUKES."

This is the slowest moving branch of the family that I have found among these recorded by Dugdale, and it is given as a sample of what characterizes the mass of these 540 persons. For the most part the children were produced at an early age. One girl was a mother at 12, and others were mothers a very little older. One boy contracted syphilis at the age of 13, and was a pauper and petit criminal through life. He was born when his father was 18 and the father was born when the grandfather was 20. His mother was a syphilitic quadroon and second cousin to her husband, who was

a white man. He had four children. The average known harlotry of the women of five generations is 52.4 per cent.

DUGDALE'S CONCLUSIONS.

Dugdale draws a number of conclusions from his investigations, of which I will mention only a few.

1. Crime as compared to pauperism indicates vigor.

2. Pauperism is an indication of weakness of some kind, either youth, disease, old age, injury, or, for women, child-birth.

3. The eldest child tends to become the criminal of the family and the youngest child the pauper.

4. The younger children are more likely than the older ones to become inmates of the poor-house through the misconduct or misfortune of parents. They domesticate themselves there and spontaneously return when emergencies of life overtake them. On the other hand, children old enough to provide for themselves are forced by necessity to rely upon themselves, and in consequence are less liable to become paupers in old age.

THE REAL EXPLANATION.

It remains for us to interpret these conclusions in the light of the ages of parents at the time the children are born. The class here being treated of are illiterate, very few being able to read or write, are vicious, intemperate, licentious, and frequently acquire venereal diseases. Among such a class, a person born healthy reaches his best physical development not far from the age of 25, after which there comes a decline due to intemperance, sexual excesses or disease. As a consequence, children born early in the life of such parents are physically more vigorous than those born when their parents are at an age at which healthy people are in their

prime. Such vigor is, however, relative rather than actual. Even when the parents are born healthy, children produced after the age of 30 are more than likely to be tainted with degeneracy arising from parental viciousness. It thus happens that among this class of people the only persons liable to be physically vigorous are the eldest of the eldest in steady procession.

Crime and pauperism may be considered as the practical protests of persons incapable of meeting the competition of their fellow men, because no man will go into crime or pauperism unless it appears to him as the easiest solution of his difficulties. This is but another form of Herbert Spencer's principle that human actions follow the lines of least resistance. When this inability to compete in the struggle of life comes from a weak intellect combined with a comparatively vigorous body, the protest takes the aggressive form of crime; when it arises from physical defects and lack of energy it takes the humbler form of pauperism.

THE GENESIS OF CRIME AND PAUPERISM.

These degenerate classes have been much studied with a view of learning the causes of degeneracy and the application of remedies, but up to the present there has been little more than an accumulation of partially understood facts. In some cases the family history of degenerates has been traced through six or seven generations, but beyond this the history has been lost in the mists of the past and the real origin has not been found. The most that is known is that degenerate classes, and classes low in the scale of intelligence, continue indefinitely in the same stage.

In the absence of definite records showing the origin of degenerate families we will construct a hypothetical genealogy of one. There occurs, as is frequently the case, an early reproduction, say

at 14 or 15 for the mother and 15 or 16 for the father. This offspring of childish parents happens, by fortuitous circumstances, to unite at an early age with some person of the opposite sex who has been produced in the same manner. From this union we have a third individual who is the product of immature parents, and whose parents are both products of immature grandparents. This child is healthy so far as freedom from disease goes, but, from what has been previously shown, we know that he, or more probably she, will lack something in physical stamina and very much in mental capacity. At this point we will refer to our typical and hypothetical ancestor and carry his characteristics back to an early age.

AGE OF ACUTE SEXUALITY.

From the time of puberty to the age of twenty, the sexual instincts are acute and intense. Unless the mind be kept pretty steadily at studies, or on some subject that will attract the attention, the thoughts of the boy or girl will dwell much more on persons of the opposite sex than upon other things. As a consequence the period of adolescence is a period of sexual intensity and passion, and a child born of parents at this age has the sexual instincts abnormally developed, the same as we have aggressiveness from parents of 25, the love of the beautiful from parents of 35, reasoning and practical usefulness from parents of 45, and morality and philosophy from parents over 50.

Returning now to our hypothetical child, we have a low grade of intellectual capacity with its accompanying low appreciation of morality, together with acute sexual characteristics, all of which have their origin in the series of early reproductions. If this child be a female, and the ordinary opportunities arise, she will doubtless begin at an early age to produce illegitimate offspring. The

earlier of these children will doubtless be physically healthy, but they will inherit the accumulated mental and moral obliquities of their parent. The sexual passions of such a parent lead to sexual excesses, to exhaustion and to disease, with the result that the later children are even worse than the first. We then have launched upon the world another family of "Jukes" or "Ishmaels" with all of the consequences that such families involve upon the community.

Although this hypothetical case does not represent any definitely known instance, it is no fancy sketch but an actual representation of what may and does occur. Every one knows of some such instance of early reproduction, and it would not be at all remarkable to have two of them unite to produce a third.

Among the better classes, especially the better educated classes, such early reproductions are rare, though not always non-existing, but in the slums of our large cities, and in many groups of our laboring classes, they are quite common. It is from the females of these early reproductions that are recruited the great mass of our prostitutes, and it is due to the sterility engendered by prostitution that the spread of degeneracy is checked. If we could save these girls from prostitution and get them early married, we would soon have a decaying race of people.

CHAPTER XIV.

LOWER ANIMALS.

Tracing the effect of age of parent before reproduction, in the development of mental ability, need not be confined to man. The same result may be shown in the whole animal kingdom from the highest to the lowest. It is my purpose, in the present chapter, to compare various animals with each other very much as I have compared the different races of men. In doing this I am somewhat hampered by the want of accurate data, but I have been able to secure enough to give a fair idea of the operation of the law of use-inheritance. In making comparisons involving the ages of parents, due consideration must be given to the size and bulk of the animals, the degree of their activity, and the conditions under which they exist. Thus, a comparison between a mouse and a tortoise for age would not be legitimate unless due consideration be given to their relative sizes and their relative degrees of activity. It is also quite evident that a cow, which has little to do but eat, sleep and reproduce, lives under quite different conditions from a deer, which has to seek its food and keep on the alert against enemies. For these reasons I have restricted my comparisons as much as possible to animals of the same size, and have noted the other differences so that the effect of age before reproduction may receive its proper consideration.

THE APES.

Next to man, the anthropoid apes are the highest of all animals. Of the gorilla I have not been able to learn at what age he arrives

at maturity nor how long he lives. Huxley states[1] that the orang-outan is not believed to be adult before the age of ten or fifteen. In writing at a much later date, Prof. Hartmann says[2]: "It is not yet ascertained at what age the orang becomes capable of propagating his species, nor how long the female continues to bring forth young. * * * The young, which are slow in coming to maturity, live long under the protection of their mother." Wood states[3] that the chimpanzee reaches "perfection of development" at the age of nine or ten. We are not informed what "adult" and "perfection of development" in these connections mean, but, applied to man, they would mean about 25 years. We may therefore assume that the orang and the chimpanzee begin to breed at about seven or eight, and that the average age of reproduction is about 15 to 18. While this is only an estimate from very meagre data, it cannot be far wrong.

THE HORSE.

The horse is, with the possible exception of the dog, the most intelligent of domestic animals. He reaches maturity at the age of 4 or 5, and lives beyond 20, and in rare cases beyond 30. He is able to, and does, breed at an early age. The stallion Hambletonian commenced in the stud at the age of 2 years and continued till the age of 26[4]. Mr. William Day, writing in 1888 of the English thoroughbred horses, says[5]: "The three best stallions this generation has seen—perhaps, indeed, the best ever seen—are Touchstone, Voltigeur, and Stockwell." These three stallions are

(1) Man's Place in Nature, 1863, p. 34.
(2) Anthropoid Apes, p. 248.
(3) Mammalia, p. 23.
(4) Helm, American Roadsters, p. 178.
(5) The Horse, p. 214.

descended in three lines from Eclipse, foaled in 1764, and are 5, 6, and 7 generations respectively from their ancestor. The shortest period from one generation to the next, in any of these lines, is seven years, and the longest is nineteen years. The average time per generation from Eclipse to Touchstone is 13.40 years; to Voltigeur is 13.83 years; and to Stockwell is 12.14 years. From these three stallions down to their three most prominent descendants, the average is 13 years. Sanders gives[6] the ages of sires for 56, and the ages of dams for 53, famous stallions and trotters. From this table I find that the average age of sires at birth of their offspring was 13.18 years, and the average age of the dams was 9.85 years. If, however, we omit the dams of stallions and take only the dams of trotters, we find the average age rises to 10.55 years. In only six cases out of 53 was the dam less than 7 years of age. From these we may conclude that a stallion is at his best between the ages of 10 and 15 and that a mare is best between 8 and 12. We also notice that the dams of performers are somewhat older than the dams of horses known only as sires.

PARTICULAR HORSES.

To discover what there might be in this I looked up the ancestry of several performers, of which Goldsmith Maid may be taken as a sample. In the ancestry of this great trotter I find mention of four "old mares" and one "mare" about which there is no statement of age. One of these "old mares" was 13 and another, the dam of Goldsmith Maid, could hardly have been less than fifteen. The paternal ancestry of Goldsmith Maid is 5-3-26, from which we see that there were two reproductions from young sires mated with old mares, the dams in each case being old. In this case we evidently

(6) Horse Breeding, p. 161.

have use-inheritance accompanied by inheritance by sex. The followers of Wiesmann tell us that the trotting horse has been produced solely by selection and not at all by the results of use-inheritance. On the contrary, the men who have bred our great trotters tell us that no great trotters have been produced except from mares who have seen much hard service, and they give us many examples to substantiate the assertion. "The famous old pacing mare Pocahontas paced some of the hardest races of her life in the winter of 1853-4, and her great son, Tom Rolfe, was foaled a few months afterwards." Auracaria was foaled by Pocahontas when she was 25 years old and, "contrary to what might be expected, this daughter of her old age herself became a great brood mare, producing, among others, the grand race horses Chamant and Rayon D'Or.[7]" Sanders also tells us[8] that "it is notorious that females that breed too early fail to attain their full size and development. Above all, the system of breeding from immature animals should not be continued from generation to generation, as that can only tend to accumulate and intensify the evil."

THE FASTEST TROTTERS IN THE WORLD.

In examining the pedigrees of the 132 fastest trotting horses in the world I found the average age of the sires to be 10.20 years, and the average age of the dams to be 9.20 years. The average age of the grandsires was 12.86 years, and of the grandams it was 9.88. For great-grandsires it was 13.14 years, and for great-grandams it was 10.56 years. These results are averages from a total of 1,239 sires and dams, and they illustrate the fact that while the son of a comparatively young sire may develop considerable speed

(7) Sanders, Horse Breeding, pp. 178-9.
(8) Ibid., p. 174.

as a trotter, he is at a distinct disadvantage when it comes to the production of speed in the next generation. In fact, all of the very great sires, with one exception, have themselves been sons of unusually old sires. Hambletonian, the greatest of all sires and from whom are descended practically all of the horses exhibiting excessive speed as trotters, was foaled in 1849 and was the son of a horse 26 years of age. The average age of the six known sires in the pedigree of Hambletonian was 20.3 years, and those of the five known dams averaged more than 15 years. No other known horse is descended from such a uniform series of old sires and old dams.

THE GREATEST SIRES OF SPEED.

In this examination I found five horses which stood out preeminently as appearing more frequently in the pedigrees of performers than did other horses. The ages of the sires of these five horses averaged 18.6 years, and the ages of their grandsires averaged 21 years. These extraordinary ages appearing in preceding generations and serving as a basis for speed in succeeding generations are confirmatory of what is only partially shown in man, and furnish an explanation of why some of our eminent men have been sons of comparatively young men.

The one exception of a great sire not being the son of an old horse is the case of George Wilkes, and is exceedingly instructive. George Wilkes was the son of Hambletonian when seven years old. He was a small horse, was sneered at as "a pony," and not being considered of much value for breeding purposes was kept as a racing stallion. During the first seventeen years of his life he was trained and raced more than any other stallion that ever lived. Having outlived his usefulness as a race horse he was sent to the stud as the only thing to be done with him, and during the few remaining

years of his life he became the progenitor of more horses of extreme speed than any sire except Hambletonian.

It is part of the history of the trotting horse during the nineteenth century that those stallions which were selected for their fine qualities for breeding purposes and were kept without being trained, never produced anything of value, while those stallions which were not highly esteemed, but which were regularly trained, became the progenitors of great speed in the second and third generations.

TRANSMISSION BY SEX IN HORSES.

The records for trotting horses enable us to trace in them the transmission by sex of acquired functional capacity. Fifty years ago it was considered detrimental to the breeding value of a stallion to use him for racing purposes. Those used in the stud were not raced and those raced were not used in the stud. This prejudice did not extend to mares, and the result was that the most famous trotters were mares. During more recent years there has been a change of sentiment in this regard, and stallions are now both bred and raced. Under these conditions the extra age of sires as compared to dams is beginning to tell, and stallions are now slightly more speedy than mares.

In examining the pedigrees of fast horses I found that the sires of fast stallions were older than the sires of fast mares, and that the dams of fast mares were older than the dams of fast stallions. With some minor exceptions at fragmentary portions of the pedigrees, this peculiarity is found to extend to the grandsires and granddams, and to the great-grandsires and great-granddams. In other words, very fast stallions arise as the result of a fortuitous combination of old sires, and very fast mares arise as the result of a fortuitous combination of old dams.

When these pedigrees were examined for activity rather than for age, it was found that the sires, grandsires and great-grandsires of fast stallions were more highly trained than were the sires, grandsires and great-grandsires of fast mares. It was also found that the dams, granddams and great-granddams of mares were more highly trained than were the dams, granddams and great-granddams of fast stallions. These facts show that the development acquired by training is transmitted by sex. This is further exemplified by the fact that George Wilkes, the most highly trained of all stallions, appears almost invariably as grandsire or great-grandsire in the straight male line. In other words, he transmitted excessive speed to the third and fourth generations only through his sons.

THE RELATION OF AGE AND TRAINING IN SIRES.

Because the sires of fast stallions are both older and more highly trained than are the sires of mares, it may be assumed that the highly trained horses appear as the old horses, but such is not the fact. When the sires in the pedigrees of stallions were sorted out for both training and age, it was found that whenever comparatively young sires appeared in the pedigrees they were the highly trained ones, and that whenever sires appeared which were not highly trained they were old ones. The same thing is true of the dams in the pedigrees of fast mares. These facts show that to produce fast horses the progenitors must be developed either by severe training or by the allowance of a sufficient amount of time for the development to be acquired by moderate training.

While the results found for the thoroughbred stallions and for the list quoted from Sanders indicates that the best age for stallions is about thirteen years, my own personal investigations into the

pedigrees of the fastest trotting horses in the world and published *in extenso* in "The Horseman," Chicago, Dec. 2, 1902, shows that a stallion is at his best at some age beyond twenty. The reason why this does not appear in examining the pedigree of any horse is because stallions of such great age have produced very few foals, and it is impossible to find any horse descended from a line of such old sires. The nearest approach to it is in the case of the greatest of all stallions—Hambletonian. His own sire was 26 and his great-grandsire was 28. Cresceus, the fastest trotting stallion in the world at the present day, is the son of a horse 23 years old, and he has another [23] and a [22] in his immediate ancestry, though not in the straight male line.

REPRODUCTION EARLIER IN COMMON HORSES THAN IN BLOODED STOCK.

What has been given clearly shows that age plays an important part, and that the parents do something more than simply transmit germ plasm identical with that which they received. The result also shows what is best for the horse from a purely physical standpoint. These ages apply, however, only to fine blooded horses and do not represent what actually takes place with horses in general. From a variety of sources I estimate the average age of reproduction for all horses to be about seven years for the dams, and eight or nine years for the sires.

CATTLE.

The cow is of about the same size and weight as the horse, and is domesticated under almost identical conditions, but the cow is not classed as among the intelligent animals. She comes to the breeding age a little earlier, and does not last as long as the mare. "It has been our custom for many years, for dairy purposes, to

breed our heifers at fifteen or seventeen months, so as to cast their first calves at two years or twenty-six months of age, and we have found a decided advantage in it."[9] The same authority says of bulls: "they should not be used, other than sparingly, at less than two years."[10] At the other extreme we find that the short-horn cow, Young Mary, had fifteen calves and died at 21, and that Old Comely, the dam of the celebrated bull Twopenny, was killed at the age of 26. But such instances of longevity among cattle are rare. I find, however, that some of the very best of the blooded stock are the produce of unusually old animals. The celebrated bull Favorite (252 English Herd Book) was calved in 1793. When 10 years old he got Comet (155 E. H. B.), the famous 1,000 guinea bull; and the next year got North Star (458 E. H. B.), another famous bull.[11] The bull Cotmore (376), who is said to have been "one of the finest bulls ever seen," was the son of Sovereign (404), when at the age of 15 years.[12] These are said to be extreme ages and not at all representative of the ordinary practice. A fair idea may be obtained from Allen's remark[13] that "some men have a strange notion that after a bull arrives at the age of 4 or 5 years, he should be discarded." I estimate the average age of reproduction for cattle at 4 or 5 years, but that the best age is about 3 or 4 years more than this.

DOGS AND SHEEP.

The dog, which vies with the horse as being the most intelligent of domestic animals, reaches maturity at two or three years of age,

(9) Allen, American Cattle, p. 260.
(10) Ibid., p. 263.
(11) Allen, American Cattle, p. 264.
(12) Miles, Stock Breeding, p. 163.
(13) American Cattle, p. 264.

and lives to ten or fifteen, and sometimes to over twenty, and one has been known to live to thirty-four. Owing to the conditions under which the dog is kept, he does not usually breed before 3 or 4 years old, and his average age of reproduction must be about 7 or 8 years. His association with man and the instruction given him when young, makes him mentally more active than the horse.

The sheep, an animal slightly larger than the average dog, begins to breed at less than one year of age and, according to Youatt, will continue to breed up to the age of ten. The average age of reproduction is about 3 or 4 years, and the intelligence is correspondingly less than that of the dog.

RABBITS AND SQUIRRELS.

The rabbit breeds early and often. It begins at the age of six months, and, in a state of nature, can rarely survive to the age of three. The average age of reproduction must be less than two years.

The squirrel, an animal somewhat smaller than the rabbit but vastly more intelligent, breeds only once a year, and the young remain with the parents until the next spring. I have not been able to determine whether they breed at one year of age, or wait until the second year. In either case, the average age of reproduction must be greater than with the rabbits, as they produce few at a time and live longer. "It may be considered pretty certain that both the Ground Squirrel and the Flying Squirrel hibernate, and these are certainly among the lowest—perhaps are actually the lowest—in intelligence of the whole tribe."[14] Hibernation may be considered as so much time taken out of the life of the individual which hibernates.

(14) Mills, Animal Intelligence, p. 59.

THE BEAVER.

The beaver is by far the most intelligent of the smaller wild animals. The young remain with their parents until three years of age, after which they commence a colony of their own.[15] Although beavers only weigh from 30 to 60 pounds, this makes them begin breeding later than either the horse or the cow, and later than any other active animal anywhere near them in size. I have not been able to learn how long they live, so cannot estimate the average age of reproduction. I find, however, that the young ones assist in building the dams and lodges, so that they have at least two years of practical education before they commence producing young ones of their own.

SEALS AND DEER.

The seal is another very intelligent animal. The brain is large with many convolutions. Seals are easily tamed, affectionate, and docile; at zoological gardens they are taught to sit erect, to bow, to kiss the hand, pretend to be asleep and to snore, turn the crank of an organ, shoulder a gun, shake hands, and perform other similar tricks.[16] All male seals under six years of age are "bachelor seals" and do not go to the breeding grounds. Elliott estimates that, under normal conditions, the bull of the Alaska fur seal lives to an average age of 18 to 20 years, and the cows to an average of ten or twelve years. He also estimates the average age of males on the rookeries at 15 to 20 years and the females at 9 to 10 years.[17] If the first estimate is correct it would appear that the last estimate was high. The difference in age of the males and

(15) Martin, Castorologia, p. 48; also Brown, Animals and Birds, p. 7.
(16) American Cyclopædia, Vol. XIV, pp. 730-1
(17) Brown, Animals and Birds, pp. 175 to 186.

females is accompanied by a corresponding difference in size, the females being about one-half the size of the males.

The deer is an animal not much different in size from the seal, it is very active and, living where it is exposed to many enemies, it has to be constantly on the alert for its own protection, but no one would think of attempting to teach the deer such tricks as are taught to seals, or any other tricks comparable to them. The deer breeds at the age of 2, comes to maturity at 3, and may live to the age of 20.[18] The average age of reproduction is, however, about 4 or 5 years as against 12 or 15 years for the seal.

ELEPHANT AND HIPPOPOTAMUS.

The elephant, owing to its huge size and strength, lives a life comparatively free from natural enemies and, consequently, of comparative peace, yet it is one of the most intelligent and sagacious of all animals. It comes to maturity at about 30 years of age and is said to live 150 years. It probably begins to breed at about the age of 25, but I am not able to estimate the average age of reproduction. It must, however, be high.

The nearest animal which I can compare with the elephant is the hippopotamus, and that comparison is not very complete. An adult hippopotamus is about 14 feet in length and girth. A young one, about 10 months old, received in London was one-half this length and girth and consequently about one-eighth the weight.[19] From this it would appear that the hippopotamus becomes adult between the ages of 3 and 5.

GUINEA PIGS AND WHITE MICE.

Coming down to small animals, the Guinea pig may be said to be anything but intelligent. It begins to breed at the age of 9 or

(18) American Cyclopædia, Vol. VII, p. 75.
(19) American Cyclopædia, Vol. VIII, p. 742.

10 weeks and breeds every 5 weeks. White mice are a degenerating type, and are used for experimental purposes because they begin to breed at the age of 30 days and breed every 30 days.[20]

BIRDS.

The common hen is quite a stupid bird. It is certainly not a teachable animal. Geyelin says:[21] "It has been ascertained that a hen cannot possibly lay more than 600 eggs." From a table given by him it appears that about two-thirds of these are produced before the age of 4 years. The average age of reproduction may therefore be placed at 2 years. As compared with the hen, the "century living crow" may be considered as remarkably intelligent. A great many anecdotes have been told of the crow's sagacity and the difficulty man has in deceiving it. The parrot is probably the most intelligent of all birds, and it is known to live to a great age. Humboldt saw in South America a parrot which was the sole living creature that could speak the language of a lost tribe.[22] Lankester[23] states that they live to the age of 120 years, are the longest lived of all birds, and are also the highest of all birds. As the average age of reproduction is approximately one-half the average length of life, we may estimate the crow and the parrot as compared to the hen.

INSECTS.

Bumble bees rank considerably above ordinary insects in intelligence. In spring and early summer only queens are found. These build nests and perform the duties of both queen and workers. The first broods produced by them are workers who subse-

(20) Talbot, Degeneracy, p. 48.
(21) Poultry Breeding, p. 27.
(22) Descent of Man, Vol I, p. 228.
(23) Comparative Longevity, pp. 56 to 60 and 74.

quently relieve the queen of the worker's duties. Late in the summer males and young queens appear. In the autumn all but the young queens perish. These hibernate in protected places until spring when they found new colonies.[24] Here we have an existence of a little more than a year, about eight months of which is intense activity. That part of the new generation which is to continue the species is produced the last thing, the early products being used as infertile workers.

This is in marked contrast with butterflies and moths. As caterpillars their lives are anything but active; as cocoons they hibernate; and as adults they flutter about for a few days and expire. The relative intelligence of bumble bees and moths is proportional to the length of their active lives.

The honey bee is much above the bumble bee. If the queen be accidentally killed or lost, the hive is thrown into the greatest confusion; the bees rush from the hive and seek the queen in all directions; after some hours all becomes quiet again and labors are resumed. If there be no eggs nor brood in the combs, the bees seem to lose their faculties; they cease to labor and to collect food, and the whole community soon dies. If there be brood in the combs, the labors continue as follows: having selected a grub not more than three days old, the workers sacrifice three contiguous cells that the cell of the grub may be made into a royal cell; they supply it with the peculiar stimulating jelly reserved for the queens, and at the end of the usual sixteen days the larva of a worker is metamorphosed into a queen.[25] This is intelligence and not instinct, and this intelligence is inherited from the queen which lives several years, and much longer than either the workers or the drones.

(24) Comstock, Insect Life, p. 257.
(25) Appleton's Cyclopædia.

DARWIN ON THE COCCUS AND THE ANT.

"The female coccus, while young, attaches itself by its proboscis to a plant; sucks the sap, but never moves again; is fertilized and lays eggs; and this is its whole history. On the other hand, to describe the habits and mental powers of a female ant would require, as Pierre Huber has shown, a large volume; I may, however, briefly specify a few points. Ants communicate information to each other, and several unite for the same work, or games of play. They recognize their fellow ants after months of absence. They build great edifices, keep them clean, close the doors in the evening, and post sentries. They make roads and even tunnels under rivers. They collect food for the community, and when an object too large for entrance is brought to the nest, they enlarge the door, and afterwards build it up again. They go out to battle in regular bands, and freely sacrifice their lives for the common weal. They emigrate in accordance with a preconcerted plan. They capture slaves. They keep Aphides as Milch-cows. They move the eggs of the aphides as well as their own eggs and cocoons, into warm parts of the nest, in order that they may be quickly hatched; and endless similar facts could be given. On the whole, the difference in mental power between an ant and a coccus is immense; yet no one has ever dreamed of placing them in distinct classes, much less in distinct kingdoms."[26]

In comparison to its size, the ant is the most intelligent of all living creatures, and by the same comparison it is the longest lived. Sir John Lubbock kept a queen ant for fourteen years and he did not know how old she was when he got her. If men lived as long for their size we would have some of the inhabitants of ancient Babylon and Egypt living amongst us as young men.

(26) Descent of Man, Vol I, p. 179.

CHAPTER XV.

REPRODUCTION, PUBERTY AND LONGEVITY.

Nearly a century ago Lamarck told us that "the development of organs and their force, or power of action (functional capacity) are in direct relationship to the employment of these organs" and that "all that has been acquired or altered in the organization of individuals during their lives is preserved by generation, and transmitted to individuals *which spring from those which have undergone these changes.*" In stating his laws Lamarck laid particular stress on the fact that acquired changes are proportional to the activity of the organs and the length of time during which the activity was continued, and he states that the transmission of acquired characters takes place *after* the acquirement. By the very simple process of comparing the offspring of individuals "which have undergone these changes" in different degrees, we have found that "the development of organs and their force, or power of action" in the offspring are "proportional to the length of their employment" in parents, exactly as Lamarck told us they were.

This process of comparison has been carried through various animals, the different races of men, and different men in the higher races. Taking the series as a whole, we find that the inheritance by offspring, if not absolutely proportional to ancestral acquirement by use, is so nearly proportional that we are not able to point out the discrepancies.

THE FACTORS OF ANCESTRAL USE.

Ancestral use is made up of two factors, activity, and length of time during which activity is continued before reproduction.

We may have these two factors in three combinations; first, when both factors are relatively low; second, when one factor is low and the other is high; and third, when both factors are relatively high. In the first case we have the lowest forms of animal life, among which we may include the worms. The second case is in two forms, (a) those in which the activity is low and the time is high as in turtles, shell fish and degenerating forms of parasites, and (b) those in which the activity is high and the time is low, as in insects and most birds. In the third case we have the higher mammals, and we find their height in the scale proportionately to the product of these two factors.

SELECTED CASES FOR COMPARISON.

By taking a series of cases among the higher mammals in which the activity does not vary greatly and in which the length of time before reproduction is pretty accurately known, and by making a diagram for this series of cases, we have the diagonal line shown in Fig. 11. If we were to make another diagram in which the figures at the side represented the inherited mental power of these classes of individuals instead of their average ages at reproduction, we would draw practically the same diagonal line. We thus see that the quality of the inheritance is proportional to the factor time. We are able to determine this pretty accurately because time may be expressed numerically. Unfortunately the factor activity cannot be so definitely known, but by comparing such animals as the tortoise and the parrot, hibernating and non-hibernating animals, and our observations that, as far as known, great men have been the sons of mentally active men, we may be quite sure that we would find the same proportionalism for activity when the factor time was constant.

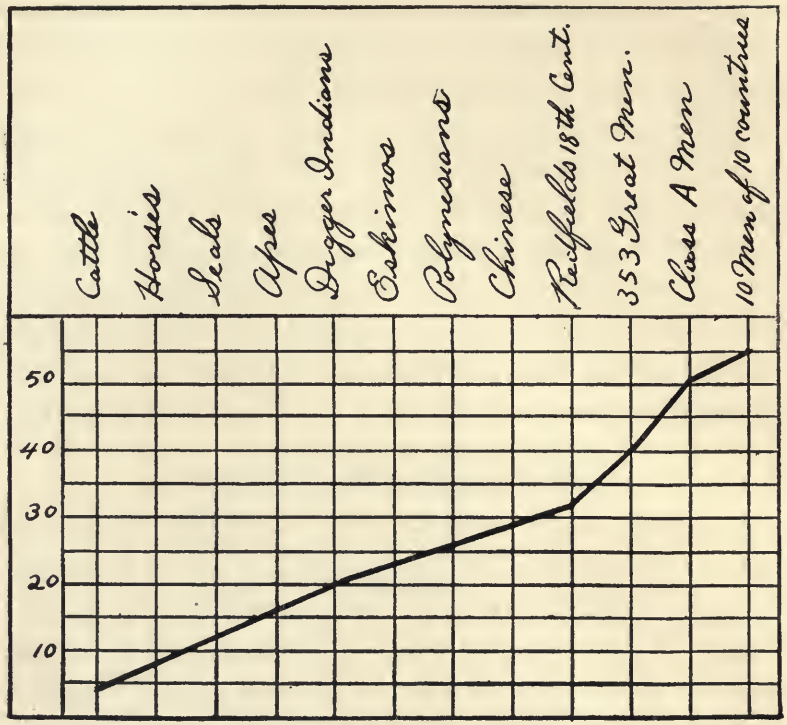

FIG. 11—APPROXIMATE AVERAGE AGES AT REPRODUCTION, ILLUSTRATING RELATIVE INTELLIGENCE.

LENGTH OF TIME DEVELOPMENT CONTINUES.

In the higher animals the degree of activity, both mental and physical, necessary for continued development lasts to a very late period in life. We may observe the increase in intelligence, coming from increased age, as low in the scale as among fishes. Young fish may be easily caught, but old fish are wary and are caught with difficulty. That the physical powers persist, and even increase, up to nearly the limit of life, we see principally exemplified in polygamous animals, among which an old male is almost always

the head of a herd, a position which he maintains by means of his superior strength. It is only with man in civilized and semi-civilized communities that the old become feeble long before dissolution, and this feebleness may be almost certainly attributed to his own and his ancestors' vicious lives.

As the degree of activity is normally sufficient for a continued development to a late period in life, and as the degree of activity for any given class of animals cannot be varied so greatly as can be the period of reproduction, we may consider time as the principal element in evolution. We may observe this among men, who vary most in activity and by whom more children are conceived before they arrive at twenty-four years of age than after they have passed forty-four. No matter how extraordinary be the mental activity, a man cannot acquire before the age of twenty-four a mental development equal to what another man will acquire at the age of forty-four by a very moderate degree of mental activity.

EVOLUTION OF MAN AND THE HIGHER ANIMALS.

Among the higher mammals, and especially with man, an increase in time carries with it a gradual increase in mental activity, so that whenever there is an increase in time before the act of reproduction, that fact will of itself cause an increase of mental activity without the aid of any special mental stimulus. In other words, time is itself a stimulus to mental activity, and whenever we have an increase of time before reproduction, then we have a sure progenitor of progress.

Having proved that the length of time between generations is the principal factor in evolution, we have an explanation of the wonderful rise and fall of Greece and Rome, and an explanation of why some races have risen from barbarism and others have not.

We have also an explanation of why some animals are higher in the scale than others, and we have placed in our hands a ready means for raising the standard of the human race and for developing our domestic animals.

It having been shown that increased age in parents is an absolutely essential element in the progressive evolution of intellect, and that there is no limit to the amount of age which may be advantageously added to parents before the time of reproduction provided these parents maintain their physical health and vigor, it becomes interesting to know what steps may be taken for advancement along this line. The first step would, of course, be delaying the age of puberty, as such delay would shut off the very early reproduction, and there are very good reasons for thinking that as much time is added to the latter part of the reproductive period as is subtracted from the first part by delay.

THE AGE OF PUBERTY.

Quatrefages[1] has given us statistics as to the age of female puberty, and from these it appears the time of arrival at puberty is more or less affected by climate, by quality and amount of nutrition, and by mode of life. For Paris he states that the average age of female puberty is, for the upper classes, 13 years and 8 months; for the middle class, 14 years and 5 months, and for the lower classes 14 years and 10 months. Country girls are behind city girls four and one-half months for Paris and eight and one-half months for Strassburg. For Toulon the average age is given as 14 years and 5 days, for Strassburg as 16 years and 54 days. Between these two cities there is a difference of three degrees of latitude and five degrees of mean temperature; Toulon is equable and sunny, and

(1) The Human Species, p. 416.

the inhabitants live outdoors and drink wine; the climate of Strassburg is uneven and cloudy and the people live in the houses and drink beer. M. Raciborski draws the conclusion that the age of puberty is advanced or retarded a little more than a month for each degree of latitude, with the condition that the temperature varies with the latitude. We find this exemplified in the Creoles of Jamaica, who arrive at puberty at from 10 to 11 years of age, while with the Swedes and Norwegians this stage is delayed till the age of 15 or 16.

CAUSES INFLUENCING THE AGE OF PUBERTY.

While the average age of female puberty may be set at about 14 years for the central portion of the temperate climate, it may be instructive to look a little more closely at the causes of variation at a definite place. I have previously pointed out that during the adolescent stage the individual is acutely sexual, and that children produced during this period are more intensely sexual in character than those produced at a later stage in life. An individual who has one inherited character more intense than other characters will have that particular character developed at an earlier age in him than it is developed in an ordinary individual.[2] As a consequence, the child of an early reproduction is more likely to arrive at puberty at an early age than one who is produced from old parents, and in cases of successive early reproductions this tendency will be still more strongly marked. We would also have the same result in cases where parents had habitually indulged in sexual excesses for a considerable period prior to the conception of children. We have abundant evidence of this in the cases of the "Jukes" and "Ish-

(2) It is only necessary, for the proof of this assertion, to compare the characters and aptitudes of our 354 great men with each other.

maels." Although these people live in a climate where the average age of puberty is between 14 and 15 years, many of the girls bear children before these ages and sometimes are mothers at 12. Parents who necessarily work hard are less likely to indulge in sexual excesses than those who live in luxury and ease, a fact that readily accounts for the difference in age of puberty between the upper and lower classes of Paris and the difference between city and country. This is a better explanation than assuming that the difference is caused by the food and mode of life of the children themselves, because some of the poorest and most illy nourished are notoriously licentious and their children come earliest to puberty. Besides the Jukes and the Ishmaels we have an example in the Eskimos, who are low in the scale of intelligence, who idle in their huts except when forced to seek food, who are immoral in their sexual relations, and who come to puberty at an early age in defiance of the effects of temperature and quality of food. I have before pointed out that the lower classes produce children at a very early age, and Darwin speaks of most savages as being "utterly licentious."[3]

We may therefore conclude that early puberty is a case of use-inheritance arising from sexual intensity and excess in parents, and that it has its orgin in early reproduction.

EARLY REPRODUCTION AND LONGEVITY.

Early reproduction and early puberty not only lead to low mentality and degeneracy, but to early decay and early death. Lankester gives[4] the following table of expectancy of life:

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(3) Descent of Man, Vol. II, p. 366.
(4) Comparative Longevity, p. 118.

Expectancy of life at the age of 60.

Healthy English lives	15.37 years
All English males	13.53 years
Sovereigns of all countries	10.90 years
Intemperate persons	8.94 years

Sovereigns are, as much as possible, a succession of the earliest reproductions, and we find them the shortest lived, on the average, of all persons except the intemperate. Not all sovereigns, however, have succeeded to the throne in the ordinary routine, and the same authority states that hereditary princes are less long lived than those who have won their positions by merit.[5] There is also given a table showing the expectancy of different classes at all ages, and the marked advantage of the female of the English peerage over the males brings forth the comment that the contrast between the two is greater than between the sexes of any other recorded group.[6] The females of the English peerage, unlike the males, are not necessarily the earliest reproductions. They may be the latest born or even the product of families outside of the peerage.

Still more emphatic is the following table:

Average age of those dying after 51.[7]

Clergy	69.49 years
Lawyers	68.41 years
Literary and scientific	67.55 years
Artists	65.96 years

This is a classification that runs exactly parallel with our previous classifications under the head of mental aptitudes, and from

(5) Ibid., p. 108.
(6) Ibid., pp. 115 and 120.
(7) Comparative Longevity, p. 109.

our previous tables we could give the average ages of the fathers of these men without knowing anything about who they were.

THE LONGEVITY AND BIRTH-RANKS OF GREAT MEN.

To test this matter more fully I have calculated the length of life of all of the great men of whom I have the birth-ranks, omitting a few who came to violent deaths from one cause or another. The result of this is shown in the following table:

Relation of Birth-Rank to Length of Life.

Birth-Ranks.	No. of Persons.	Aggregate Ages.	Average Ages.
Over 51	51	3,476	68.15
45-50	54	3,710	68.70
41-44	45	2,933	65.18
35-40	54	3,539	65.54
31-34	42	2,817	67.07
Under 31	45	2,855	63.44

This table shows quite plainly that sons of old fathers live longer than sons of young fathers, a fact that corresponds with what has gone before and also with our previous observations in regard to horses, cattle and seals.

SELECTION ELIMINATED.

There enters into this matter, however, a question of selection. It may be argued that the sons of old men are necessarily the sons of long lived parents, while sons of young men are the sons of both long lived and short lived parents, and consequently cannot be expected to live so long on an average. This contention has a reasonable sound and is, in fact, more reasonable than many of the attempts to explain by selection those phenomena generally attrib-

uted to use-inheritance, but it can be shown to be fallacious. To do this I again had recourse to the Redfield Genealogy and selected from it every family which had four or more sons who reached maturity and who did not lose their lives because of war or accident. The result of this has been put into the following table:

Average Life of Different Sons.

	Eldest Son.	Second Son.	Third Son.	Fourth Son.
Years	60.85	69.14	69.85	71.14

Here we find that the average length of life of the fourth surviving son is more than ten years greater than the average life of the eldest surviving son. There can be no selection in this case because the different sons of a family are sons of identical parents, and not sons of different and selected parents. Furthermore, we find the results in this case more uniform and more emphatic than in the previous case, and from it we may conclude that selection has no bearing on the matter.

LONGEVITY AND BIRTH-RANKS OF BROTHERS AND SISTERS.

To test this matter still further I took some fifteen or twenty different family genealogies and abstracted from them every family in which four or more children lived to become adults. In doing this I made no discrimination between sons and daughters, but took all that came and tabulated them for birth-ranks and length of life. From 1,104 persons thus selected, and among whom those having high birth-ranks were the brothers and sisters of those having low birth-ranks, it was found that there was a very uniform increase in length of life as birth-ranks grew higher. The ages of the fathers ranged from 19 to 64, and a diagram made from the table showed that for each four years added to the age of the father one year was added to the length of life of the child. I also

abstracted from the table all of those persons living more than eighty years and those living less than sixty years. Those living more than eighty years were distributed according to birth-ranks and were compared with the normal distribution of persons living to this age as determined from all of these persons. From this comparison it was found that when the fathers were less than twenty-five years of age only forty per cent of the normal number lived to be eighty years old. When the fathers were over fifty years of age, one hundred and forty per cent of the normal number lived to this age. In other words, the chances of the adult son of a fifty-year-old father living to eighty years of age are three and one-half times as good as are the chances of the son of a twenty-five-year-old father. When the mark was set at sixty years of life instead of eighty years, it was found that the chances of long life in favor of the son of the older father were 1.6 to 1.

BIRTH-RANKS AND EXPECTANCY.

The results of this tabulation were then put into the following table of expectancy:

Table of Expectancy by Birth-Ranks and Ages.

	Expectancy of life at age of		
Birth-Ranks.	25	30	40
Less than 30.....	39.53.....	35.88.....	29.22
30 to 39.....	40.33.....	36.23.....	29.62
40 to 49.....	42.44.....	38.52.....	30.81
50 and over.....	45.27.....	41.45.....	31.95

The expectancy of this table is somewhat higher than that of insurance tables, and this difference arises from two causes. First, I eliminated all of those persons known to have been killed by acci-

dent or war. The reason for doing this is that this is an investigation of natural heredity and not an investigation of accidents. The other reason is that the children of large families appear to live longer, on an average, than children of small families. This arises from the fact that parents do not usually rear large families of children living to become adults unless they themselves have considerable stamina.

INFANT MORTALITY.

Another peculiarity of this investigation is that infant mortality increases with the age of the parents and is greatest with the last child produced. The last child of a large family is the most variable in natural longevity. When he survives to be 25 or 30 he usually lives to a great age. The elder children live more uniformly to a moderate age.

The reasons for these differences is that as long as parents retain their full health and vigor the older they are the longer their children will live, but if parents lose their health or fail in bodily vigor, then the later children will live a less length of time than their earlier children. In this examination of large families there were found many cases in which the relationship between infant mortality and the longevity of the children born nearest in point of time to those who died in infancy showed very plainly the rise and fall in health of parents, principally the mother.

REVIEW OF EVIDENCE.

From the foregoing facts it is quite evident that man, within a few generations, may, if he chooses, bring about a delay in the arrival at puberty, the result of which will be the elimination of the least intelligent and most vicious, the raising of the intellectual

power of the whole community, and an increase in the average longevity.

The effect of delay in arriving at puberty gives more time for physical development and adds to the physical as well as to the mental powers. I have previously shown that some of the finest race horses are the product of old sires and dams, and we know that those animals which are slowest in arriving at puberty are the strongest and most tenacious of life. Among the races of men we find the same thing. The white race is the physical superior to all others, they arrive at puberty from 13 to 15 and live to the age of 70 or 80. The degraded races arrive at puberty at 8 or 10,[8] and rarely live beyond the age of 45.[9] Wherever those races which, according to the advice of Galton, Haycraft and others, begin reproduction at an early age come into contact with the late maturing and slowly breeding whites, they rapidly fade away. We see the result of it on the American Continent, the Sandwich Islands, New Zealand, Australia and elsewhere.

TREATMENT OF THE CHILD.

Next after the question of puberty, or perhaps coming before it in a practical sense, in the process of adding age to parents, is the problem of right living. While the principal element in determining the age of puberty is undoubtedly the effect of its inheritance, it is quite true that climate, surroundings and actions have a material influence. Stimulation or excitement may precipitate what would otherwise be delayed. It is therefore desirable that a child's early life should be guided into proper channels so that the habits it forms may neutralize the bad inheritance and

(8) The Human Species, p. 415.
(9) Comparative Longevity, p. 107.

strengthen the good. While a child should be guided it should not be overguided. If a child is to grow up and be able to produce healthy children late in life, it needs a physical development more than it needs a mental one. This physical development comes best through outdoors romp and play, and much more in the mud and dirt than is at all agreeable to parents. No greater error can be made than to keep a child aways dressed for company and crowded in its studies. Such a course may produce a show animal, but it is destruction to the next generation. Growth, both of body and mind, is a slow process, and a forced growth ends in early decay. This is but another illustration of the fact that those animals which are slowest in arriving at maturity are the strongest.

CHAPTER XVI.

EFFECTS OF SEXUAL REPRODUCTION.

When an organ, as the brain, is used it acquires a functional capacity as a result of such use, and the functional capacity acquired is, within limits, proportional to the amount of use. The act of using an organ causes the tissues of the organ to waste away, and the rate of waste is proportional to the intensity of use. The material wasted away by use is replaced by other material furnished by the system of which the wasted organ is a part. The amount of new material thus supplied is determined by the rate of waste. When the waste is rapid in consequence of intense activity, the new material not only equals, but slightly exceeds the amount wasted, the surplus of new material being for the purpose of meeting similar conditions of unusual activity. When the waste is very slow, the amount of new material may, and generally does, not equal the amount of waste, and the inactive organ diminishes in size because of its inactivity. In this process of waste and repair the new material takes on a functional capacity which is determined by the functional activity of the repaired organ, and the functional capacity of the organ as a whole is determined by the activity which existed at the time when the various parts were built up by original growth or by previous repair.

WASTE AND REPAIR AS THEY PROBABLY EXIST IN THE GERM CELLS.

A germ cell is the epitome of an individual of the species to which it belongs. Within it are contained all of the elements which characterize the adult, and it is from these elements that the future adult develops. Such cells increase in number by a process of cell

divisions, and in these divisions each cell divides its entire structure into two equal halves so that each half contains all of the original elements in the same proportions which they were contained in the original cell. If we assume that a cell prior to division is a certain individual, and after division one of its halves is the same individual, then, in the process of division, this individual is subjected to conditions of waste similar to those in an adult, and this waste must be repaired by the addition of new material. The material for this repair is furnished by the adult individual within which the germ cell is housed, and this material is furnished to the cell in the condition in which the adult is furnished it for its own use. As the adult is furnishing material for the repair of all of its own organs at the time when it is called upon to repair the elements of these organs in the cell, and as the functional condition of the repairing material is determined by the functional activity of the adult organs to be repaired, the repairing organs included, it is evident that the repaired part of the cell is built up of material having the functional capacity demanded by the functional activity of the adult organs. The original part of the cell has its material of a functional capacity corresponding to conditions as they existed at previous periods of repair, and as the new material is not set off or separated from the older material but is intimately united with it, the functional condition of the material of a cell is a compound of a series of conditions extending an indefinite distance into the past, the potency of which conditions is proportional to their nearness to the present.

HABITS OF ORGANS.

This resulting condition of the cell is, however, somewhat modified by what in different departments of science we call inertia, persistency of force, stability of a compound, habit, memory. These

expressions all imply fixity or tendency to remain in the condition which exists at any particular time. Thus, when an organ which has for a long time been dormant, or only slightly exercised, is suddenly exercised violently, the system responds by repairing the waste caused by this violent exercise, but it cannot repair waste so rapidly nor so completely as it can after the exercise has been continued for a considerable period of time. The result of this is that the newly exercised organ becomes quickly fatigued, and cannot continue the exercise more than a short time. After the system has acquired the habit of repairing waste in a particular organ, that organ may be exercised for a much longer period before fatigue ensues. Also after the system has once acquired the habit of repairing the organ, that habit, after being lost by temporary disuse, is reacquired much more quickly than it was acquired in the first place, and the length of time necessary for such a re-acquirement is proportional to the length of the disuse.

FUNCTIONAL CONDITION OF CELLS.

We thus see that a germ cell is made up of material which is in a functional condition represented by a series of repairs following upon a series of cell divisions, the quality of each repair of which is dependent upon the coincident repairs going on in the body of the adult within whom the cell is housed. As the functional condition of the organs of the adult is the result of a continuous but varying process of repair, it will be evident that the functional condition of these organs is accurately duplicated by a corresponding functional condition of the elements of these organs in the germ cell.

When conception takes place cell divisions result in an aggregate of somatic cells in which cell growth is substituted for cell

repair, and the cells enter upon a quiescent period equivalent to disuse, during which the functional condition of the material of the growing cells deteriorates. For the brain of man we may say that this disuse continues for about one year, after which come those glimmerings of intelligence that indicate the gradual revival of use. Use increases as the child grows, and the amount of use necessary to regain the functional capacity existing in the cell and the parent before conception depends upon how great was the original functional condition and how firmly fixed was the habit of repair. Ordinarily it would be the amount normally occurring in an individual prior to the period of complete maturity, but might be more or less according to the degree of activity.

REPRODUCTION AS TEMPORARY DISUSE.

We may therefore say that in the chain of life reproduction is temporary disuse existing for a period of a year and recurring at irregular intervals, the length of which intervals is the time elapsing between generations. Following each period of disuse there is a period of slight use extending through several years of the child's life. Under such conditions it will be evident that the extent to which an organ like the brain may be developed will depend upon the ratio of the length of the periods of use to the length of the periods of disuse, and will be greatest when the variable period of use is greatest. The circumstances are very similar to what would exist if a man should exercise his arms for a few months and then carry them done up in a plaster mold for thirty days, and repeat these operations alternately in unending series. If the period in the plaster mold were always thirty days, evidently the extent to which he might develop his arms by exercise would be determined by the distance between the plaster periods. When this distance

becomes a fixed quantity then there is a definite limit to the amount of development, extending the distance gives opportunity for evolution, reducing it results in degeneracy.

IMMATURITY.

It is probable that sexual excesses induce rapid divisions of the germ cells, and that when rapid divisions occur, they take place before the previously divided cells have had time to regain their full size and development. The consequence of such an action would, of course, be germ cells of reduced size and immature character, from the germ standpoint.

Now it has been shown, in the vegetable kingdom,[1] that if immature seeds (*i. e.,* unripe seeds which do not weigh more than about two-thirds as much as those which are fully ripe) be planted, they germinate readily, but the plantlets lack vigor and the fruit from them is smaller and less firm. What the fruit from such plants lack in size they usually make up in numbers, and fruit produced in this way matures somewhat earlier than that produced by the use of fully ripe seeds. By continuing the use of immature seeds for several generations, the characters of reduced size and vigor, early development and tendency toward fecundity are accentuated.

IMMATURE GERM CELLS.

Applying this fact to the propagation of animals from immature germ cells, we have a clearer view of why sexual excesses induce early puberty and reduce bodily vigor. Contrariwise, when we observe these characters in children we may infer propagation from immature and dwarfed germ cells. The bodily weakness observed in the children of young, or comparatively young, parents

(1) Bailey, Plant-Breeding, p. 103.

should not be confounded with that existing in children of very old parents, because the latter arises from another cause, viz., the weakness existing in the parent due to old age and physical decay. In the one case the weakness exists in both body and mind, in the other case the body is weak but the mind is strong. The first has its cause in immature germ cells; the second in the inherited inertness of the repairing organs of the body, and is sometimes designated as malnutrition.

If propagation takes place before the bodily growth of the parent is fully completed, and there be no immaturity of the germ cells arising from too rapid cell divisions, then there is a tendency toward increased bodily size of the offspring. This is illustrated in the case of sheep by the largest lambs being produced by rams not fully grown.[2] The explanation of this is that the repairing organs of the parent being functionally active in that condition which produces bodily growth, they produce the same condition in the repairing of the germ cells after their divisions.

BRAIN SIZE AND BRAIN POWER.

While brain power is, to a considerable extent, dependent upon brain size, yet it is well known that the relative brain power of two persons cannot be determined by measurements of their cranial capacities. A person with a comparatively small brain is very often greatly superior to a person with a much larger brain. This discrepancy may be understood by comparing the causes of brain size and brain power. It has been shown that brain activity causes the brain growth to continue up to the age of twenty-five or thirty, while a lack of activity will cause brain growth to cease at about twenty. If reproduction take place during the latter part of brain

(2) Day, The Horse, p. 203.

growth due to a college education, then the offspring would have an unusual increase of brain size, which would be transmitted to the next generation. If this last transmission occurs at an early age we would have a large brain with small brain power. On the other hand, if a person whose brain ceased to grow at the age of twenty and who accumulated considerable brain power late in life after the brain had ceased to grow, should have a child in mature years, then this child would inherit considerable mental power and relatively small cranial capacity. We may see an illustration of this in the case of the Incas, whose cranial capacity was small, but who were comparatively high in the scale of civilization. The education of their children was limited to that of their fathers, but their marriageable age did not come till from 24 to 26.[3]

INHERITANCE AT CERTAIN AGES.

Darwin has shown that characters which appear at certain ages in the parent tend to reappear in the offspring at corresponding ages, and he adds the statement that when there are deviations from this rule the tendency appears to be for them to occur earlier rather than later in the offspring. The rule of uniformity that causes the reappearance of characters in offspring at ages corresponding to those in which they appeared in the parent, relates to those characters which are not affected by use and disuse, while characters which are stimulated and developed by long continued functional activity appear earlier and characters which are degenerated by disuse appear later. The general rule relating to functionally developed characters appears to be that each fertilized germ starts upon its career of development with an initial velocity which would bring it, at the normal age of physical maturity, to a con-

(3) Latourneau, Evolution of Marriage, p. 174.

dition corresponding to the condition of its parents at the time of conception. This initial velocity is accelerated or retarded by each individual according as his functional activity is greater or less than that of his immediately preceding ancestors.

TIME OF APPEARANCE OF CHARACTERS VARIED BY AGE AT WHICH REPRODUCTION OCCURS.

Applying this to the brain of man and assuming that the functional activity be uniform from generation to generation, then, if the average age of reproduction coincided with the normal age of maturity (which may be assumed to be about 30 years for man), the race would neither advance nor recede, but remain stationary. If, in a particular instance, the age of reproduction for a healthy individual be advanced from 30 to 50, and this advance in age be accompanied by a functional activity sufficient to cause this individual's brain at the age of 50 to be of greater functional capacity than it was at the age of 30, then the offspring, following the same grade of activity that its parent followed, would, at the age of 30, have a functional capacity approximately equal to that its parent had at the age of 50. If the act of reproduction occurs when the parent is 15 instead of 50, then the rate of development of the offspring would be slower and, at the age of 30, he would be developed only about as far as his parent was at the age of 15. What the offspring is at the age of maturity, therefore, depends upon the amount the parent has developed at the time of conception. The amount of this development depends, of course, upon the degree of functional activity and the length of time the functional activity is continued. As the parent is itself an offspring and is in like measure dependent upon its parents, it is evident that each person's inheritance is the product of the average ancestral activity and the average length of time this activity continued for each ancestor.

PERSISTENCY OF ADVANCED AND RETROGRADE STEPS.

If a son conceived by a functionally active parent when at the age of 50 reverts to the normal condition and himself produces a son when at the age of 30, this son in the third generation will be, like the one in the second generation, an advance upon the first but not on the second, and the same advance will be maintained from generation to generation. Thus a single step in advance will constitute a step in advance through succeeding generations, and a single retrograde step will cause the retrograde condition to be transmitted through an indefinite number of generations. As, however, each individual is the product, not of one parent but of two, each step in one direction will be divided among a number of individuals or neutralized by a step in the opposite direction unless two steps in the same direction happen to unite.

INHERITANCE BY SEX.

The rule relating to this appears to apply to all characters which appear in the individual after the age of puberty, irrespective of whether they arise congenitally or are the result of development due to voluntary actions of ancestors. By characters which arise congenitally I mean characters such as the beard on man, ornamental plumage on birds, and all of those forms which are in no way connected with the volition of the individual. Such characters have been pretty fully dealt with by Darwin and need not be further referred to.

Acquired characters are those which are enlarged, developed and strengthened by functional activity, or are degenerated by the lack of such activity. The amount of such development or degeneracy is measured by the time during which the process continues,

and that part which accumulates after the age of puberty tends to be inherited by sex. In the human species we find the brain of man larger and stronger than that of woman, and we can find the explanation in the fact that men are mentally more active than women, and that fathers average three or four years older than mothers. From the further fact that the procreative powers of men extend to a later age than they do with women, we may conclude that by no possibility can the mental powers of women overtake those of men. Certain individual women will of course exceed certain individual men, but there will always be certain men who will exceed any possible women.

TRANSFERENCE OF SEXUALLY DEVELOPED CHARACTERS TO THE OPPOSITE SEX.

While characters developed in the adult by functional activity are transmitted principally, if not exclusively, to offspring of the same sex, there is a process by which such sexually developed characters are gradually transferred to individuals of the opposite sex. Thus, the combined result of great functional activity and late reproduction produce an individual who starts his development with a great initial velocity and consequently reaches, before puberty, a greater development than his father reached at that period of his life. Whatever is thus developed in the new individual before puberty by reason of greater initial velocity, is transmitted alike to both sexes of the next generation, and whatever is developed after puberty is transmitted to the same sex. If this new individual of the second generation should also accumulate the result of much use before reproducing, then the descendant in the third generation would develop with still greater rapidity and consequently would transmit a greater amount to the opposite sex in the fourth generation.

It will thus be seen that sexually developed characters transferred from one sex to the other are those characters which are functionally developed, and that the transference is not from an individual of one sex in one generation to an individual of the opposite sex in the second generation, but through an individual of the same sex in the second generation to one of the opposite sex in the third generation.

Good examples of this transference of acquired development to the opposite sex in the third generation are found in the pedigrees of trotting horses. The highly trained stallion George Wilkes does not appear as the sire of any of the very fast mares, but he appears ten times as the sire's sire and as many more times as the sire's grandsire. For mares, the grandsires and great-grandsires are almost as old as they are for stallions.[4]

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(4) This matter is examined at length in articles on "The Origin of Speed," in "The Horseman," Chicago, of Dec. 2, 1902, and Jan. 13, 1903.

BEETHOVEN [31]

MOZART [37]

RUBENS [49?]

REMBRANDT [40]

HANDEL [63]

CHAPTER XVII.

MENTAL AND PHYSICAL RESULTS.

SECONDARY SEXUAL CHARACTERS AND INTELLIGENCE.

There is a general impression that each individual starts out in life destined to follow a prescribed path in its development, and that this path is practically identical with that followed by its parents. Because the son of a beardless youth in due time develops a beard of his own, it is assumed that this same son should also develop the same mental powers and characteristics which his father developed, and at the same periods of his life.

There are in this assumption two sources of error; first, it presumes a relationship between a functionless organ and the functional condition of a very different organ; and second, it presumes that because the son of a beardless youth produces a beard of his own, hence, a successive series of sons of beardless youths will continue to produce beards to the same extent that sons of bearded men would.

Functional power, in the brain or in any other functioning organ, is a condition into which the organ is placed as the result of long continued use. In youth this functional power is at a low stage because the greater portion of the energy of growth is consumed in adding bulk and little can be spared for placing the increased material into a functional condition.

ORGANS DURING EMBRYONIC STAGE.

The cells from which a new being grows are built up of material having the functional condition of the parents at the time of

conception, and the new material added tends to take on the conditions pre-existing in the original cells. From the time of conception, however, the cells and the added material exist in a state of biological disuse, which disuse is gradually changed into use at some period after birth and before maturity. The functional condition, therefore, first declines and afterwards rises, and the distance it falls below the average condition of the adult of the race depends upon the point at which it started out at the time of conception. As the periods of gestation and of infancy represent a definite period of time during which disuse exists, it is evident that the functional power will drop off to a nearly or quite constant amount and will be lowest when the starting point is lowest. As a consequence of this the son of a beardless youth starts use from a very low point, and as he does not have an infinite length of time in which his organs can grow and be gradually changed into the functioning condition, he cannot rise as high as can some other son who starts on a higher plane.

THE BEARD AND SEXUAL MATURITY.

In the case of the beard we have an organ which is not subject to the law of use and disuse, and consequently it does not lose during gestation and infancy some quality which it had at the time of conception. It does, however, lose in another way by reason of early reproduction, as we see in the case of the lower races of men who reproduce early and are beardless. Going over Europe from South to North we have a regular gradation of later and later reproduction, and accompanying this we have just as regular an increase of beard until we come to the Eskimos, who reproduce early and are beardless. Among the lower races, the Australian is the only one strongly bearded, and among these we find a low

grade of mental activity, and the most marked difference between the ages of the fathers and mothers. With the Arabs, Turks, and the higher casts of the Hindus, we also have classes of bearded men who habitually have wives much younger than themselves.

While the beard is not of itself a functioning character, and consequently is not influenced by use or disuse, it grows upon the face and is dependent upon sexual maturity, as we see from the fact that a eunuch raises little or no beard. Our beardless boy-father is a sexually immature person, and while he transmits sexual intensity, he also transmits sexual immaturity, and in a few generations this sexual immaturity will exhibit itself by a lack of that character which is developed from maturity.

SECONDARY SEXUAL CHARACTERS IN LOWER ANIMALS.

This illustration of the beard on a man is typical of a long line of secondary sexual characters which appear in the lower animals. Darwin has pointed out that polygamous animals exhibit the greater number and most marked of secondary sexual characters, and he ascribes their existence to selection. While admitting that perhaps selection plays a part in this matter, I feel confident that the absolute or relative age of the male plays a more important part. We know that as long as the male lives the sexual characteristics become more and more pronounced, and we also know that the polygamous male who is the head of a considerable harem is a vigorous old male, the younger males being either killed or driven away. The younger females are under no such disadvantages, and as a consequence the disparity in age between the male and the female is very marked. With monogamous animals there is no reason why the average age of males and females should differ much, and we find little difference between the sexes, though

Darwin uses these animals for the greater number of his illustrations of sexual selection. These phenomena are explainable only on the theory of use-inheritance, and are simply other illustrations of the previously demonstrated fact that the offspring tend to be reproductions of the parents as they existed at the time of conception, and not as they existed at some previous time or will exist at some future time.

RELATION OF MENTAL POWER TO MENTAL APTITUDE.

It has been shown that mental power is the product of a series of slowly moving generations, and that mental aptitude is the product of a single generation, the quality of which is determined to a considerable extent by the age at which reproduction takes place. Age, however, is not the controlling factor in mental aptitudes, but an approximate method of determining the condition of the parent at the time of conception. Whatever has been intensely interesting to the parents during a few years immediately preceding the conception and has influenced their actions and molded their characters, will be transmitted to the offspring and will mold his character to a large extent throughout life. As different things influence the same parent in different degrees at different periods of life, the actual influence transmitted to a child is often lost sight of when he is measured in the light of influences existing at some later period in the life of the parent. A man who has become famous as a statesman or a mathematician may have been, at an earlier period in his life, an enthusiast over art or literature. A son conceived at this earlier period exhibits an inclination toward these pursuits, and the world, not knowing these earlier influences, wonders because the son does not inherit those traits which made the father famous.

As compared to philosophical reasoning, art, literature, and music may be considered as less profoundly intellectual, still great intellectual power is essential to eminence in any of these lines. We see this illustrated in the fact that the greatest artists, poets and musicians either themselves have pretty high birth-ranks, or are the sons of men having high birth-ranks. In the case of Byron the high birth-rank belongs to the grandfather, as is also the case of Emerson and Beethoven. With Hawthorne and Swift we find it in both father and grandfather. In any case the intellectual power is first built up by one or more cases of late reproduction, and then the peculiar mental aptitude is produced by the proper conditions.

MENTAL APTITUDES INFLUENCED BY OPPOSITE SEX.

Mental power being the result of late development and the product of a series of generations, appears to be transmitted principally by sex. This does not appear to be the case with mental aptitudes which are the product of single generation, and seem to be largely influenced by the opposite sex. In the case of Burns, Chatterton, Goethe and Schiller we have comparatively old fathers, and mothers about 19 or 20 years of age. In Greece, which was noted for its development of art and literature, we have the same characteristics of old fathers and young mothers. According to traditions, Homer was produced in this way. As it is impossible that all Greek mothers should have been young, it is probable that some of the older ones were the mothers of the Greek philosophers. My statistics in this matter are, however, so meager that I can throw this out only as conjecture. In the case of the philosopher Locke we find the mother nearly ten years older than the father, which is in sharp contrast with the poets previously mentioned.

In the case of Shakespeare we have both parents between the ages of thirty and forty and both grandfathers probably (almost certainly) over 45.

STERILITY.

Sterility is of two kinds, natural and acquired. Natural sterility may be divided into two classes, that which is congenital and consequently arises from causes at present unknown, and that which arises from the circumstances or surroundings of life. Acquired sterility may also be divided into two classes, that which has its origin in a vicious or unnatural life, and that which is deliberately produced by the individuals themselves.

Congenital sterility I shall not discuss because I can throw no new light on the subject. I may remark, however, that it is probably the rarest of all kinds. Although "inherited sterility" is a contradiction of terms, and consequently an absurdity, there is such a thing as inheriting a tendency toward sterility, which tendency may become, or develop into, actual sterility, and thus become congenital sterility. That this semi-sterility is hereditary is well shown by Mr. Day in his excellent work "The Horse." He mentions the cases of many mares who would slip or be sterile through many seasons, and shows that the few progeny that they did have were afflicted with the same trouble. Mr. Galton, in his *"Hereditary Genius,"* show that heiresses are more frequently sterile than other women, and as a consequence have caused the extinction of a great many English families. The fact that sterility causes such extinction makes it its own remedy, and whatever may be its cause, I assume that it is about as desirable as leprosy.

CIVILIZATION AND STERILITY.

That other form of natural sterility finds its cause in the advancing stages of civilized society, and perhaps may be best illus-

trated from animals. In a state of nature, sterility is extremely rare, nearly all individuals being perfectly fertile. Many animals which are perfectly fertile in a state of nature become sterile when kept in captivity or when only kept as pets. Such sterility arises from the fact that the animals are placed in an unnatural condition, and not being capable of adapting themselves to circumstances, their reproductive organs are injuriously affected, though they are otherwise perfectly healthy. In the early history of the human race, and during many ages, men and women lived outdoors and roamed freely through the woods. In modern civilization they are crowded into cities and spend much time in circumstances wholly unlike those to which their ancestors were exposed. As a consequence many women become sterile or semi-sterile, and when we see such sterility it is very plain that they were advanced in civilization before they were prepared for it. In other words, the majority of sterile or semi-sterile women are not proper members of the circles in which they move, but belong in a less advanced civilization.

That form of acquired sterility which arises from a vicious or unnatural life is so closely allied to that other form just described that it is not always possible to distinguish between the two. Properly speaking it arises in individuals who are perfectly adapted to live in the most advanced state of society, but who misuse the opportunities placed in their way and live a kind of a life not at all necessary to higher civilization. If not actually vicious they certainly are reckless, and lack of good judgment leads them into dissipations that result in sterility or semi-sterility.

PREMEDITATED STERILITY.

The last form of sterility, that which results from premeditated acts, becomes more common as the density of the population in-

creases. In many cases it comes from a desire to stay "in society," and to avoid the cares and responsibilities of parenthood. In other cases there are other causes which need not be dilated upon. It would seem as if this form of sterility should receive the strongest condemnation, but I am not disposed to look at the matter in that light. Persons who deliberately shirk responsibility are not a desirable kind, and the world will not be improved by perpetuating them. As to other causes, I may remark that each individual knows something about himself that the world at large does not know, and when we see a person who deliberately avoids becoming a parent I know of no reason why we should not take such a person at his own estimate and conclude that he is not as good stock as he appears, and that the sooner that the particular breed is eliminated the better.

FAMILY LIMITED BY SOCIAL CONDITIONS.

It is doubtless true that the increasing complexity of society places a premium on sterility and a punishment upon fertility. Not only is there the added burden of more mouths to feed and backs to clothe, but landlords discriminate agains tenants having children, and there is, in our large cities, a class of social parvenus who hold up their hands in holy horror at a family of more than two or three. Arguments in favor of larger families are without avail, and plans of offering premiums to mothers are not practicable. There is, however, a plan that will not only meet the difficulty, but is simple justice to those who undertake the cares and responsibilities of rearing our future citizens. In every representative government, each person is presumed to have a voice in selecting its legislators, and consequently in making the laws which govern the community in which he lives. In practice this is re-

stricted to men over 21 years of age, though each individual is just as vitally interested in good government as are these men.

PARENTAL RESPONSIBILITY AND THE FRANCHISE.

As each man is the guardian of his minor children and is responsible that they are properly cared for, clothed, fed and educated, so that they may in turn become good citizens, it is no more than justice to such fathers and such children that the guardian have an extra vote for each minor child under his care. It is quite certain that the father of a family is more vitally interested in a good government than is the bachelor who has no responsibilities beyond himself. It is therefore no more than simple justice that the voice in the government be proportional to the amount of interest. Under such a condition the artificial discrimination against a parent arising from the increasing complexity of modern civilization would be counteracted by a political discrimination in his favor. Many a parent, who under the present conditions struggles with poverty and adversity, would, under such a system, obtain political favors which would enable him to rear and educate his children much better than is now possible. With increased opportunities arising from political justice to parents, there would be a check on that form of premeditated sterility that arises from pure desperation at inability to provide for children already produced.

SIZE OF FAMILY INFLUENCED BY BIRTH-RANKS OF PARENTS.

In this connection I may remark that it is the most common of circumstances in the present state of society for parents, after one or two children are born, to be very careful that there are no more. This appears to be very much a case of "discretion," and the more intelligent persons are usually the more discrete. We see this illustrated by the fact that the more advanced portions of society usually

have small families, while the more ignorant and lower classes commonly have large families. To learn to what extent this practice has existed in the past and what effect birth-ranks have upon the subject I tabulated two hundred New England families, in one hundred of which the fathers had birth-ranks of [30] or less, and in the other hundred the fathers had birth-ranks of [40] or more. The fathers having the lower birth-ranks had 568 children, while the fathers having the higher birth-ranks had only 309 children. From what has been previously said in regard to the age of parents at the time their children are born, it is easily seen that this is a process of eliminating the best and selecting the poorest for preservation. It is only necessary for the process to be carried to extremes to end in degeneracy. That it has not led to degeneracy is due partly to the later age at which reproduction begins and partly to the increased amount of mental activity required of each individual before the age of reproduction.

QUANTITY AND QUALITY IN INCREASE OF POPULATION.

Much stress has been laid by Galton and others on the necessity for early reproduction as the only means of causing the population to increase, but much more is made of this than there is need of. If the births per annum are 25 or more per 1,000, the number is sufficient to cause the population to increase, because the death rate is some number less than this. As far as mere numbers go, it is immaterial whether this 25 per 1,000 is produced by young parents or by old parents, and as the supply of women over 30 and men over 40 who are capable of reproducing is much greater than necessary to produce this result, it is the part of wisdom to encourage older persons to become parents. The first step leading to this is to make it known to parents of small families that the product

of later age is, in the main, superior to the product of earlier life. Tyler says: "If we could add even five years to the working life of our statesmen, scholars and discoverers, the work of the last five years with the advantages of all previously acquired knowledge and experience might be of more value than that of their whole previous lives."[1] To this I will add that if we could induce the parents of each family to have one more child five years after they would normally cease reproduction, the children so produced might do more for the advancement of civilization and race progress than all of the other children put together.

THE CYCLE OF ACTIONS.

It has been shown that later births cause the production of greater brains and the consequent advance of civilization; that the increasing stress of civilization tends to produce sterility; and that sterility acts to wipe out the race. This cycle of actions doubtless was an important factor in the decay of ancient civilizations, and it may be inquired if such is the inevitable result of progress. To this I reply that it is not necessarily so. It has been shown that where sterility actually occurs it does not occur so much among those who are advanced as among those who take their places in the ranks of the advanced but are not themselves advanced. The process by which men and women of higher intellect are produced tends to make them adapted to the circumstances which they themselves create, while those not so produced are placed in an unnatural position and acquire sterility in the same manner that wild animals become sterile when removed from their natural haunts to the society of man. The decline of Greece and Rome was not due to any inability on the part of their intelligent men and women to

(1) The Whence and the Whither of Man, p. 215.

produce children, but partly to their disinclination to do so, and partly to their unending wars, which were continually thinning their ranks. While it is still too soon for wars to cease, there is such an increasing tendency to check it that there is very little danger of future wars having much influence on future generations. The danger in the future lies more in the disinclination to reproduce than in either wars or sterility.

DOMINANT RACE OF THE FUTURE.

If asked what race will in the future dominate the world I would unhesitatingly reply: That race which can increase in numbers at the latest average age of reproduction. The increase does not need to be rapid, but it must be actual. Fear need not be expressed because some earlier reproducing race is increasing more rapidly. When the pressure of population becomes greater the early reproducing and less intelligent races will give away before the stronger and more intelligent. The result of this may be seen in many parts of the world.

CONCLUSION.

Evolution is a result arising from increased length of time between generations when the functional activity remains constant, or from increased functional activity when the time between generations remains constant, and is most marked when time and degree of activity both increase. Degeneracy originates in decrease of time and activity, though it may arise from an exhausting activity or from a length of time great enough to produce exhaustion.

Knowing the forces antecedent to evolution we may set these forces into operation and, theoretically, may arrive at any desired degree of development. Within the space of eight or ten generations

man has nearly doubled the length of time between generations of our improved breeds of horses and cattle, and much of this improvement has undoubtedly arisen as a result of this increased length of time. This increase of the time between generations has not been deliberate, but has been the unconscious result of retaining superior animals for breeding purposes as long as possible. As these animals breed at all possible ages, and as selection is used to weed out the undesirable individuals, it is only necessary to look through the ancestry of the remaining ones to find the best average age of reproduction. This age of reproduction is not to be determined by one generation, but by the average of several successive generations.

While man may not use selection upon himself in the same manner in which he uses it on the lower animals, he may accomplish the same result by the use of his intelligence. The advance of civilization tends to discourage early marriage, but the luxury and idleness arising from the accumulation of wealth tend to bring on sexual excesses which in turn lead to early puberty and early marriage. Later reproduction, when unaccompanied by sexual excesses, tends gradually to delay the time of puberty in succeeding generations, and physical and mental activity in the child not only tend toward the same result, but increase the development of body and brain before puberty. The greater the physical and mental strength before puberty the longer the individual tends to live, and consequently the later is the age to which reproduction may be extended. We thus have a cycle of causes and effects, each of which may be intelligently controlled and each of which tends towards a longer life and a higher and better development.

In the more advanced portion of the civilized races puberty is

reached at 14 or 15, the average age of reproduction is at 32 or 33, and, among the healthy individuals, the average length of life is 60 to 70. The first point of attack is to increase the average age of reproduction by discouraging very early marriages and teaching the older individuals that their best children are produced comparatively late in life. With the child produced, the next step is to encourage him in physical and mental activity. At this point comes the test of parents' good sense, for nothing can be more vicious than to push the mental development at the expense of the physical. The two should go together, and if anything the physical should be in advance of the mental because, by its nature, the mental development is slower than the physical and is dependent upon it for the length of time it is continued. A precocious child is an interesting object, but using him for display and flattery is a process of injuring him and killing his children.

The remark of Oliver Wendell Holmes to the effect that a man's education should begin with his grandfather is literally true, and should be extended to include both grandfathers in their early childhood. If it also includes a considerable education accumulated by the great-grandparents, then the son will become a man of great mental power, and the amount of mental power will be proportional to the accumulation during these three generations. As great accumulation is the result only of long time, this means that we must have functional activity accompanied by late reproduction. Men of today are exerting themselves to give their sons education and opportunities greater than they themselves had, and they take much private satisfaction in the prospective prosperity of these sons. As these sons will in due course of time feel in the same way toward the next succeeding generation, it is evident that the man who has his children's happiness at heart should aim at his grandchildren

through his children. When this becomes the universal custom and is acted upon intelligently, the race will advance more rapidly than ever before.

To our children we may say: Play hard and study hard that you may grow to be healthy and intelligent men and women.

To our young men and women we may say: All persons who are good for anything and who hope to be honorable and respectable members of society, should marry and leave behind them children who will properly represent them when they are gone, but be not hasty in marrying because the best specimens of human beings are never the children of young parents.

To our older men and women we may say: All that you have learned and all that you have accomplished can, and will be, transmitted to future generations by others through the medium of records, but in whatever measure you have developed your body and your mind by patient and long continued efforts, that measure can be transmitted only by yourself to your descendants, and whatever honor these descendants achieve in the future, that honor will be your honor.

NOTE.

There has been much difficulty in finding dates of births of fathers and mothers, and it is desirable to have these filled out as much as possible in future editions. Those who have carefully read the preceding pages will probably be struck by the fact that eminent men are very frequently descended from youngest sons and youngest daughters, or from sons and daughters having high birth-ranks. It is therefore desirable that dates be obtained for grandparents and great-grandparents as much as possible.

The phenomenon of mimicry is quite common. Certain insects look like twigs, others take the form of leaves; animals are gray or green according to the color of their surroundings; animals living in the arctic regions are often white in semblance of snow; other animals living in jungles or in places where narrow vertical shadows are cast, are often barred in imitation of such shadows.

From a limited number of cases it appears that the sex of children is influenced by the surroundings of the mother. A woman who kept a boarding house patronized exclusively by men, had a son. Another woman who had a house full of sisters and aunts, who saw few men except her husband, and not much of him, had a daughter. A number of other cases of the same character have been observed. This may be mimicry and may possibly be due to a psychological cause. It is desirable that further instances be observed of mothers being similarly situated so that it may be determined whether the observed cases represent an actual law or are only coincidents.

The statistics relating to pauperism and crime are not so full as desired. It will help greatly if wardens of penitentiaries, overseers of the poor, and persons connected with relief organizations would gather statistics as to the birth-ranks of those with whom they have to deal. It is particularly important that the birth-ranks for two or three generations be determined when possible.

The author will esteem it as a favor if information on any of these points, or on collateral points, be sent to him at the address given below.

C. L. Redfield,
1563 Monadnock Block, Chicago.

JOHN HUNTER [65]

ELIZABETH [42]

APPENDIX.

The scope of the biographical inquiry and the evidence from which the tables have been constructed are shown in the following list. The birth-ranks as far as known are appended to each name in brackets immediately following the dates of birth and death. The absence of a birth-rank does not necessarily mean that the rank may not be found, but simply that I have not been able to find it from the facilities at hand or without an amount of research which I was unwilling to give the matter at this time.

The amount of effort given to finding dates has varied with the individual to whom they related. For the more eminent of these men every available source was examined before search was abandoned; for the less eminent I have been content to examine those sources which were most convenient. The sources from which I have obtained these dates have been biographical dictionaries, American, French, German, and Spanish Encyclopædias, and individual biographies. In a number of cases I have found that the dates given by one authority do not correspond with those given by another. In such cases I have sometimes adopted the date which appeared to have the best authority, and in other cases I have used the date given by the last found authority on the assumption that I may have made a mistake in copying the first date. Such cases are, however, comparatively rare, and usually do not involve a difference of more than one, two or three years. While the proper ranking of any individual should involve the birth-ranks

of all persons for at least three generations, I have been content to obtain that of the individual himself except in the cases of very remarkable men or cases in which further birth-ranks were easily found.

ABBAS, BEN ABD-EL-MOTTALIB (566-652) [67], paternal uncle of Mohammed and progenitor of the Abbasside dynasty. He was son of Abd-al-Muttalib (499—) [A]. See Mohammed.

ABBATUCCI, CHARLES (1771-1796) [45], a French general who attained distinction before reaching the age of 25. He was son of Jacques Pierre Abbatucci (1726-1812), a French general born in Corsica.

ADAMS FAMILY. Charles Francis Adams (1807—) [40], was son of President John Quincy Adams (1767-1848) [32], who was son of President John Adams (1735-1826) [43], who was son of Deacon John Adams (1692—) [38], who was son of Joseph Adams (1654—) [28], who was son of Joseph Adams (1626—) [A?]. The wife of Joseph (1654) was Hannah Bass (1667—) [68÷2], who was granddaughter of John Alden (1599—).

ABD-EL-KADER (1806—), an Arab emir in Algeria. "A man of remarkable powers and accomplishments." He was son of Mahiddin.

AGASSIZ, LOUIS JOHN RUDOLPHE (1807-1873) [31], a Swiss naturalist in America, son of Rudolphe Benjamin Agassiz (1776-1837). His ancestors were clergymen for six generations. His mother was the daughter of a physician.

AGRIPPINA (B. C. 12—A. D. 33) [51], wife of Germanicus, and "a woman of great ability, beauty and virtue." She was the youngest daughter of Agrippa (B. C. 63—A. D. 12).

ALCIBIADES (B. C. 450-404) [A^2?], a famous Athenian statesman and general. He was son of Cleinias who "greatly distinguished himself at the naval battle of Artemisium," which was fought B. C. 480.

ALEXANDER THE GREAT (B. C. 356-323) [26], the most famous of Greek generals. He was son of Philip of Macedon (B. C.

382-336) [A^2?], the real founder of the Macedonian power, and the man who planned the campaigns which Alexander carried out. Philip was the son of Amyntas II (B. C.—369), who contested the right to the throne in B. C. 429, or 47 years before the birth of his son. Amyntas II was son of Alexander I, who was son of Amyntas I, King from B. C. 540 to 500.

ALFRED THE GREAT (849-901) [A^2?], the greatest of British kings, was fifth and youngest son of Ethelwulf (—858), who was King of the West Saxons in 828, and was called "the old king" at the time of his death.

ALLEN, ETHAN (1739-1789), an American soldier, eldest of five sons of Joseph Allen.

ALLEN, WILLIAM (1784-1868) [41], an American author, educator and lexicographer, and president of Bowdoin college. He was son of Rev. Thomas Allen (1743-1810).

ALSTROMER, KLAS (1736-1796) [51], a Swedish botanist, son of Jonas Alströmer (1685-1761), a public-spirited Swede.

AMPERE, ANDRE MARIE (1775-1836), a French physicist and mathematician of great ability.

ANDERLONI, PIETRO (1784-1849), an Italian engraver of famous pictures. His brother Faustino, 18 years older, was also an engraver but less famous.

ANDERSEN, HANS CHRISTIAN (1805-1875), a Danish author of fairy tales. His father was a poor shoemaker, but possessed literary taste.

ARAGO, a French family of four brothers, of whom the eldest, *Dominque* (1786-1853), a physicist and statesman, and the youngest, *Etienne* (1803—), an author and revolutionist of 1848, were the most prominent.

ARISTOTLE (B. C. 384-322) [A^3?], a Greek philosopher and naturalist, son of Nicomachus, who was the friend and physician in ordinary of King Amyntas II. See page 127.

ARKWRIGHT, SIR RICHARD (1732-1792) [A], inventor of

the cotton-spinning frame. He was the youngest of a family of 13, and his parents were too poor to give him an education.

ARNAULD, ANTOINE (1612-1694) [52], a French theologian and author, called "the great Arnauld." He was the youngest and most famous of several famous sons of Antoine Arnauld (1560-1619), a Parisian lawyer.

ASSING, LUDMILLA (1827—) [A], a German authoress, daughter of Rosa Maria Assing (1783-1840), a poetess.

ASTOR, JOHN JACOB (1763-1848), the founder of the Astor family in America. He was the youngest of four sons.

AUDUBON, JOHN JAMES (1780-1851) [57], an American naturalist, famous for his "Birds of America" and his "Quadrupeds of America." He was son of John Audubon (1723—) [A^3], a French admiral who was twentieth child of a poor fisherman.

AUGUSTINE, SAINT (Aurelius Augustinus) (354-430), a doctor of the Latin church, famous for his influence and his writings on morality, philosophy and theology. He was son of Patricius, a pagan nobleman, and was an orphan at an early age.

AUGUSTUS, CAIUS JULIUS CAESAR OCTAVIANUS (B. C. 63—A. D. 14) [$(153+x)\div3$], the founder of the Roman Empire and the greatest of the Romans. He was son of Caius Octavius, a rich senator, and Atia, a daughter of Julia, the youngest sister of Julius Cæsar. The paternal great-grandfather was in the battle of Cannæ, B. C. 216, and was one of the few who escaped.

BACH, the name of a celebrated family of musicians. See page 180.

BACHE, BENJAMIN FRANKLIN (1801—) [$64\div2$], an American physician, grandson of Richard Bache (1737-1811) and Sarah Franklin (1744-1808) [38], only daughter of Benjamin Franklin (1706-1790).

BACON, FRANCIS (1561-1626) [52], an English philosopher, expounder of inductive philosophy, and lord chancellor of England. He was the youngest son of Sir Nicholas Bacon (1509-1579), an English statesman who was second son of Robert Bacon. His mother

was daughter of Sir Anthony Cooke and was said to have been the best educated woman in England.

BAER, CARL ERNST VON (1792-1876), a German zoologist.

BAIRD, SPENCER FULLERTON (1823-1887), an American naturalist, son of Samuel Baird, a lawyer of much culture. Was an orphan at 10.

BALTARD, VICTOR (1805—) [40], an eminent French architect, son of Louis Pierre Baltard (1765-1846), the architect of the Pantheon, the Paris prisons and other famous buildings. Prosper Baltard (1796—), also an architect, was elder brother of Victor, but less eminent.

BALZAC, HONORE DE (1799-1850), a French novelist who wrote 97 books.

BANCROFT, GEORGE (1800-1891) [45], an American historian, son of Rev. Aaron Bancroft (1755-1839), director of divinity at Harvard College.

BARRINGTON, the name of an English family of four brothers who became famous in different walks of life. They were sons of John Shute-Barrington (1678-1734), a lawyer and author. William Wildman Barrington (1717-1793) [39], the eldest, was secretary of war, chancellor of the exchequer and treasurer of the navy. Daines Barrington (1727-1800) [49] was jurist, naturalist and author. Samuel Barrington (—1800) [A²] was a rear admiral. Shute Barrington (1734-1826) [56] was a prelate, author and philanthropist.

BARROT, CAMILLE HYACINTHE ODILON (1791-1873) [38], a popular French advocate and statesman, especially prominent in political trials. He was son of ———— ———— (1753-1845), a Royalist advocate. Victorin Ferdinand Barrot (1806—) [53], brother of the Odilon, was solicitor of the treasury, counsel for Louis Napoleon, minister of the interior, and senator.

BASIL THE GREAT (329-379), a saint of the Christian church, son of St. Basil the Elder and Ste. Emmelia.

BECKET, THOMAS A. (1117-1170), an English prelate and statesman. His father, Gilbert Becket, was a native of Rouen, had

been a merchant at that place, but was established as a merchant in London at the time of his son's birth.

BEECHER FAMILY. Lyman Beecher, D. D. (1775-1863) was the first famous member of the family. He was son of David Beecher by his third wife. Lyman Beecher was the father of eleven children who grew to maturity, the most prominent of whom are: Catherine E. (1800-1878) [25]; Harriet (Mrs. Stowe) (1812—) [37]; Henry Ward (1813-1887) [38]; and Thomas K. (1824—) [49] (by second wife). See also page 93.

BEETHOVEN, LUDWIG VAN (1770-1827) [31], a German musical composer ranked as one of the greatest. He was son of Johann van Beethoven (1739-1792) [27], a tenor singer, who was son of Ludwig van Beethoven (1712-1773) [54], a musician who was son of Wilhelm van Beethoven (1658—).

BELL, SIR CHARLES (1774-1842) [A?], a British surgeon and anatomist of high distinction. He was the youngest of six children of Rev. William Bell and was a brother of John Bell (1763-1820), who was also a surgeon and who was the second son.

BENTHAM, JEREMY (1748-1832), an English juridical philosopher and utilitarian writer. He was the eldest, and for nine years the only child. His father and grandfather were lawyers, and his great-grandfather was a successful pawnbroker in the time of Charles II. His mother was the daughter of a retired shopkeeper.

BENTLEY, RICHARD (1662-1742), an English classical scholar and critic, son of Thomas Bentley by his second wife.

BENTON, THOMAS HART (1782-1858), an American statesman, son of Col. Jesse Benton, a prominent lawyer in North Carolina. He was an orphan at the age of eight.

BERGMAN, TORBERN OLOF (1735-1784), a distinguished Swedish chemist and naturalist.

BERKELEY, GEORGE (1684-1753), an Irish prelate and philosopher, son of William Berkeley, a collector at Belfas..

BERNADOTTE, JEAN BAPTISTE JULES (1764-1844), a French marshal under Napoleon and subsequently king of Sweden

and Norway under the title of Charles XIV. He was the son of a lawyer.

BERNARD, SAINT (1091-1153), a French ecclesiastic. He was the third of seven children of Tescelin, a Knight of the house of Châtillon, and Aleth, daughter of Count Bernard.

BERNOULLI, a celebrated family of Swiss mathematicians and savants. The most eminent member of the family was John Bernoulli (1667-1748), who is ranked with Newton and Leibnitz, and who was born 44 years after his brother Nicholas. See also page 182.

BERRYER, ANTOINE PIERRE (1790-1868) [33], a French advocate and statesman, son of Pierre Nicolas Berryer (1757-1841), an eminent lawyer.

BERTHOLLET, CLAUDE LOUIS (1748-1822), a French chemist.

BERZELIUS, JOHAN JAKOB (1779-1848), a Swedish chemist, son of a government schoolmaster.

BESSEMER, SIR HENRY (1813—), an English engineer, inventor of the Bessemer process of making steel.

BISMARCK-SCHONHAUSEN, OTTO EDUARD LEOPOLD VON (1815—) [44], a German statesman and principal factor in the establishment of the German Empire. He was the youngest surviving son of Karl W. F. von Bismarck (1771—), who was the fourth son of Karl Alexander von Bismarck, who was second son of August Friedrich von Bismarck.

BLACKSTONE, SIR WILLIAM (1723-1780), an English lawyer whose writings on the common law are still standard in all English-speaking countries. He was the fourth and posthumous son of a silk mercer, who was third son of an eminent apothecary. His mother died before he was 12 years old, leaving him to the care of his uncle, a London surgeon.

BLAINVILLE, HENRI MARIE DUCROTAY DE (1777-1850), a French naturalist. He was an orphan at an early age.

BLUCHER, GEBHARD LEBERECHT VON (1742-1819), a Prussian field marshal.

BLUMENBACH, JOHANN FRIEDRICH (1752-1840), a German naturalist, son of a teacher.

BOCCACCIO, GIOVANNI (1313-1375), an Italian novelist, illegitimate son of a wealthy merchant.

BOCKH, AUGUST VON (1785-1867), a German philologist and antiquary. He was younger brother of Friedrich von Böckh (1777-1855), who was prime minister of Baden.

BOERHAAVE, HERMANN (1668-1738), a Dutch physician, son of a clergyman.

BOETHIUS, ANICIUS MANLIUS TORQUATUS SEVERINUS (475-525), a Roman philosopher and statesman. He was son of a Roman consul and was an orphan as a child.

BOGARDUS, JAMES (1800-1874), an American inventor who produced many devices now in use.

BONAPARTE, NAPOLEON (1769-1821) [23], emperor of France and the greatest soldier of modern history. His father was Carlo Maria Bonaparte (1746-1785), a lawyer, a follower of Paoli, and an officer in the Corsican war against Genoa. His mother was Maria Letizia Ramolino (Madame Lætitia), a woman of remarkable character who followed her husband in his campaigns shortly before the birth of Napoleon.

BONNET, CHARLES (1720-1793), a Swiss naturalist and philosopher. Was uncle of de Saussure (1740-1799).

BONOMI, JOSEPH (1796—) [57], an English archæologist and author, son of Giuseppe Bonomi (1739-1808), an Italian architect who located in London.

BOSSUET, JACQUES BENIGNE (1627-1704), a French prelate famous for his oratorical powers. He came from a family of lawyers.

BOSWELL, JAMES (1740-1795) [34], a British author, biographer of Samuel Johnson. He was son of Judge Alexander Boswell (1706—).

BOWDITCH, NATHANIEL (1773-1838), an American mathematician, son of a cooper.

BOYLE, ROBERT (1626-1691) [60], an Irish philosopher, called, on account of his philosophical experiments, "the great Christian philosopher." He was the fourteenth child of Richard Boyle (1566-1643), earl of Cork.

BRAHE, TYCHO (1546-1601) [29], a Danish astronomer, son of Otto Brahe (1517—), who was descended from a younger branch of a princely family. His youngest sister displayed great mental ability.

BRONTE, CHARLOTTE (1816-1855) [39], an English novelist, daughter of Rev. Patrick Bronté (1777-1861), a native of Ireland and one of ten children.

BROUGHAM, HENRY (1779-1868), an English statesman, orator and lord chancellor.

BROUSSAIS, FRANCOIS JOSEPH VICTOR (1772-1838), a French physician, son of a physician. His son, Casimir A. M. Broussais (1803-1847) [31], was also a physician.

BROWN, JOHN (1735-1788), a Scottish physician, founder of the Brunonian system. He was the son of a poor farmer.

BRUCE, ROBERT (1274-1329) [21], king of the Scots, son of Robert Bruce (1253-1304) [43], son of Robert Bruce (1210-1295), who was the younger branch of the family descended from the youngest brother of King William the Lion.

BRUNEL, ISAMBARD KINGDOM (1806-1859) [37], an English engineer and naval architect. He was the designer of the Great Eastern as well as the first steamship to regularly cross the Atlantic. He was son of Sir Mark Isambard Brunel (1769-1849), a civil engineer of French birth.

BRUNO, GIORDANO, an Italian philosopher, expounder of the Copernican system. Burned at the stake in Rome, Feb. 17, 1600.

BRYANT, WILLIAM CULLEN (1794-1878) [27], an American poet, son of Peter Bryant (1767-1820) [36], a distinguished physician who was son of Dr. Philip Bryant (1731-1816) [29], who was son of Ichobod Bryant (1702-1759).

BUCH, LEOPOLD VON (1774-1853), a German geologist.

BUCKINGHAM, DUKE OF (George Villiers) (1592-1628), an English statesman and lord high admiral. He was second son of Sir George Villiers of Brookesby by his second wife. His brother, Sir Edward Villiers (1585-1626), was the second son by first wife. He was an orphan at 13.

BUCKLAND, FRANCIS TREVELYAN (1826—) [42], an English naturalist, son of William Buckland, D. D. (1784-1856), an English geologist.

BUCKLE, HENRY THOMAS (1821-1862) [42], the author of "History of Civilization." He was son of Thomas Buckle (1779—).

BUDDHA (B. C. 550-470). See page 124.

BUFFON, GEORGE LOUIS LECLERC (1707-1788) [24], a French naturalist, son of Benjamin Leclerc (1683-1775), a councillor of the parliament of Dijon.

BULWER, HENRY LYTTON EARLE (1804-1872) [47], an English diplomatist and author, brother of Bulwer-Lytton and son of Gen. Bulwer (1757—).

BULWER-LYTTON, EDWARD GEORGE EARLE LYTTON (1806-1873) [49], an English novelist. His son, Edward Robert Bulwer-Lytton (Owen Meredith) (1831-1891) [25], was a poet.

BUNSEN, CHRISTIAN KARL JOSIAS (1791-1860) [A^2], a German scholar and diplomatist. His father became a soldier in 1760. His grandfather was a lawyer.

BUNSEN, ROBERT WILHELM (1811—) [A^3], a German chemist, inventor of the Bunsen battery, the Bunsen burner, the Bunsen photometer, the Bunsen pump, and other devices. He was a cousin of C. K. J. Bunsen, but was 20 years younger.

BUNYAN, JOHN (1628-1688) [25], an English preacher, and author of "Pilgrim's Progress." He was son of Thomas Bunyan (1603—), a tinker.

BUONARROTI, MICHAEL ANGELO (1475-1563) [31], an Italian painter, sculptor, architect, poet and musician. He was son of Ludovico Leonardo Buonarroti Simone (1444—), governor of Caprese. The mother of Angelo was 19 at his birth.

BURDETT-COUTTS, ANGELA GEORGIANA (1814—) [44], an English philanthropist, youngest daughter of Sir Francis Burdett (1770-1844), an English politician who married the youngest daughter of Thomas Coutts, a London banker.

BURKE, EDMUND (1730-1797), an English statesman, son of Richard Burke who practiced law in Limerick and later in Dublin, where he married in 1725. Ancestry in female line to poet Spenser is 177÷4=44+.

BURNOUF, EUGENE (1801-1852), [26], a French orientalist, son of the distinguished philologist, Jean Louis Burnouf (1775-1844). His cousin, Emile Louis Burnouf (1821—), was an eminent scholar born 20 years later.

BURNS, ROBERT (1759-1796) [38], a Scottish poet, son of William Burns (1721—), who was son of Robert Burns. The mother of Burns was much younger than her husband and died Jan. 14, 1820.

BURR, AARON (1756-1836) [40], an American soldier, politician and vice-president of the United States. He was son of Rev. Aaron Burr (1716-1757), president of the College of New Jersey.

BURRITT, ELIHU (1810-1879) [A?], an American scholar and reformer known as the "Learned Blacksmith." He was the youngest of ten children.

BUTLER, BENJAMIN FRANKLIN (1818-1893), an American lawyer, statesman and soldier, son of John Butler who was son of Capt. Zephaniah Butler.

BYRON, GEORGE GORDON (1788-1824) [32], an English poet, son of John Byron ("mad Jack Byron") (1756—) [33], who was son of Admiral John Byron (1723-1786) [54], who was son of William Byron (1669—).

CAESAR, CAIUS JULIUS (B. C. 100-44), a Roman general and statesman.

CALDERON DE LA BARCA, PEDRO (1600-1681), a Spanish dramatist, and "next to Shakespeare the greatest of modern playwrights." He was the youngest of four children and an orphan at

the age of eight. His father was connected with the financial branch of the government under Philip II.

CALHOUN, JOHN CALDWELL (1782-1850) [55], an American statesman of high order, son of Patrick Calhoun (1727—).

CALVIN, JOHN (1509-1564), a religious reformer, son of Gérard Chauvin, an apostolic notary and fiscal procurator in Noyon.

CAMPER, PIETER (1722-1789), a Dutch anatomist and physician.

CANDOLLE, AUGUSTIN PYRAMUS DE (1778-1841), an eminent Swiss botanist, son of a magistrate.

CANNING, CHARLES JOHN (1812-1862) [42], a British statesman, created earl, son of the statesman George Canning.

CANNING, GEORGE (1770-1827) [67÷2], a British statesman, posthumous son of George Canning, a London barrister who was son of Stratford Canning (1703-1775).

CANNING, STRATFORD (1786-1880) [83÷2], a British statesman, youngest son of Stratford Canning, son of Stratford Canning (1703-1775).

CANOVA, ANTONIO (1757-1822), an Italian sculptor descended from a long line of stone cutters.

CARLYLE, THOMAS (1795-1881) [38], a British author, son of James Carlyle (1757—), son of Thomas Carlyle.

CARNOT FAMILY. See page 182.

CARPENTER, WILLIAM BENJAMIN (1813-1885) [33], an English physiologist, son of Lant Carpenter, LL. D. (1780-1840), an English clergyman.

CARPZOV FAMILY. See page 181.

CARTWRIGHT, EDMUND (1743-1823), an English clergyman, inventor of the power loom. He was son of William Cartwright. His elder brother, John Cartwright (1740-1824), a political reformer, was the third son.

CARUS, KARL GUSTAV (1789-1869), a German physician and naturalist.

CARUS, VICTOR JULIUS (1823—) [28], a German biologist, son of Ernst August Carus (1795-1854) [25], a professor of surgery who was son of Friedrich August Carus (1770-1807), a professor of surgery and an author.

CASSINI, a family of Italian and French astronomers, four members of which were directors of the Paris observatory for the first 122 years of its existence. I. Giovanni Domenico Cassini (1625-1712), the first director, made many discoveries. II. Jacques Cassini (1677-1756) [52], son of the preceding and second director. He and his father were the two most eminent members of the family. III. César François Cassini (1714-1784) [37], son of the preceding and third director. IV. Jacques Dominique Cassini (1748-1845) [34], son of the preceding and fourth director. V. Alexandre Henri Gabriel Cassini (1781-1832) [33], a botanist, son of the preceding.

CASSIODORUS, MAGNUS AURELIUS (468-560), an Italian statesman, author and ascetic. He was of an ancient and wealthy Roman family.

CASTELAR, EMILIO (1832—), a Spanish statesman, son of an exchange broker and an orphan at the age of seven.

CATO, MARCUS PORCIUS (B. C. 95-46) [139÷3], a Roman statesman, philosopher and general, great-grandson of Marcus Porcius Cato the Elder (B. C. 234-149), a statesman and patriot. Both were orphans when very young. M. Porcius Cato Salonianus, son of Cato the Elder, was born in his father's 80th year, and lived to become prætor.

CAVAIGNAC, LOUIS EUGENE (1802-1857) [40], a French general, son of Jean Baptiste Cavaignac (1762-1829), a French revolutionist. The elder brother of Louis, Eléonore Louis Godefroy Cavaignac (1801-1845) [39], was a journalist and republican leader.

CAVOUR, CAMILLO BENSO (1810-1861), an Italian statesman, younger son of Michael Cavour.

CELLINI, BENVENUTO (1500-1570), an Italian artist, son of a musician.

CELSIUS, ANDERS (1701-1744) [43], a Swedish astronomer

and inventor of the centigrade thermometer. He was son of Nils Celsius (1658-1724), a mathematician and naturalist.

CELSIUS, OLOF DE (1716-1794) [A?], a Swedish historian, cousin of Anders and probably son of Olaf Celsius (1670-1756), a theologian and younger brother of Nils Celsius (1658-1724).

CERVANTES SAAVEDRA, MIGUEL DE (1547-1616), a Spanish author, the youngest of four sons of Rodrigo Cervantes.

CHALMERS, THOMAS, D. D. (1780-1847), a Scottish clergyman and author, the 6th of 14 children of John Chalmers.

CHALONER, SIR THOMAS (1561-1615) [40], an English naturalist, son of Sir Thomas Chaloner (1521-1565), a diplomatist and author.

CHAMPOLLION LE JEUNE (the younger), JEAN FRANCOIS (1791-1832), a French Egyptologist, younger brother of Jacques Joseph Champollion (1778-1867), a French archæologist.

CHANNING, WILLIAM ELLERY, D. D. (1780-1842) [29], an American clergyman and author, son of William Channing (1751—) [36]. See Hall of Fame.

CHARLEMAGNE (742-814) [27], emperor of the West and king of France, son of Pepin (715-768) [25], who was son of Charles Martel (690-741) [40], who was son of Pepin of Héristal, born about 650.

CHARLES XII, king of Sweden (1682-1718) [27], son of Charles XI (1655-1697) [33], who was son of Charles X (1622-1660), who was son of John Casimir and Catherine, the sister of Gustavus Adolphus.

CHASE, SALMON PORTLAND (1808-1873), an American statesman and chief justice of the U. S. Supreme Court. He was an orphan at the age of seven.

CHATEAUBRIAND, FRANCOIS AUGUSTE (1768-1848) [A], a French author and statesman, the youngest of ten children.

CHATTERTON, THOMAS (1752-1770) [39], an English poet called by Wordsworth "the marvelous boy." He was the posthumous

son of Thomas Chatterton (1713-1752), a school teacher. His mother was 21 at the time of his birth.

CHAUCER, GEOFFREY (1328-1400), an English poet.

CHENIER: André Marie de Chénier (1762-1794) [39] and Marie Joseph de Chénier (1764-1811) [41], French poets, sons of Louis de Chénier (1723-1796), a French historian.

CHEVREUL, MICHEL EUGENE (1786-1889) [32], a French chemist, son of Michael Chevreul (1754-1845).

CHRYSOSTOM, JOHN (347-407), a bishop, doctor and saint of the Eastern church. He was an orphan in infancy.

CIBBER, COLLEY (1671-1757) [41], an English poet and dramatist, son of Caius Gabriel Cibber (1630-1700), a sculptor.

CICERO, MARCUS TULLIUS (B. C. 106-43), a Roman orator, statesman and philosopher.

CLARENDON, Earl of (Edward Hyde) (1609-1674), a British statesman and historian, third son of Henry Hyde.

CLAY, HENRY (1777-1852), an American statesman, fifth child of Rev. John Clay and an orphan at the age of four.

CLINTON, DEWITT (1769-1828) [33], an American statesman, son of James Clinton (1736-1812) [46], an American soldier who was fourth son of Charles Clinton (1690-1773).

CLINTON, GEORGE (1739-1812) [49], an American soldier and statesman, youngest son of Charles Clinton (1690-1773).

CLIVE, ROBERT (1725-1774), a British soldier and statesman, died by his own hand, son of Richard Clive.

CLOQUET, JULES GERMAIN (1790-1883), a French physician who "became one of the most eminent surgeons in the world." His elder brother, Hippolyte Cloquet (1787-1840), was also a distinguished physician and teacher of anatomy.

COBBETT, WILLIAM (1762-1835), an English political writer, son of an innkeeper.

COBDEN, RICHARD (1804-1865), an English statesman, fourth

[?] of eleven children of William Cobden and an orphan at an early age.

COCKBURN, SIR ALEXANDER JAMES EDMUND (1802—) [28?], lord chancellor of England, son of Alexander Cockburn (1774?—) [45?], a diplomat who was fourth son of Sir James Cockburn (1729—).

COKE, SIR EDWARD (1552-1633), an English jurist.

COLERIDGE, SAMUEL TAYLOR (1772-1834) [53], an English poet and philosopher, youngest son of John Coleridge (1719—), a learned and amiable clergyman.

COLFAX, SCHUYLER (1823-1885), an American statesman and vice-president, grandson of Gen. Wm. Colfax (1760—).

COLIGNY. See page 184.

COLUMBUS, CHRISTOPHER, discoverer of America. Place and date of his birth is uncertain. One account makes him the eldest, and another makes him the youngest, of three brothers.

COMBE, ANDREW (1797-1847) [A^2], a Scottish physician and author. He was the 15th child.

COMBE, GEORGE (1788-1858) [A?], a Scottish phrenologist, one of the elder brothers of Andrew.

COMPTON, HENRY (1632-1713) [42], bishop of London, youngest son of Spencer Compton (1690—).

COMTE, AUGUSTE (1798-1857), a French philosopher, founder of the system of positivism.

CONDORCET, MARIE JEAN ANTOINE NICOLAS CARITAT (1743-1794), a French savant. He was descended from a noble family and was an orphan at the age of four.

CONFUCIUS (B. C. 551-479) [A^3]. See page 123.

CONSTANTINE THE GREAT (272?-337), emperor of Rome, son of Constantius Chlorus (250?-306).

COOPER, SIR ASTLEY (1768-1841), an English surgeon, son of the curate of Brooke. His mother was a popular writer of her day.

COOPER, JAMES FENIMORE (1789-1851) [A], an American novelist, son of Judge William Cooper. He was the eleventh of twelve children.

COPE, EDWARD DRINKER (1840—), an American naturalist and comparative anatomist.

COPERNICUS, NIKOLAUS (1473-1543) [(77+x)÷2], a Polish astronomer, discoverer of the system of planetary revolutions. His father was a councillor in 1465, and his grandfather was established in business at Cracow in 1396. He was an orphan at the age of ten.

COQUEREL, ATHANASE LAURENT CHARLES (1795-1868), a French Protestant clergyman.

COQUEREL, CHARLES AUGUSTIN (1797-1851), a French author, brother of the preceding. The brothers were brought up by their aunt.

CORNEILLE, PIERRE (1606-1684), the father of the classical drama in France.

CORNEILLE, THOMAS (1625-1709), younger brother of the preceding, also a dramatist, but less eminent.

CORTES, HERNANDO (1485-1547), the conqueror of Mexico, son of Martin Cortes.

CORWIN, THOMAS (1794-1865), an American statesman, younger son of Matthias Corwin, for many years a member of the Ohio legislature.

COUSIN, VICTOR (1792-1867), a French philosopher, son of a clock-maker.

COWPER, WILLIAM (1731-1800), an English poet. His father was a chaplain to George II.

CRANMER, THOMAS (1489-1556), the first Protestant archbishop of Canterbury. He was the sixth of seven children and an orphan at fourteen.

CROMWELL, OLIVER (1599-1658), lord protector of the English commonwealth, fifth child of Judge Robert Cromwell, who was a younger son of Henry Cromwell, who was nephew of the earl of

Essex. Robert Cromwell married the widow Linne (1560—), who was descended from the youngest son of Alexander, lord steward of Scotland and founder of the house of Stuart. "This lady and Charles I were eighth cousins and her son Oliver was three generations nearer to Alexander than was the king whom he supplanted." (Appleton's Cyclopedia.) "The character of Cromwell in some of its noblest aspects seems to have been inherited from his mother." (Encyclopedia Britannica.)

CUVIER, GEORGES CHRETIEN LEOPOLD FREDERIC DAGOBERT (1769-1832) [A^2], a French naturalist. The grandfather had two sons, the younger of whom entered a Swiss regiment in the service of France and rose to high rank. He married at the age of 50. Georges was his second son.

CUVIER, FREDERIC (1773-1838) [A^3], a French naturalist and mechanic, brother of the preceding.

D'ALEMBERT, JEAN LE ROND (1717-1783) [37], a French mathematician, illegitimate son of the poet Philippe Néncault Destouches (1680-1754).

DALTON, JOHN (1766-1844), an English chemist, author of the atomic theory. He was the youngest child of Joseph Dalton, who was married in 1755.

DANA FAMILY. See page 185.

DANTE DEGLI ALIGHIERI (1265-1321), an Italian poet, youngest child of Judge Alighiero, who was one of seven sons of Bellincione, who was the younger of two sons of Alighiero, who was the elder of two sons of Cacciaguida, who was a youngest son, and who died at "mature age" in 1147.

DARWIN. See page 137.

DAUBENTON, LOUIS JEAN MARIE (1716-1800), a French naturalist, son of Jean Daubenton, a notary. He was an orphan at 20.

DAVID (B. C. 1085-1015) [A^2], second king of Israel, eighth (or eleventh, I Sam. XVI, 6, 10) son of Jesse.

DAVID, JACQUES LOUIS (1748-1825), a French painter.

DAVID, PIERRE JEAN (1789-1856), a French sculptor.

DAVIS, JEFFERSON (1808-1889) [A], president of the Southern Confederacy, youngest of ten children of Samuel Davis [A?], who was son of Evan Davis, the youngest of three brothers who came to America early in the 18th century.

DAVY, SIR HUMPHREY (1778-1829), an English chemist, eldest son of Robert Davy, a wood carver. He was an orphan at 16.

DAVY, JOHN (1790-1868), an English physiologist and anatomist, only brother of Sir Humphrey. He was an orphan at 4.

DECATUR, STEPHEN, JR. (1779-1820) [28], an American naval officer, son of Stephen Decatur (1751-1808), also a naval officer.

DEFOE, DANIEL (1661-1731), an English novelist and political writer, son of a butcher, James Foe, who was a younger son.

DELAMBRE, JEAN BAPTISTE JOSEPH (1749-1822), a French astronomer.

DELAVIGNE, JEAN FRANCOIS CASIMIR (1793-1843), a French lyric and dramatic poet.

DELUC, JEAN ANDRE (1727-1817), a Swiss physicist, ranked by Cuvier as one of the first geologists of his age. He was son of François Deluc, an author.

DEMBRINSKI, HENRYK (1791-1864), a Polish general.

DEMOSTHENES (B. C. 385-322), an Athenian statesman, an orphan at 7.

DEMPSTER, THOMAS (1579-1625) [A^2], a Scottish professor, the 24th of 29 children by the same mother.

DENHAM, SIR JOHN (1615-1668) [56], an English poet, only son of Sir John Denham (1559—).

DESAULT, PIERRE JOSEPH (1744-1795), a French surgeon.

DESCARTES, RENE (1596-1650), a French philosopher, youngest son of a councillor of the parliament of Rennes, who belonged to the younger branch of a noble family.

DESMOULINS, BENOIT CAMILLE (1760-1794), a French revolutionist.

DE SOTO, FERNANDO (1496-1542), a Spanish explorer.

DIBDIN, CHARLES (1745-1814) [A³], an English song writer and composer. He was the 18th child.

DICKENS, CHARLES (1812-1870) [26], an English novelist, the second of eight children of John Dickens (1786—).

DIDEROT, DENIS (1713-1784), a French writer and philosopher, son of a cutler.

DIOCLETIAN (245-313), a Roman emperor. His parents were of the humblest class.

DISRAELI, BENJAMIN (1805-1881) [39], an English statesman and author, son of Isaac Disraeli (1766-1848), an author who was the only son of an elderly man.

DODDRIDGE, PHILIP (1702-1751) [A³], an English clergyman, the youngest of twenty children of Daniel Doddridge, who was son of Rev. John Doddridge.

DOLLINGER, JOHANN JOSEPH IGNAZ (1799—) [29], a German theologian, son of Ignaz Döllinger (1770-1841), a German physiologist.

DOMINIC (1170-1221), a saint of the Roman Catholic church, and founder of the order of friar preachers.

DOUGLASS, STEPHEN ARNOLD (1813-1861), an American statesman, son of a physician and an orphan at the age of two months.

DRAPER, JOHN WILLIAM (1811-1882), an American chemist and physiologist, son of Rev. John C. Draper.

DREBBEL, CORNELIS VAN (1572-1634), a Dutch philosopher and inventor.

DRUMMOND, THOMAS (1797-1840), a British naval officer and inventor.

DRYDEN, JOHN (1631-1700), an English poet, eldest of fourteen children of Erasmus Dryden, who was third son of Sir Erasmus Dryden.

DUDEVANT, AMANTINE LUCILLE AURORE DUPLIN (George Sand) (1804-1876), a French novelist, daughter of Maurice

Duplin who died when she was four years old. Her maternal grandmother was an illegitimate daughter of Marshal Saxe (1696-1750). This is [108÷3], two steps of which are female.

DUJARDIN, FELIX (1801-1860), a French naturalist, son of a poor watchmaker.

DUMAS, ALEXANDRE DAVY (1803-1870) [41], a French dramatist and novelist, author of "Count of Monte Cristo." His father (1762-1806) [52], of the same name, was a son of the Marquis de la Pailleterie (1710—) by a negro girl. The younger Dumas was born in 1824 [21].

DUNDAS, HENRY (1741-1811), a British statesman.

DU PONT DE NEMOURS, PIERRE SAMUEL (1739-1817), a French economist and statesman.

DURER, ALBRECHT (1471-1528), a German painter and engraver, son of a Hungarian goldsmith.

EARLE, PLINY (1809—) [47], an American physician, son of Pliny Earle (1762-1832), an American inventor.

EATON, AMOS (1776-1842), an American physicist.

EDISON, THOMAS ALVA (1847—) [43], an American inventor, son of Samuel Edison (1804—) and Nancy Elliott (1810—).

EDWARDS, JONATHAN (1703-1758) [34], an American divine, son of Rev. Timothy Edwards (1669—) [22], who was son of Richard Edwards (1647—) [A?], who was son of William Edwards.

ELIZABETH (1533-1603) [42], queen of England, daughter of Henry VIII (1491-1547) [37], who was son of Henry VII (1456-1509), the first of the Tudors.

ELLSWORTH, OLIVER (1745-1807), an American statesman and jurist. His son, William Wolcott Ellsworth (1791-1868) [46], was governor of Connecticut and judge of the supreme court of that state.

EMERSON, RALPH WALDO (1803-1882) [34], an American philosopher and poet, son of Rev. William Emerson (1769—) [26],

who was son of Rev. William Emerson (1743—) [A], who was son of Rev. Joseph Emerson, born about 1698.

EMMET, ROBERT (1780-1803), an Irish revolutionist of undoubted mental ability. His brother, Thomas Addis Emmet (1764-1827), a politician and lawyer, was 16 years his senior. Thomas was the second son of Dr. Robert Emmet. Robert was the third and youngest son.

ENCKE, JOHANN FRANZ (1791-1865), a German astronomer, son of a clergyman.

ENDLICHER, STEPHEN LADISLAUS (1804-1849), a Hungarian botanist and linguist.

ENFANTIN, BARTHELEMY PROSPER (1796-1864), one of the founders of St. Simonism, son of a banker.

EPAMINONDAS (B. C. 418-362), a Theban statesman, son of Polymnis.

EPICURUS (B. C. 342-270), a Greek philosopher.

ERASMUS, DESIDERIUS (1467-1536), a Dutch theological and classical scholar and writer, the natural son of Gerard Praet and the daughter of a physician. He was an orphan at an early age.

ERICSSON, JOHN (1803-1889), a Swedish-American inventor and engineer.

ERSKINE, THOMAS (1750-1823) [40], a British jurist and statesman, third and youngest son of Henry David Erskine (1710—) [38], who was son of David Erskine (1672—).

EUGENE, PRINCE (1663-1736), a French general in the service of Austria, fifth and youngest son of Prince Eugène Maurice.

EULER, LEONHARD (1707-1783), a Swiss mathematician.

EURIPIDES (B. C. 480-406), an Athenian tragic poet.

EVANS, OLIVER (1755-1819), an American inventor and engineer.

EVARTS, WILLIAM MAXWELL (1818-1900) [37], an American lawyer, son of Jeremiah Evarts (1781-1831), secretary of Ameri-

can foreign missions. His mother [60?] was daughter of Roger Williams (1721-1793).

EVERETT, EDWARD (1794-1865), an American statesman, orator and author, son of Rev. Oliver Everett who was pastor of the Boston New South Church from 1782 to 1799.

EWING, THOMAS (1789-1871), an American statesman.

EYCK, JAN VAN (1390-1441) [A], a Flemish painter. His brother, Hubert van Eyck (1366-1426), was also a painter and 24 years his senior.

FARADAY, MICHAEL (1791-1867) [30], an English chemist and natural philosopher, son of James Faraday (1761—) [about 40], a blacksmith who was son of Robert Faraday, who was born between 1708 and 1730.

FARRAGUT, DAVID GLASCOE (1801-1870) [46], an American admiral, son of George Farragut (1755—).

FENELON, FRANCOIS DE SALIGNAC DE LA MOTHE (1651-1715), a French prelate and author. He was by a second marriage "contracted in mature years."

FERGUSON, ADAM (1723-1816), a Scottish philosopher and historian. He was the youngest son of a numerous family.

FICHTE, JOHANN GOTTLIEB (1762-1814), a German philosopher, son of a poor weaver.

FIELD FAMILY, sons of David Dudley Field (1781-1867), an American clergyman. David Dudley Field (1805-1894) [24], a lawyer; Stephen Johnson Field (1816—) [35], a justice of the U. S. Supreme Court; Cyrus West Field (1819-1892) [38], a merchant of Atlantic cable fame; Henry Martyn Field (1822—) [41], a clergyman.

FIELDING, HENRY (1707-1754) [(125+x)÷3], an English novelist and dramatist, eldest son of Gen. Edward Fielding, who was youngest son of the Earl of Desmond, who was son of Earl of Denbigh, who was born before 1582.

FILLMORE, MILLARD (1800-1874), thirteenth president of the United States.

FISH, HAMILTON (1808-1893) [50], an American statesman, son of Col. Nicholas Fish (1758-1833).

FITCH, JOHN (1743-1798), an American inventor.

FLAMSTEED, JOHN (1646-1719), an English astronomer.

FLETCHER, JOHN (1579-1625) [A^2?], an English dramatist and poet, youngest son of Rev. Richard Fletcher who was ordained in 1550.

FLOURENS, MARIE JEAN PIERRE (1794-1867), a French physiologist.

FORBES, DUNCAN (1685-1747) [41], a Scottish statesman, son of Duncan Forbes (1644-1744).

FORBES, DAVID (1828-1876), an English geologist, one of nine children of Edward Forbes.

FORBES, EDWARD (1815-1854), an English naturalist, son of Edward Forbes and brother of David.

FORBES, JAMES DAVID (1809-1868), a Scottish physicist, fourth and youngest son of Sir William Forbes.

FORSTER, JOHANN GEORG ADAM (1754-1794) [25], a German traveler and naturalist, eldest son of Johann Reinhold Forster (1729-1798), also a traveler and naturalist.

FOURIER, FRANCOIS MARIE CHARLES (1772-1837), a French writer on social science, son of a draper.

FOX, CHARLES JAMES (1749-1806) [44], an English statesman, son of Henry Fox (1705—) [78], who was son of Sir Stephen Fox (1627—), who was the youngest son of William Fox.

FRANKLIN, BENJAMIN. See page 102.

FRANKLIN, SIR JOHN (1786-1847) [A], an English naval officer and Arctic explorer, 12th and youngest son of Wallingham Franklin.

FREDERICK THE GREAT (1712-1786) [24], king of Prussia, son of Frederick William (1688-1740) [31], who was son of Frederick I. (1657-1713) [37], who was son of Frederick William of Brandenburg (1620-1688).

FREMONT, JOHN CHARLES (1813-1890) [A?], an American general and explorer. His father was a Frenchman who was captured by the British during the latter part of the 18th century. He was an orphan at the age of 5.

FRESNEL, AUGUSTIN JEAN (1788-1827), a French physicist, son of an architect. He had two younger brothers, one of whom was an engineer and the other of whom was an orientalist.

FROEBEL, FRIEDRICH (1782-1852), a German educator, founder of the kindergarten system of schools. He was youngest son of a clergyman who died in 1802. His mother died in his infancy.

FROISSART, JEAN (1337-1410), a French chronicler and poet, son of a heraldic painter.

FROUDE, JAMES ANTHONY (1818-1894), an English historian, youngest [?] son of Robert Hurrell Froude, archdeacon of Totness.

FROUDE, WILLIAM, (1810-1879), an English engineer, fourth son of archdeacon Froude and an elder brother of the preceding.

FULTON, ROBERT (1765-1815), an American inventor. He was an orphan at the age of 3. Had cousin 32 years older.

GAINSBOROUGH, THOMAS (1727-1788) [A?], an English landscape and portrait painter, youngest of nine children of John Gainsborough.

GALILEO (1564-1642) [31], an Italian philosopher and mathematician, son of Vincenzo Galilei (1533-1591), who was also a philosopher, a man of learning and the author of a number of treatises on music.

GALL, FRANZ JOSEPH (1758-1828), a German physician, the founder of phrenology.

GALLATIN, ALBERT (1761-1849), a Swiss-American statesman, son of Jean Gallatin, who was a Geneva merchant and councillor of state. He was an orphan in infancy.

GAMBETTA, LEON (1838-1882), a French statesman, son of a grocer.

GARIBALDI, GIUSEPPE (1807-1882), an Italian patriot, belonged to a family of seamen.

GARRICK, DAVID (1716-1779), an English actor, son of Peter Garrick who, as a child, escaped the persecution (about 1687) of Huguenots in France.

GARRISON, WILLIAM LLOYD (1804-1879) [about 31], an American abolitionist, son of Abijah Garrison. His mother was Frances Maria Lloyd (1776—).

GAUSS, KARL FRIEDRICH (1777-1855), a German mathematician.

GAY-LUSSAC, JOSEPH LOUIS (1778-1850), a French chemist.

GENGHIS KHAN (1160-1227), an Asiatic conqueror.

GENOVESI, ANTONIO (1712-1769), an Italian philosopher and political economist.

GEOFFROY SAINT-HELAIRE, ETIENNE (1772-1844), a French zoölogist. His son Isidore (1805-1861) [33] was also a zoölogist.

GERANDO, JOSEPH MARIE DE (1772-1842), a French philosopher and statesman.

GIBBON, EDWARD (1737-1794) [71÷2], an English historian, the eldest and only survivor of six sons, and grandson of Edward Gibbon (1666—).

GIFFORD, WILLIAM (1757-1826), an English author, an orphan in childhood.

GIOBERTI, VINCENZO (1801-1852), an Italian philosopher.

GIRARD, STEPHEN (1750-1831), an American merchant and banker.

GIRARDIN, EMILE DE (1806-1881), a French journalist, natural son of Count Alexandre de Girardin and Madame Dupuy, the wife of a counsellor.

GLADSTONE, WILLIAM EWART (1809-1899) [45], a British statesman, fourth son of Sir John Gladstone (1764—) [32], who was son of Thomas Gladstone (1732—).

GLUCK, CHRISTOPH WILIBALD VON (1714-1787), a German composer, son of Alexander Johannes Klukh.

GODWIN, WILLIAM (1756-1836), an English author, son of a dissenting clergyman.

GOETHE, JOHANN WOLFGANG VON (1749-1832) [39], a German author, poet and philosopher, son of Johann Kaspar Goethe (1710—) [53], an imperial councillor who was son of Friedrich Goethe (1657—), who married a widow and who was son of Hans Christian Goethe, a blacksmith. His mother was Katherina Elizabeth Textor (1731—) [38], daughter of Johann Wolfgang Textor (1693—), a lawyer. Other ancestors of his mother were a lawyer, a professor, a councillor, and a government official.

GOLDONI, CARLO (1707-1793), an Italian dramatist, son of a physician.

GOLDSMITH, OLIVER (1728-1774) [38?], an English author, fifth child of Rev. Charles Goldsmith and Anne, daughter of Rev. Oliver Jones. Charles Goldsmith went to Trinity College in 1707 and was probably born about 1690.

GORDON, CHARLES GEORGE (1833-1885), known as "Chinese Gordon," fourth son of Gen. Henry William Gordon.

GORGEY, ARTHUR (1818—), a Hungarian general.

GRACCHUS, TIBERIUS SEMPRONIUS (B. C. 168-133) [42], a Roman statesman, son of Tiberius Gracchus (B. C. 210—) and Cornelia, daughter of Scipio Africanus (B. C. 234-183).

GRACCHUS, CAIUS SEMPRONIUS (B. C. 159-121) [51], a younger brother of the preceding and said to have been a statesman of greater power.

GRANT, ULYSSES S. (1822-1885) [28], an American general, son of Jesse R. Grant (1794—) [46], who was son of Noah Grant (1748—).

GRANVELLE, ANTOINE PERRENOT (1517-1586), a Spanish statesman, son of Nicolas Perrenot, the chancellor and minister of Charles V.

GRATTAN, HENRY (1746-1820), an Irish statesman and orator, son of a barrister.

GRAY, ASA (1810-1888) [25], an American botanist, son of Moses Gray (1785—) [40], who was son of Moses Wiley Gray (1745—) [48], who was son of Robert Gray (1697—). See page 102.

GRAY, THOMAS (1716-1771), an English poet and naturalist, author of the "Elegy written in a Country Churchyard," son of Philip Gray.

GREELEY, HORACE (1811-1872), an American journalist, son of Zaccheus Greeley.

GROTIUS, HUGO (1583-1645), a Dutch jurist.

GROVE, SIR WILLIAM ROBERT (1811—), an English physicist and inventor.

GUESS, GEORGE (1770-1843), a half-breed Cherokee Indian, inventor of the Cherokee alphabet, said to be the most perfect alphabet in existence.

GUIZOT, FRANCOIS PIERRE GUILLAUME (1787-1874), a French statesman and historian, son of a distinguished lawyer who died on the scaffold in 1794.

GUNTER, EDMUND (1581-1626), an English mathematician, son of a Welshman. He was inventor of Gunter's Chain, Gunter's Line, Gunter's Quadrant, and Gunter's Scale.

GUSTAVUS ADOLPHUS (1594-1632) [44], king of Sweden, son of Charles IX. (1550-1611 [54], who was youngest son of Gustavus Vasa (1496-1560), who was from a younger branch of the noble house of Vasa.

GUTENBERG, JOHANN (1400-1468), the reputed inventor of printing. His family was of noble lineage.

GUYON, JEANNE MARIE BOUVIER DE LA MOTTE (1648-1717), a French mystical writer, daughter of Claude Bouvier.

HAECKEL, ERNST HEINRICH (1834—), a German naturalist.

HAHNEMANN, SAMUEL CHRISTIAN FRIEDRICH (1755-1843), a German physician, founder of the homœopathic system of medicine.

HALE, SIR MATTHEW (1609-1676), an English jurist, son of a lawyer and an orphan at an early age.

HALL, JAMES (1811—), an American geologist and palæontologist.

HALL, ROBERT (1764-1831) [A²], one of the greatest of English pulpit orators. He was youngest of a family of fourteen.

HALLER, ALBRECHT VON (1708-1777), a Swiss physiologist.

HALLEY, EDMUND (1656-1742), an English astronomer, son of Edmund Halley.

HAMILTON, ALEXANDER (1757-1804) [A?], an American statesman, youngest son of James Hamilton, who was son of Alexander Hamilton. His mother was the daughter of a physician, had married a physician, and had obtained a divorce before she married James Hamilton. She bore her last husband many sons, of whom only Thomas and Alexander lived to maturity. She died while Alexander was a child.

HAMILTON, SIR WILLIAM (1788-1856) [30], a Scottish philosopher, son of William Hamilton (1758-1790), a surgeon who was son of Thomas Hamilton, who was a professor of anatomy at Glasgow in 1757 and who was a younger son.

HAMILTON, SIR WILLIAM ROWAN (1805-1865), a British philosopher, fourth child of Archibald Hamilton, a solicitor.

HAMPDEN, JOHN (1594-1643), an English statesman, son of William Hampden, a member of parliament who died during his son's childhood. His mother was Elizabeth Cromwell, aunt of Oliver Cromwell (1599).

HANDEL, GEORG FRIEDRICH (1685-1759) [63], a German-English composer, son of Georg Handel (1622-1697) [40], a surgeon who was son of Valentin Handel (1582-1636).

HANIBAL (B. C. 247-183) [23?], a Carthaginian general, son of

Hamilcar Barca (270?-229), the Carthaginian hero of the first Punic war.

HARE, ROBERT (1781-1858), an American physicist.

HARRISON, BENJAMIN (1833-1900) [60÷2], president of the United States, grandson of Pres. William Henry Harrison (1773-1841), who was third and youngest son of Gov. Benjamin Harrison.

HARTLEY, DAVID (1705-1757), an English philosopher.

HARTMANN, EDUARD VON (1842—), a German philosopher.

HARVEY, WILLIAM (1578-1657), an English physician, discoverer of the circulation of blood. He was the second child and eldest son of Thomas Harvey by his second wife, Jane Halke.

HASTINGS, WARREN (1732-1818) [24], an English general and governor-general of India, son of Pynaston Hastings (1708—), who was said to have married at the age of 15 and who was the youngest son of Rev. Pynaston Hastings.

HAUY, RENE JUST (1743-1822), a French mineralogist of humble parentage.

HAWTHORNE, NATHANIEL (1804-1864) [29], an American author, son of Capt. Nathaniel Hawthorne (1775—) [44], who was son of Daniel Hawthorne (1731—) [40], who was son of Joseph Hawthorne (1691—) [50], who was son of Judge John Hawthorne (1641—). Hawthorne's mother was daughter of Richard Manning (1755—) [52], who was son of John Manning (1703—).

HAYDEN, JOSEPH (1732-1809), a German composer. Appleton's Cyclopedia states that he was the eldest of twenty, the Enc. Britannica says he was the second of twelve.

HEGEL, GEORG WILHELM FRIEDRICH (1770-1831), a German philosopher.

HEINE, HEINRICH (1799-1856), a German poet and critic, of Jewish parentage.

HELMHOLTZ, HERMAN LUDWIG FERDINAND (1821-1894), a German physicist and physiologist, son of Ferdinand Helm-

holtz, a teacher of philology and philosophy, and a man of high learning and great culture.

HELMONT, JAN BAPTISTA VAN (1577-1644), a Flemish physician.

HELVETIUS, CLAUDE ADRIEN (1715-1771) [30], a French philosopher, son of John Claude Adrien Helvétius (1685-1755) [55]. who was physician to the queen of France and who was son of John Adrian Helvétius (1630-1709), a physician who was son of John Frederick Helvétius, also a physician.

HENRY, PATRICK (1736-1799), an American orator and statesman, a younger son of Col. John Henry and the widow of Col. John Syme.

HERDER, JOHANN GOTTFRIED VON (1744-1803), a German author, son of a schoolmaster.

HERODOTUS (B. C. 484-420), a Greek historian known as the father of history.

HERSCHEL, SIR JOHN FREDERICK WILLIAM (1792-1871) [54], an English astronomer and physicist, son of Sir William Herschel (1738-1822) [31], an English astronomer who was son of Isaac Herschel (1707—) [A], who was youngest son of Abraham Herschel, who was son of Hans Herschel, who quitted Moravia early in the 17th century.

HERSCHEL, CAROLINE LUCRETIA (1750-1848) [43], an astronomer, sister of Sir William Herschel.

HOBBES, THOMAS (1588-1679), an English philosopher, second son of Rev. Thomas Hobbs.

HOGARTH, WILLIAM (1698-1764), an English painter, only son of Richard Hogarth, who was a teacher and who was a third son.

HOLBACH, PAUL HENRI THYRY (1723-1789), a French philosopher.

HOLBEIN, HANS, called the younger (1497-1543), a German painter, son of Hans Holbein the Elder, who was born between 1450 and 1460 and who was also a painter.

HOLMES, OLIVER WENDELL (1809-1894) [46], an American physician and author, son of Rev. Abiel Holmes (1763-1837).

HOMER, a Greek poet, lived about B. C. 900.

HOOD, THOMAS (1798-1845), an English poet, son of a bookseller and an orphan at 12.

HOOKER, SIR WILLIAM JACKSON (1785-1865), an English botanist, son of Joseph Hooker.

HOUSTON, SAM (1793-1863) [A], an American soldier, youngest of a family of nine.

HOWARD, CHARLES, Lord Effingham (1536-1624) [60?], an English admiral, son of William Howard (1476?—) [33?], lord high admiral, who was son of Thomas Howard (1443—), the second duke of Norfolk. N. B.—William had an elder brother, Thomas, born 1473.

HOWARD, JOHN (1726-1790), an English philanthropist, son of John Howard, and an orphan at 17.

HOWE, ELIAS (1819-1867), inventor of the sewing machine, son of a farmer and miller.

HUBER, VICTOR AIME (1800-1869) [36], a German politico-economical writer, son of Ludwig Ferdinand Huber (1764-1804) [37], an editor who was son of Michael Huber (1727-1804), a German scholar.

HUC, EVARISTE REGIS (1813-1860), a French missionary and traveler.

HUGHES, JOHN (1797-1864), an Irish-American archbishop, the youngest of three sons of a farmer.

HUGO, VICTOR (1802-1885) [29], a French poet and novelist, youngest son of Gen. Joseph L. S. Hugo (1773-1828).

HUMBOLDT, FRIEDRICH HEINRICH ALEXANDER VON (1769-1859) [49], the most eminent of German naturalists, youngest son of Major Alexander Georg Humboldt (1720-1779).

HUMBOLDT, KARL WILHELM VON (1767-1835) [47], a German scholar, brother of the preceding.

HUME, DAVID (1711-1776) [(71+x)÷2], a Scottish historian, youngest child of David Hume and an orphan in infancy. His maternal grandfather was David Falconer (1640—).

HUME, JOSEPH (1777-1855), a British statesman, younger son of a shipmaster. He was an orphan at 9.

HUNT, JAMES HENRY LEIGH (1784-1859), an English poet and author. His father was a Philadelphia lawyer prior to the Revolutionary war. He was youngest of a large family.

HUNT, THOMAS STERRY (1826-1892), an American chemist, geologist and mineralogist.

HUNTER, JOHN (1728-1793) [65], a British surgeon and physiologist, ranked as the "greatest surgical operator" of his time, and "among the greatest of modern natural philosophers." He was the youngest son of John Hunter (1663—).

HUNTER, WILLIAM (1718-1783) [55], an eminent physician and anatomist, elder brother of the preceding.

HUSS, JOHN (1373-1415), a Bohemian religious reformer. He was an orphan at an early age.

HUTTEN, ULRICH VON (1488-1523), a German scholar and reformer.

HUXLEY, THOMAS HENRY (1825-1895) [A], an English naturalist, seventh and youngest surviving child of George Huxley, who was second son of Thomas Huxley, who was married in 1773.

HUYGENS, CHRISTIAN (1629-1695) [33], a Dutch astronomer and natural philosopher, second son of Constantine Huygens (1596-1687), a poet and diplomatist who was son of Christian Huygens, secretary of the state council.

HYPATIA (370-415), a Greek Neo-Platonic philosopher, daughter of Theon, a distinguished mathematician and astronomer.

IRVING, EDWARD (1792-1834), a Scottish preacher.

IRVING, WASHINGTON (1783-1859) [52], an American author, son of William Irving (1731—) [55+x], who was son of Magnus Irving, who was of legal age in 1697.

ISMAIL PASHA (1830—) [41], khedive of Egypt, son of Abraham Pasha (1789-1848).

ITURBIDE, AUGUSTIN DE (1783-1824), emperor of Mexico, son of Spanish parents. He was an orphan at 15.

JACKSON, ANDREW (1767-1845), seventh president of the United States. He was a posthumous son.

JACKSON, CHARLES THOMAS (1805-1880), an American physicist.

JACOBI, FRIEDRICH HEINRICH (1743-1819), a German philosopher, son of a wealthy merchant. His elder brother, Johann Georg Jacobi (1740-1814), was a poet.

JACQUARD, JOSEPH MARIE (1752-1834), a French mechanician, inventor of the Jacquard loom. He was an orphan at 20.

JANSENIUS, CORNELIUS (1585-1638), a Dutch theologian.

JAY, JOHN (1745-1829), an American statesman and first chief justice of the United States. He was son of Peter Jay.

JAY, WILLIAM (1789-1858) [44], an American jurist and philanthropist, son of the preceding.

JEFFERSON, THOMAS (1743-1826) [35], third president of the United States, son of Col. Peter Jefferson (1708—) and Jane Randolph, daughter of Isham Randolph.

JEFFREY, FRANCIS (1773-1850), a Scottish critic, eldest son of a clerk of the court.

JEFFREYS, GEORGE (1648-1689) [40], an English judge, son of John Jeffreys (1608—).

JENKINSON, ROBERT BANKS (1770-1828) [43], a British statesman, second earl of Liverpool, son of Charles Jenkinson (1727-1808), first earl.

JENNER, EDWARD (1749-1823), an English physician, inventor of vaccination. He was the third and youngest son of Rev. Stephen Jenner, and was an orphan at 5.

JOAN OF ARC, "the Maid of Orleans" (1411-1431), a French heroine, fifth child of poor parents.

JOHNSON, SAMUEL (1709-1784) [53], an English author, son of Michael Johnson (1656—), a bookseller.

JOHNSON, SIR WILLIAM (1715-1774), a British general and colonial officer, younger son of Christopher Johnson.

JONES, INIGO (1572-1652), an English architect of humble origin.

JONES, OWEN (1809-1874), an English architect, only son of Owen Jones, a Welsh tradesman who published in 1801-7 "Myvyrian Archæology of Wales" in three volumes, which Matthew Arnold describes as a "great repository of Welsh literature."

JONES, SIR WILLIAM (1746-1794), an English orientalist and legal writer. He was son of an eminent mathematician and an orphan at 3.

JONSON, BEN (1574-1637), an English dramatist, the posthumous son of a clergyman. The father lost his estate about 20 years before his son's birth.

JOSEPH (B. C. 1745-1635) [92], prime minister of Egypt, son of Jacob (B. C. 1837-1689) [59], who was son of Isaac (B. C. 1896-1760) [100], who was son of Abraham (B. C. 1996-1821).

JOUFFROY, THEODORE SIMON (1796-1842), a French philosopher.

JOULE, JAMES PRESCOTT (1818—), [34] an English natural philosopher, son of Benjamin Joule (1784—).

JUAREZ, BENITO PABLO (1806-1872), president of Mexico, and an orphan at an early age.

JUDSON, ADONIRAM (1788-1850), an American missionary, son of Rev. Adoniram Judson.

DE JUSSIEU FAMILY, see page 117.

JUSTIN and JUSTINIAN, Byzantine emperors, sons of poor barbarian parents.

KAMEHAMEHA III. (1814-1854), [61] a sovereign of the Hawaiian Islands, son of Kamehameha I., the Great (1753-1819).

KANT, IMMANUEL (1724-1804), a German metaphysician, fourth of eleven children of John George Cant.

KAULBACH, WILHELM VON (1805-1874), a German painter, son of poor parents.

KEAN, EDMUND (1787-1833), an English actor.

KEATS, JOHN (1795-1821), an English poet, eldest son of Thomas Keats.

KEMBLE FAMILY. Roger Kemble (1721-1802), was the founder of the family and had twelve children. Mrs. Sarah Siddons (1755-1831) [34], was the eldest. John Philip Kemble (1757-1823) [36], was an actor. George Stephen Kemble (1758-1822) [37], was an actor. Elizabeth (Mrs. Whitlock) (1761-1836) [40], was an actress. Charles Kemble (1775-1854) [54], 11th child, actor. Frances Anne Kemble (Fanny Kemble) (1811-1893) [36], was daughter of Charles. Adelaide (Mrs. Sartoris) (1820—) [45], was also daughter of Charles. John Mitchel Kemble (1807-1857) [32], the eldest son of Charles, was a historian.

KENT, JAMES (1763-1847) [34], an American jurist, son of Moss Kent (1729—) [25], a lawyer who was son of Rev. Elisha Kent (1704—).

KEPLER, JOHANN (1571-1630), a German astronomer, discoverer of the laws of planetary movements. His father was of noble origin but in reduced circumstances.

KING, RUFUS (1755-1827) [37], an American statesman, son of Richard King (1718—), eldest son of John King, who came to America early in the 18th century.

KINGSLEY, CHARLES (1819-1875), an English clergyman, son of Rev. Charles Kingsley.

KLAPROTH, HEINRICH JULIUS VON (1783-1835) [40], a German traveler and orientalist, son of Martin Heinrich Klaproth (1743-1817), a chemist.

KLOPSTOCK, FRIEDRICH GOTTLIEB (1724-1803), a German poet, son of a public functionary.

KNOX, JOHN (1505-1572), a Scottish religious reformer.

KOSCIUSZKO, THADDEUS (1746-1817), a Polish patriot.

KOSSUTH, LAJOS (1802-1894), a Hungarian patriot, son of a lawyer.

KOTZEBUE, AUGUST FRIEDRICH FERDINAND VON (1761-1819), a German dramatist. He had distinguished sons Otto [26], Moritz [28], Paul [40], William [52], and Alexander [54].

LAFAYETTE, MARIE JEAN PAUL ROCH YVES GILBERT MOTIER (1757-1834) [24?], a French general in the American revolutionary war. His father was killed in battle at the age of 25. Lafayette married at the age of 16.

LAMARCK, JEAN BAPTISTE PIERRE ANTOINE DE MONET DE (1744-1829) [42], a French zoölogist, botanist and palæontologist, founder of evolution. Considered by Huxley and Haeckel to have been clearer headed than Cuvier. He was son of Jacques Pierre de Monet (1702-1760) [(110+x)÷2], who was grandson of the Etienne de Monet who bought an estate in 1592.

LAMARTINE, ALPHONSE MARIE LOUIS DE (1790-1869), a French poet.

LAMB, CHARLES (1775-1834), an English author, son of John Lamb, a poet. The elder brother of Charles was born in 1763.

LAMENNAIS, HUGUES FELICITE ROBERT DE (1782-1854), a French author, fourth of six children of Pierre Louis Robert Lamennais, a merchant and ship owner. His mother died in 1787.

LANDSEER, SIR EDWIN (1803-1873) [34], an English painter, youngest son of John Landseer (1769-1852), an engraver. The elder sons were artists.

LAO-TSE, a Chinese moral and ethical philosopher, a contemporary of Confucius. His teachings were of the mildest and most gentle character and more nearly resembled those of Jesus than did the teachings of any other person. His father did not marry until 70 years of age.

LAPLACE, PIERRE SIMON (1749-1827), a French astronomer and mathematician of humble origin.

LAVATER, JOHANN KASPAR (1741-1801), a Swiss physiognomist, son of a physician.

LAVOISIER, ANTOINE LAURENT (1743-1794), a French chemist and one of the founders of modern chemistry. He was son of a wealthy tradesman, and at the age of 5 he lost his mother.

LAW, EDWARD (1790-1871) [40], an English statesman, earl of Ellenborough and governor-general of India. He was son of Edward Law (1750-1818) [47], a chief justice of the king's bench who was son of Edmund Law (1703—), bishop of Carlisle.

LAYARD, AUSTEN HENRY (1817—), an English archæologist and orientalist.

LEA, ISAAC (1792-1886), an American naturalist who was a younger son. An older brother, Thomas Gibson Lea (1785-1844), was a botanist and a still older brother was a merchant in Philadelphia.

LE CONTE, JOHN (1818-1891) [36], and JOSEPH (1823-1891) [41], American physicists, sons of Louis Le Conte (1782—).

LE CONTE, JOHN LAWRENCE (1825-1883) [41], an American naturalist, son of John Le Conte (1784-1860), a naturalist.

LEDRU-ROLLIN, ALEXANDRE AUGUSTE (1808-1874), a French politician.

LEE FAMILY OF VIRGINIA. Richard Lee (1646-1714), a younger and probably the youngest son of a "numerous household" was the father of five sons, the last two of whom, Thomas Lee (1690-1750) [44[, and Henry Lee (1691—) [45], were progenitors of the eminent branches. Thomas had five sons of whom the last three were the eminent members, viz.: Richard Henry Lee (1732-1794) [42], a statesman; Francis Lightfoot Lee (1734-1797) [44], signer of the Declaration of Independence; and Arthur Lee (1740-1792) [50], a statesman. From Henry Lee (1691—) [45], we have his youngest son, Henry Lee (1729—) [38], his grandson, Col. Henry Lee (1756-1818) [27], and his youngest great-grandson, Gen. Robert Edward Lee (1807-1870) [51].

LEE, CHARLES (1731-1782), a major general in the American

revolutionary army, youngest son of Col. John Lee of the British army.

LEGARE, HUGH SWINTON (1797-1843), an American statesman.

LEIBNITZ, GOTTFRIED WILHELM (1646-1716) [A^2], a German philosopher, second son by third wife of a professor of philosophy. He was an orphan at 6.

LEIDY, JOSEPH (1823-1892), an American naturalist and physiologist.

LESLIE, CHARLES (1650-1722) [80], a British theological writer, son of Rev. John Leslie (1570-1671), a British prelate, the oldest bishop in the world at the time of his death.

LESSEPS, FERDINAND DE (1805-1894) [31], a French engineer, son of Matthieu de Lesseps (1774-1832).

LESSING, GOTTHOLD EPHRAIM (1729-1781) [36], a German author, son of Rev. Johann Gottfried Lessing (1693—) [47], who was son of Theophilus Lessing (1646—).

LESSING, KARL FRIEDRICH (1808-1880) [115÷3], a German painter, great-grandson of Rev. Johann Gottfried Lessing (1693—) [47].

LEVERRIER, URBAIN JEAN JOSEPH (1811-1877), a French astronomer.

LIEBIG, JUSTUS VON (1803-1873), a German chemist.

LINCOLN, ABRAHAM (1809-1865) [31], sixteenth president of the United States, son of Thomas Lincoln (1778—) [44?], who was youngest son of Abraham Lincoln (1733?—), who was third son of John Lincoln. The mother of Lincoln, Nancy Hanks, was the youngest child of a considerable family and her father, Joseph Hanks, was the youngest of five sons of William Hanks (1704—). Her mother, Nancy Shipley, was the youngest child of Robert Shipley.

LINNAEUS, CARL VON (1707-1778), a Swedish naturalist, son of Rev. Nils Linnæus and Christina, the daughter of a minister.

LISZT, FRANZ (1811-1886), a Hungarian pianist, son of Adam Liszt, and an orphan at 16.

LIVINGSTON FAMILY. See page 184.

LOCKE, JOHN (1632-1704) [26], an English philosopher, son of John Locke (1606-1661) [32], who was son of Nicholas Locke (1574—), who was a younger son. The mother of Locke was nearly ten years older than her husband.

LONGFELLOW, HENRY WADSWORTH (1807-1882) [31], an American poet, son of Stephen Longfellow (1776—) [27], a lawyer who was son of Stephen Longfellow.

LOPEZ, FRANCISCO SOLANO (1827-1870) [37], president of Paraguay, son of Carlos Antonio Lopez (1790-1862), also president of Paraguay and a shrewd diplomatist.

LOUIS XIV. (1638-1715) [37], called the Great, king of France, son of Louis XIII. (1601-1643).

LOWELL, JAMES RUSSELL (1819-1891), [37], an American author and poet, youngest [?] son of Rev. Charles Lowell (1782-1861) [39], who was youngest son of Judge John Lowell (1743-1802), who was son of Rev. John Lowell, the first minister of Newburyport, Mass.

LOWTH, ROBERT (1710-1787) [49], an English professor and poet, son of William Lowth (1661-1731).

LOYOLA, SAINT IGNATIUS DE (1491-1556) [A], founder of the society of Jesus (Jesuits). He was the youngest of eleven children.

LUBBOCK, SIR JOHN (1834—) [31], an English physicist, son of Sir John Lubbock (1803-1865), an astronomer.

LULLY, RAYMOND (1235-1315), a Spanish philosopher.

LUTHER, MARTIN (1483-1546), the leader of the German reformation, son of Jean Luther who was originally a poor peasant but who appears to have acquired property before his son's birth.

LYELL, SIR CHARLES (1797-1875) [30], a British geologist, son of Charles Lyell (1767—), a botanist.

MACAULEY, THOMAS BABINGTON (1800-1859) [32], an

English historian, son of Zachary Macauley (1768—) [A], who was son of John Macauley who was a minister in 1746.

MACHIAVELLI, NICCOLO (1469-1572) [41], an Italian statesman, son of Bernardo Machiavelli (1428—), a lawyer who was son of Niccolo Machiavelli. His mother was a poetess.

MAC MAHON, MARIE EDME PATRICE MAURICE DE (1808-1893) [A?], president of France, eighth and youngest child of Charles Laure de Mac Mahon, a personal friend of Charles X. (1757-1836).

MAGENDIE, FRANCOIS (1783-1855), a French physiologist.

MALTHUS, THOMAS ROBERT (1766-1834) [36], an English political economist, son of Daniel Malthus (1730—).

MANN, HORACE (1796-1859) [40], an American educationist, son of Thomas Mann (1756—) [40], who was son of Nathan Mann (1716—) [34].

MANUTIUS, PAULUS (1511-1574) [62], an Italian author and publisher, youngest son of Aldus Manutius (1449-1515), also a painter and the founder of the family.

MARAT, JEAN PAUL (1744-1793), a French revolutionist, son of Jean Paul Marat, a doctor of some learning.

MARCELLUS, MARCUS CLAUDIUS (B. C. 268-208), a Roman consul, the most prominent member of the most illustrious plebeian family of the Claudia Gens. Ancestry: for three generations, [123÷3]; for seven generations [281÷7].

MARIE ANTOINETTE (1755-1793) [47], Queen of France, youngest daughter of Francis I. of Austria (1708-1765) and Maria Theresa (1717-1780).

MARIETTE, AUGUSTE EDOUARD (1821-1881), a French archæologist.

MARION, FRANCIS (1732-1795), an American revolutionary officer without advantages of education. He was "one of the purest men, truest patriots, and most adroit generals that American history can boast." He was the youngest of seven children.

MARIOTTE, EDME (—1684), a French physicist, author of Mariotte's laws relating to gases.

MARIUS, CAIUS (B. C. 157-86), a Roman soldier.

MARLBOROUGH, duke of, JOHN CHURCHILL (1650-1722) [30?], a British general, son of Sir Winston Churchill (1620?-1688), who was son of John Churchill, a lawyer.

MARSHALL, JOHN (1755-1835) [25], an American jurist, eldest son of Col. Thomas Marshall. See page 107.

MARTEL, CHARLES (690-741) [40], duke of Austrasia, natural son of Pepin of Heristal (650-714).

MARTINEAU, HARRIET (1802-1876), an English authoress, sixth of eight children of Thomas Martineau.

MARTINEAU, JAMES (1805—), an English Unitarian clergyman, youngest brother of Harriet.

MATHER, INCREASE (1639-1723) [43], an American clergyman, son of Rev. Richard Mather (1596-1669). Cotton Mather (1663-1728) [24], was son of Increase Mather.

MAZZINI, GIUSEPPE (1805-1872), an Italian revolutionist.

MEHEMET ALI (1769-1849), viceroy of Egypt, an orphan at an early age.

MELANCHTHON, PHILIP (1497-1560) [35?], the second leader of the Reformation, son of George Schwartzerd (1462?).

MENDELSSOHN, MOSES (1729-1786), a German philosopher of Jewish descent, son of a teacher.

MENDELSSOHN-BARTHOLDY, FELIX (1809-1847) [33], a German composer, son of Abraham Mendelssohn (1776—) [47], who was son of Moses Mendelssohn (1729-1786).

MENDOZA, DIEGO HURTADO DE (1503-1575), a Spanish scholar and author, the most eminent member of the Mendoza family. He was a younger, or the youngest, son of the count of Tendilla, who was nephew (or grand-nephew) of Iñigo Lopez de Mendoza (1398-1458).

MENSHIKOFF, ALEXANDER DANILOVITCH (1672-1729), a Russian prince and statesman, son of poor parents.

MERIAN, MARIA SIBYLLA (1647-1717) [54], a Swiss naturalist, daughter of Matthäus Merian (1593-1651), an engraver.

METTERNICH, CLEMENS WENZEL NEPOMUK LOTHAR (1773-1859), an Austrian statesman.

MEYERBEER, GIACOMO (1794-1864), a German composer. His brother, Wilhelm Beer (1797-1850), was an astronomer, and his brother, Michael Beer (1800-1833), was a dramatist.

MILL, JOHN STUART (1806-1873) [33], an English philosopher, son of James Mill (1773-1836), also a philosopher.

MILLAIS, JOHN EVERETT (1829—), an English painter.

MILLER, HUGH (1802-1856), a Scottish geologist, son of Hugh Miller by his second wife.

MILNE-EDWARDS, HENRI (1800-1885) [A], a French naturalist of English descent. His brother, William Frederick Edwards (1777-1842), was a physician.

MILTON, JOHN (1608-1674) [45], an English poet, son of John Milton (1563-1647), who was a musician.

MIRABEAU, GABRIEL HONORE RIQUETTI (1749-1791) [34], a French author and statesman, son of Victor Riquetti Mirabeau (1715-1789), an author who was son of Jean Antoine Mirabeau, who especially distinguished himself in the battle of Cassano in 1705.

MOHAMMED (570-632) [25], founder of the Mussulman religion, son of Abdallah (545-570) [46+], a merchant who was tenth son of Abd al Muttalib, who was born before 499, and who was son of Hashim, who was a younger son of Abd Menaf, who was a younger son of Cossai. Hashim was "advanced in years" when he married Salma, a widow with two sons. His mother was Amina, daughter of Wahb, chief of the tribe of Benu Zahra.

MOLIERE, assumed name of Jean Baptiste Poquelin (1622-1673), a French dramatist, son of Jean Poquelin.

MOLTKE, HELMUTH KARL BERNHARD VON (1800-1891)

[32], a German general, son of Philipp Victor Moltke (1768-1845) [38], a Danish general who was son of Friedrich Casimir-Siegfried Moltke (1730-1785).

MONTAIGNE, MICHEL (1533-1592), a French author, third of nine children.

MONTALEMBERT, CHARLES FORBES RENE DE (1810-1870) [96÷2], a French statesman, grandson of Marc René de Montalembert (1714-1800), a military engineer.

MONTESQUIEU, CHARLES DE SECONDAT (1689-1755), a French philosopher.

MONTMORENCY, HENRY II. (1595-1632) [103÷2], a marshal of France, appointed admiral at 16, marshal at 34 and executed at 37. He was grandson of Anne Montmorency (1492-1567).

MOORE, SIR JOHN (1761-1809) [32], a British general, son of Dr. John Moore (1729-1802).

MOORE, THOMAS (1779-1852), an Irish poet, son of John Moore, a grocer.

MORE, SIR THOMAS (1480-1535), an English statesman, son of Sir John More, a justice of the king's bench.

MORSE, SAMUEL FINLEY BREESE (1791-1872) [30], an American artist and inventor, eldest son of Jedediah Morse (1761-1826) [35], a geographer who was son of Deacon Jedediah Morse (1726—).

MORTON, WILLIAM THOMAS GREEN (1819-1868) [35?], an American dentist, the first to use ether. He was son of James Morton (1784?—) [25?], who was son of Thomas Morton (1759—).

MOSES (B. C. 1571-1451) [185÷3], Jewish lawgiver, son of Amram, who was son of Kohath, who was son of Levi (B. C. 1756-1619) [81], who was son of Jacob (B. C. 1837-1689). For additional ancestry, see Joseph.

MOZART, WOLFGANG (1756-1791) [37], a German composer, son of Johann Georg Leopold Mozart (1719-1787), a musician.

MULLER, FRIEDRICH MAX (1823-1900) [29], an English philologist, son of the German poet Wilhelm Müller (1794-1827).

MULLER, JOHANNES (1801-1858), a German physiologist, son of a poor shoemaker.

MULLER, OTTO FREDERIK (1730-1784), a Danish naturalist.

MURAT, JOACHIM (1771-1815), a French soldier and king of Naples, son of an innkeeper.

MURILLO, BARTOLOME ESTEBAN (1617-1682), a Spanish painter, son of Caspar Esteban Murillo, and a full orphan at the age of 10.

MURRAY, WILLIAM, earl of Mansfield (1705-1793), a British jurist, fourth son of David Murray.

NAGELI, KARL WILHELM (1817-1891), a Swiss botanist.

NAPIER, JOHN (1550-1617) [16], inventor of logarithms, son of Sir Archibald Napier (1534-1608) [21], son of Alexander Napier (1513-1547). Napier's mother was Janet Bothwell, sister of Adam Bothwell (1527-1593), who was bishop of Orkney and who was second son of Francis Bothwell. The mother of Sir Archibald Napier (1534) was Annabella Campbell, youngest daughter of Sir Duncan Campbell.

NASMYTH, JAMES (1808-1890) [50], an English inventor, son of Alexander Nasmyth (1758-1840), a portrait and landscape painter.

NAUDIN, CHARLES VICTOR (1815—), a French botanist.

NAUMANN, KARL FRIEDRICH (1797-1874) [56], a German mineralogist, son of Johann Gottlieb Naumann (1741-1801), a German composer.

NAUMANN, MORITZ ERNST ADOLF (1798-1871) [57], a German physician, brother of Karl.

NAUMANN, EMIL (1828—) [30], a German composer, son of Moritz E. A. Naumann (1798-1871) [57].

NEANDER, JOHANN AUGUST WILHELM (1789-1850), a German church historian whose original name was David Mendel. He was the youngest child of a Jewish peddler.

NECKER, JACQUES (1732-1804), a French statesman and minister of finance.

NEES VON ESENBECK, CHRISTIAN GOTTFRIED DANIEL (1776-1858), a German botanist.

NELSON, HORATIO (1758-1805) [36], a British admiral, third son of Edmund Nelson (1722-1802) [29], a rector who was son of Edmund Nelson (1693-1747), a rector.

NESSELRODE, KARL ROBERT VON (1780-1862), a Russian statesman of German origin.

NEWMAN, JOHN HENRY (1801-1890), an English cardinal and author, son of John Newman.

NEWMAN, FRANCIS WILLIAM (1805—), an English author, brother of the preceding.

NEWTON, SIR ISAAC (1642-1727) [36], an English philosopher, posthumous son of Isaac Newton (1606-1642), who was son of Robert Newton.

NEY, MICHEL (1769-1815), a French marshal.

NIEBUHR, BARTHOLD GEORG (1776-1831) [43], a German historian, son of Karstens Niebuhr (1733-1815), a German traveler and author.

NIEPCE DE SAINT-VICTOR, CLAUDE MARIE FRANCOIS (1805-1870) [40+x], a French chemist, nephew of Joseph Nicéphore Niepce (1765-1833), also a chemist and one of the inventors of photography.

NORTON, CHARLES ELIOT (1827—) [41], an American author, son of Andrews Norton (1786-1853), an author.

O'CONNELL, DANIEL (1775-1847), an Irish statesman, eldest son of Morgan O'Connell.

OERSTED, HANS CHRISTIAN (1777-1851), a Danish natural philosopher, son of a druggist.

OERSTED, ANDERS SANDOE (1778-1860), a Danish statesman and writer on philosophy, brother of Hans.

OFFENBACH, JACQUES (1819-1880), a French composer, son of German-Jewish parents.

OHM, GEORG SIMON (1787-1854), a German physicist, author of "Ohm's law," son of a locksmith.

OHM, MARTIN (1792-1872), a German mathematician, brother of the preceding.

OKEN, LORENZ (1779-1851), a German naturalist.

OWEN, RICHARD (1804-1892) [50], a British naturalist, son of Richard Owen (1754-1809) [A?], a merchant who was son of William Owen, who was high sheriff in 1741. Owen's mother, a widow, was Catherine Perrin (1760-1838) [40], who was daughter of Robert Perrin (1720-1757), an organist.

OWEN, ROBERT DALE (1801-1877) [30], an American author, son of Robert Owen (1771-1858), an English social reformer who was son of poor parents.

OWEN, DAVID DALE (1807-1860) [36], an American geologist, brother of the preceding.

PAGANINI, NICOLO (1784-1840), an Italian musician.

PAINE, ROBERT TREAT, JR., (1773-1811) [42], an American author, son of Robert Treat Paine (1731-1814), an American statesman.

PAINE, THOMAS (1737-1809), an American political writer, son of a Quaker shoemaker.

PALISSY, BERNARD (1510-1590), a French potter.

PALMERSTON (Henry John Temple), (1784-1865) [45], a British statesman, son of Henry Temple (1739-1802) [66÷2], who was grandson of Henry Temple (1673-1757).

PAOLI, PASQUALE (1726-1807), a Corsican patriot. His brother Clemente was 9 years older.

PAPIN, DENIS (1647-1712), a French physicist, a pioneer inventor of the steam engine and steamboat.

PARE, AMBROISE (1517-1590), a French surgeon.

PARKER, THEODORE (1810-1860) [49], an American theologian, son of John Parker (1761—) [32], who was son of John Parker (1729—).

PARSONS, THEOPHILUS (1797-1882) [47], an American jurist, son of Theophilus Parsons (1750-1813), a jurist.

PASCAL, BLAISE (1623-1662), a French author, son of Etienne Pascal, president of the court of aids.

PASTEUR, LOUIS (1822—), a French chemist and biologist. His father was decorated by Napoleon during First Empire.

PATTI, ADELINA MARIA CLORINDA (1843—), an operatic singer, younger (or youngest) daughter by second marriage. Both parents were professional singers.

PEABODY, GEORGE (1795-1869) [33], an American merchant and philanthropist, son of Thomas Peabody (1762—) [36], who was son of David Peabody (1724—) [46], who was son of Ensign David Peabody (1678—) [36].

PEEL, SIR ROBERT (1788-1850) [38], an English statesman, eldest son of Sir Robert Peel (1750-1830).

PEIRCE, BENJAMIN (1809-1880), an American mathematician.

PEPYS, SAMUEL (1633-1703) [32], an English author, son of John Pepys (1601—).

PERICLES, see page 128.

PERKINS, JACOB (1766-1849), an American inventor.

PERRY, OLIVER HAZARD (1785-1819) [24], an American naval officer, son of Christopher Raymond Perry (1761-1818) [29], a naval officer, son of Freeman Perry (1732—).

PESTALOZZI, JOHANN HEINRICH (1746-1827), a Swiss teacher, orphan at the age of 6.

PETER THE GREAT (1672-1725) [43], emperor of Russia, son of Alexis (1629-1676).

PETRARCH (1304-1374), an Italian poet, son of a notary of

Florence who was exiled prior to his son's birth. He was an orphan at about 20.

PHIDIAS (B. C. 489-432), a Greek sculptor.

PHILIP OF MACEDON, see page 127.

PINEL, PHILIPPE (1745-1826), a French physician.

PISANO, ANDREA (1270-1345) [70], an Italian sculptor and architect, son of Nicola Pisano (1200-1278), an Italian sculptor.

PISANO, GIOVANNI (1240-1320) [40], an Italian architect, brother of the preceding.

PITT, WILLIAM (1759-1806) [51], an English statesman, son of William Pitt (1708-1778), who was second son of Robert Pitt, who was son of Gov. Thomas Pitt (1653-1726), who was youngest son of John Pitt, the rector of Brandford.

PLATO (B. C. 429-348), a Greek philosopher.

PLINEY THE ELDER (23-79), a Roman author.

PLINEY THE YOUNGER (62-116), a Roman author, nephew of the Elder.

POCAHONTAS (1595-1617) [45], daughter of the Indian chief Powhattan (1550-1618).

POE, EDGAR ALLEN (1809-1849) [31], an American poet, son of David Poe (1778?) [36], who was son of Gen. David Poe (1742?—), a lawyer and officer in the revolutionary war.

POMPEY THE GREAT (B. C. 106-48), a Roman general. His father was a younger son and was consul B. C. 89.

POPE, ALEXANDER (1688-1744) [47], an English poet, son of Alexander Pope (1641-1717), a merchant who is said to have been the posthumous son of Alexander Pope, rector of Thruxton. Pope's mother was Edith Turner (1642—) [45], daughter of William Turner (1597—).

POPHAM, SIR HOME RIGGS (1762-1820) [A^3], a British rear admiral, 21st child of Stephen Popham.

PORSON, RICHARD (1759-1808), an English scholar and critic, eldest of four children of Huggin Porson.

PORTER, DAVID DIXON (1813-1891) [33], an American admiral, son of Commodore David Porter (1780-1843).

PORTER, NOAH (1811-1892), an American scholar.

POUSSIN, NICOLAS (1593-1665), a French painter.

POWERS, HIRAM (1805-1873) [A or B], an American sculptor, the eighth of nine children. He was an orphan at 12.

PRESCOTT, WILLIAM HICKLING (1796-1859) [34], an American historian, son of William Prescott (1762-1844) [36], a lawyer who was son of William Prescott (1726-1795) a revolutionary officer.

PRIESTLEY, JOSEPH (1733-1804) [33], an English philosopher; eldest of six children of Jonas Priestley (1700-1779) [39], who was son of Joseph Priestley (1661-1745).

PROCTOR, RICHARD ANTHONY (1837-1888), an English astronomer, fourth and youngest son of William Proctor, a solicitor.

PROUDHON, PIERRE JOSEPH (1809-1865), a French political writer of humble origin.

PTOLEMY II., surnamed PHILADELPHUS (B. C. 309-247) [58], king of Egypt, youngest son of Ptolemy Soter (B. C. 367-283).

PUFENDORF, SAMUEL (1632-1694), a German jurist, son of a school teacher.

PUGIN, AUGUSTIN WELBY NORTHMORE (1812-1852) [43], an English designer and architect, son of Augustus Pugin (1769-1832), an architectural draughtsman of French birth.

PUTNAM, ISRAEL (1718-1790) [A], an American revolutionary officer, the eleventh of twelve children.

PYTHAGORAS (B. C. 580-500), a Greek philosopher.

QUATREFAGES DE BREAU, JEAN LOUIS ARMAND DE (1810-1892), a French naturalist.

RABELAIS, FRANCOIS (1490-1553), a French author.

RACINE, JEAN (1639-1699) [24], a French dramatist, son of Jean Racine (1615-1639), a lawyer.

RALEIGH, SIR WALTER (1552-1618) [56], an English statesman and navigator, son of Walter Raleigh (1496-1581).

RANKINE, WILLIAM JOHN MACQUORN (1820-1872), an English physicist and engineer, son of David Rankine, an engineer.

RAPHAEL (1483-1520) [32?], an Italian painter, son of Giovanni Santi, a painter of repute who belonged to a family of artists. He was an orphan at 11, his mother dying three years earlier. For many years before Raphael's birth, Urbino, his birthplace, was one of the chief centers of artistic activity.

READE, CHARLES (1814-1884), an English novelist.

REAUMUR, RENE ANTOINE FERCHAULT DE (1683-1757), a French natural philosopher and inventor.

REDFIELD, JAMES WAKEMAN (1816-1893) [47], an American physiognomist, youngest son of Theophilus Redfield (1769-1853) [34], who was son of Capt. James Redfield (1735-1788) [53], who was son of Theophilus Redfield (1682-1759).

REGNAULT, HENRI VICTOR (1810-1878), a French physicist. His son Henri [33], was a painter.

REICHENBACH, KARL (1788-1869), a German naturalist.

REMBRANDT VAN RYN, PAUL HARMENS (1607-1669) [40], a Dutch painter, son of a miller. His mother was 35.

RENAN, JOSEPH ERNEST (1823-1892), a French orientalist and critic. Had a brother 14 years older.

REYNOLDS, SIR JOSHUA (1723-1792) [42], an English painter, son of Rev. Samuel Reynolds (1681-1746), who was son of Rev. John Reynolds.

RICHELIEU, ARMAND JEAN DUPLESSIS (1585-1642) [37], a French cardinal and statesman, younger son of François Richelieu (1548-1590).

RICHTER, JOHANN FRIEDRICH (Jean Paul) (1763-1825), a German author.

RIENZI, NICOLA GABRINI (1312-1354), "the last of the Roman tribunes."

RIVES, AMELIE (Mrs. Chandler) (1864—) [71], an American authoress, daughter of William Cabell Rives (1793-1868), an American statesman.

ROBESPIERRE, MAXIMILIEN MARIE ISIDORE DE (1758-1794), a French revolutionist.

ROMANES, GEORGE JOHN (1848-1894), an English biologist, third son of Rev. George Romanes and a daughter of Rev. Robert Smith.

ROMILLY, JOHN (1802-1874) [45], an English jurist and statesman, son of Sir Samuel Romilly (1757-1818) [(72+x)÷2], a lawyer and statesman who was youngest son of Peter Romilly, who was a younger son of Etienne Romilly, who fled from Montpelier on the revocation of the Edict of Nantes, Oct. 22, 1685.

ROSSINI, GIOACCHINO (1792-1868), an Italian composer.

ROUSSEAU, JEAN JACQUES (1712-1778), a French author, son of Isaac Rousseau, a watchmaker.

RUBENS, PETER PAUL (1577-1640), a Flemish painter, son of John Rubens, who was a councillor and alderman in his native town 16 years before his son's birth and who removed to Cologne with his wife and four children 9 years before his son was born. Rubens was an orphan at 10.

RUBINSTEIN, ANTON (1830-1894), a Russian pianist.

RUMFORD, count (Benjamin Thompson) (1753-1814), an American natural philosopher, son of Benjamin Thompson and an orphan at the age of 1.

RUSH, BENJAMIN (1745-1813), an American physician, orphan at 6. His son Richard Rush (1780-1859) [35] was a statesman.

RUSKIN, JOHN (1819-1899) [34], an English author, son of J. J. Ruskin (1785—) [25], a London merchant who was son of John Ruskin (1760—).

SAINTE-BEUVE, CHARLES AUGUSTIN (1804-1869), a French author.

SAUSSURE, HORACE BENEDICT DE (1740-1799) [31], a

Swiss naturalist, son of Nicholas de Saussure (1709-1790), a literary agriculturist. His mother was a sister of Charles Bonnet (1720-1793).

SAVONAROLA, GIROLAMO (1452-1498) [68÷2], an Italian reformer, son of Nicolo Savonarola, who was son of Michele Savonarola (1384—).

SAXE, MAURICE (1696-1750) [26], a marshal of France, natural son of Augustus of Saxony (1670-1733).

SCALIGER, JOSEPH JUSTUS (1540-1609) [56], an Italian philosopher and chronologist, tenth son of Julius Cæsar Scaliger (1484-1558), a philologist.

SCHAFF, PHILIP (1819—), a Swiss-American scholar.

SCHELLING, FRIEDRICH WILHELM JOSEPH VON (1775-1854), a German philosopher, son of a prelate at Maulbronn.

SCHILLER, JOHANN CHRISTOPH FRIEDRICH VON (1759-1805) [36], a German poet, son of Johann Kaspar Schiller (1723—) [43], who was son of Johann Schiller (1680-1733) [31], who was son of Johann Kaspar Schiller (1649-1687). Schiller's mother was Elizabeth Dorothea Kodweiss (1733—) [35], daughter of Georg Friedrich Kodweiss (1698-1771).

SCHLEGEL, AUGUST WILHELM VON (1767-1845), a German scholar, son of the poet and clergyman Johann Adolf Schlegel.

SCHLEGEL, FRIEDRICH KARL WILHELM VON (1772-1829), a German philosopher and author, brother of the preceding.

SCHLEIERMACHER, FRIEDRICH DANIEL ERNST (1768-1834), a German theologian, son of a Reformed minister.

SCHLIEMANN, HEINRICH (1822—), a German archæologist, son of poor parents.

SCHOOLCRAFT, HENRY ROWE (1793-1864), an American author.

SCHOPENHAUER, ARTHUR (1788-1860) [42], a German pessimistic philosopher, youngest child of Heinrich Floris Schopenhauer (1746—).

SCHULTZ-SCHULTZENSTEIN, KARL HEINRICH (1798-1871), a German physiologist.

SCHUMACHER, HEINRICH CHRISTIAN (1780-1850), a Danish astronomer.

SCHUMANN, ROBERT (1810-1856), a German composer, son of a publisher.

SCHURZ, CARL (1829—), an American statesman.

SCIPIO AFRICANUS MAJOR (B. C. 234-183), a Roman general. His father was consul, B. C. 218; his grandfather, B. C. 259; his great-grandfather, B. C. 298; and his great-great-grandfather, B. C. 328.

SCOTT, SIR WALTER (1771-1832) [42], a Scottish author, younger son of Walter Scott (1729—). His mother was daughter of Prof. John Rutherford.

SCOTT, WINFIELD (1786-1866), an American general.

SECCHI, PIETRO ANGELO (1818-1878), an Italian astronomer.

SENECA, LUCIUS ANNAEUS (—65) [A^2], a Roman stoic philosopher born a few years before the Christian era, son of Marcus Annæus Seneca (B. C. 61-A. D. 35).

SEWARD, WILLIAM HENRY (1801-1872), an American statesman, son of Dr. Samuel Seward.

SEYMOUR, HORATIO (1810-1886), an American statesman, son of Henry Seymour, who was son of Major Moses Seymour.

SHAFTSBURY, earl of, ANTHONY ASHLEY COOPER (1621-1683) [$(70+x)\div 2$], an English statesman, son of Sir John Cooper and Anne, daughter of Sir Anthony Ashley (1551-1627). He was an orphan at 10.

SHAKESPEARE, WILLIAM, see page 134.

SHELLEY, PERCY BYSSHE (1792-1822), an English poet, son of Sir Timothy Shelley.

SHERIDAN, PHILIP HENRY (1831-1888), an American general, third child of John Sheridan.

SHERIDAN, RICHARD BRINSLEY (1751-1816) [30], an English dramatist and politician, son of Thomas Sheridan (1721-1788) [37], an elocutionist who was son of Thomas Sheridan (1684-1738), an Irish clergyman, who was son of James Sheridan, who was youngest son of Rev. Dennis Sheridan. The mother of Richard was a novelist.

SHERMAN, JOHN (1823-1899) [35], an American statesman, son of Charles Robert Sherman (1788-1829) [30], who was son of Taylor Sherman (1758-1815) [37], who was son of Daniel Sherman (1721-1799) [34].

SHERMAN, WILLIAM TECUMSEH (1820-1891) [32], an American general, brother of the preceding.

SIDNEY, HENRY (1641-1704) [46], earl of Romney, an English statesman, youngest son of Robert Sidney (1595-1677) [32], son of Robert Sidney (1563-1626) [34], son of Sir Henry Sidney (1529-1586) [47], son of Sir William Sidney (1482-1554).

SIDNEY, SIR PHILIP (1554-1586) [25], an English author, son of Sir Henry Sidney (1529-1586) [47]. The mother of Sir Philip was daughter of John Dudley (1502—) [40], who was son of Edmund Dudley (1462—).

SIEMENS BROTHERS, German inventors and engineers, Ernst Werner (1816—); Karl Wilhelm (1823—); and Friedrich (1826—).

SILLIMAN, BENJAMIN (1779-1864) [A], an American physicist, son of Gold Selleck Silliman, who graduated at Yale college in 1752. Benjamin Silliman, Jr. (1816—) [35], also a physicist.

SMITH, ADAM (1723-1790), a Scottish philosopher, posthumous son of Adam Smith, who was controller of customs at Kirkcaldy in 1713.

SMITH, SIDNEY (1771-1845) [32], an English author, son of Robert Smith (1739-1827), who was an orphan at an early age.

SMOLLETT, TOBIAS GEORGE (1721-1771) [73÷2], a British

author, son of Archibald Smollett, who was youngest son of Sir James Smollett (1648-1731).

SNELL, WILLEBRORD (1591-1626) [44], a Dutch mathematician, the first to calculate the size of the earth, and the discoverer of refraction of light. He was son of Rudolph Snell (1547-1613), a mathematician and philologist.

SOCRATES (B. C. 470-399), a Greek philosopher.

SOLOMON (B. C. 1033-975) [52], King of Israel, son of David (B. C. 1085-1015) [A²], who was youngest son of Jesse.

SOPHOCLES (B. C. 496-406), a Greek tragic poet.

SPALDING, MARTIN JOHN (1810-1872), an American archbishop.

SPENCER, HERBERT (1820—), an English philosopher, son of a teacher.

SPENSER, EDMUND (1553-1599), an English poet.

SPINOZA, BARUCH (1632-1677), a Dutch philosopher born in Amsterdam of Jewish parents. His father was a Portuguese merchant who fled to Holland to escape persecution.

STAEL-HOLSTEIN, ANNE LOUISE GERMAINE NECKER DE (1766-1817) [34], a French authoress, only child of Finance Minister Necker (1732-1804).

STEPHENS, ALEXANDER HAMILTON (1812-1883), an American statesman, youngest son of Alexander B. Stephens, who was son of Alexander Stephens (born about 1715 to 1725?) who settled in Pennsylvania in 1746 and who was in England an adherent of Prince Charles Edward.

STEPHENSON, GEORGE (1781-1848), an English railway engineer and inventor. At 18 he could not read. He was son of Robert Stephenson, a fireman. His son Robert Stephenson (1803-1859) [22], was also an engineer.

STEVENS, EDWIN AUGUSTUS (1795-1868) [46], an American inventor and founder of Stevens' Institute of Technology, son of John Stevens (1749-1838), an inventor.

STEVENS, ROBERT LIVINGSTON (1788-1856) [39], an inventor, brother of the preceding.

STEWART, DUGALD (1753-1828) [36], a Scottish metaphysician, son of Rev. Dr. Matthew Stewart (1717-1785), professor of mathematics.

STORY, JOSEPH (1779-1845) [36], an American jurist, son of Dr. Elisha Story (1743—).

STORY, WILLIAM WETMORE (1819—) [40], an American sculptor, son of Judge Joseph Story (1779-1845) [36].

STRADIVARIUS, ANTONIO (1644-1737), an Italian violin maker.

SUAREZ, FRANCISCO (1548-1617), a Spanish theologian.

SULLA, LUCIUS CORNELIUS (B. C. 138-78) [105÷2?], dictator of Rome in B. C. 81. His grandfather was prætor B. C. 186. For six generations=253÷6.

SUMNER, CHARLES (1811-1874) [35], an American statesman, son of Charles Pinckney Sumner (1776—), a lawyer.

SWEDENBORG, EMANUEL (1688-1772) [35], a Swedish philosopher, son of Jasper Swedberg (1653-1735), bishop of Skara.

SWIFT, JONATHAN (1667-1745) [27], a British author, posthumous son of Jonathan Swift (1640—) [45], who was son of Thomas Swift (1595—) [A], who was son of Thomas Swift, who was a preacher in 1570.

TALLEYRAND-PERIGORD, CHARLES MAURICE (1754-1838), a French statesman, eldest son of Count de Talleyrand-Perigord.

TANEY, ROGER BROOKE (1777-1864), an American jurist.

TASSO, TORQUATO (1544-1595) [51], an Italian poet, son of the poet Bernardo Tasso (1493-1569).

TENNYSON, ALFRED (1809-1892) [59÷2], an English poet, fourth of twelve children of Rev. George Clayton Tennyson, who was son of George Tennyson (1750-1835).

THACKERY, WILLIAM MAKEPEACE (1811-1863), an English author.

THEINER, AUGUSTIN (1804-1874), a German historian. His brother Johann Anton Theiner (1799-1860), was a theologian.

THIERS, LOUIS ADOLPHE (1797-1877), a French statesman.

THOMSON, WILLIAM (Lord Kelvin) (1824—), a British mathematician. His elder brother James Thomson (1816—), was a civil engineer.

THORWALDSEN, BESTEL (1770-1844), a Danish sculptor, son of an Icelandic wood carver.

TISCHENDORF, LOBEGOTT FRIEDRICH CONSTANTIN VON (1815-1874), a German Biblical palæographer.

TITIAN (1477-1576), an Italian painter, youngest of four children.

TORREY, JOHN (1796-1873), an American botanist.

TOUSSAINT, FRANCOIS DOMINIQUE (1743-1803), a Haytian general. His parents were slaves of pure negro blood.

TREVIRANUS, GOTTFRIED REINHOLD (1776-1837), a German naturalist. His brother Ludolf Christian Treviranus (1779-1864), was a botanist.

TREVITHICK, RICHARD (1771-1833) [36], English inventor of the steam carriage, son of Richard Trevithick (1735—).

TROLLOPE, ANTHONY (1815-1882) [35+x], an English novelist, son of Anthony Trollope, a lawyer. His mother, Frances (Milton) Trollope (1780-1836), was also a novelist.

TROMP, CORNELIS VAN (1629-1691) [32], a Dutch admiral, son of Maarten Harpertzoon van Tromp (1597-1653), also an admiral.

TRUMBULL, JOHN (1756-1843) [46], an American painter, son of Jonathan Trumbull (1710-1785), an American revolutionist.

TURNER, JOSEPH MALLORD WILLIAM (1775-1851), an English painter, son of William Turner, a hairdresser.

TYNDALL, JOHN (1820-1893), a British natural philosopher, son of John Tyndall.

VANDYKE, SIR ANTHONY (1599-1641), a Flemish painter, the seventh of twelve children of Francis Van Dyke.

VANE, SIR HENRY (1612-1662) [24], an English statesman and colonial governor of Massachusetts, son of Sir Henry Vane (1589-1655), secretary of state, who was son of Henry Vane of Hadlow by his second wife.

VERDI, GIUSEPPE (1814—), an Italian composer.

VERNET, JEAN EMILE HORACE (1789-1863) [31], a French painter, the last of four generations of painters, all eminent. He was son of Antoine Charles Horace Vernet (1758-1836) [44], who was son of Claude Joseph Vernet (1714-1789) [25], who was the eldest son among twenty-two children of Antoine Vernet (1689-1753). Of the other sons of this large family; Antoine Ignace (1726-1775 [37]; François Gabriel (1728—) [39]; Antoine François (1730-1779) [41], appear to have been the more eminent ones.

VILLEMAIN, ABEL FRANCOIS (1790-1870), a French author.

VILLIERS, CHARLES PELHAM (1802-1898) [43], an English statesman, son of George Villiers (1759-1827) [50], who was son of Thomas Villiers (1709-1786).

VILLIERS, GEORGE WILLIAM FREDERICK (earl of Clarendon), (1800-1870) [41], an English statesman, brother of the preceding.

VINCI, LEONARDO DA (1452-1519), an Italian painter, sculptor, architect and physicist, natural son of Pietro da Vinci, who did not die till 1504. Da Vinci is credited with having the most remarkable intellect of his age.

VIRCHOW, RUDOLF (1821-1902), a German physiologist.

VIRGIL (B. C. 70-19), a Roman poet.

VISCONTI, ENNIO QUIRINO (1751-1818), an Italian archæologist. His son Louis Tullius Joachim Visconti (1791-1853) [40], was a French architect.

VOLTA, ALESSANDRO (1745-1827), an Italian physicist.

VOLTAIRE, FRANCOIS MARIE AROUET DE (1694-1778), a French author, son of a treasurer of the chamber of accounts. His only brother was ten years his senior.

WAGNER, MORITZ FRIEDRICH (1813—), a German naturalist.

WAGNER, RUDOLPH (1805-1864), a German physiologist, brother of Moritz.

WAGNER, RICHARD (1813-1883), a German composer, son of an actuary of police, and an orphan in infancy.

WAGNER, RUDOLF JOHANNES (1823—), a German chemist.

WALLACE, ALFRED RUSSEL (1822—), an English naturalist. He was a younger son.

WALLACE, SIR WILLIAM (1270-1305), a Scottish patriot, younger son of Sir Malcolm Wallace.

WALLENSTEIN, ALBRECHT WENZEL EUSEBIUS VON (1583-1634), an Austrian general. He was an orphan at an early age.

WALPOLE, SIR ROBERT (1676-1745) [26], an English statesman, fifth child of Robert Walpole (1650—) [a?], who was eldest of thirteen children of Edward Walpole.

WALPOLE, HORACE (1717-1797) [41], an English author, youngest son of the preceding.

WASHINGTON, GEORGE (1732-1799) [38], first president of the United States, son of Augustine Washington (1694—) [33]. The mother of Washington was Mary Ball (1706—) [A^2], who was daughter of Col. Joseph Ball, probably born before 1650.

WATT, JAMES (1736-1819) [38], a Scottish inventor, son of James Watt (1698-1782) [56], who was son of Thomas Watt, (1642-1734), a teacher of mathematics.

WEBB, JAMES WATSON (1802-1884) [49], an American journalist, son of Samuel B. Webb (1753-1807).

WEBER, KARL MARIA FRIEDRICH ERNST VON (1786-1826), a German composer, son of a musician.

WEBSTER, DANIEL (1782-1852) [43], an American statesman, son of Ebenezer Webster (1739—) [25], a lawyer who was son of Ebenezer Webster (1714—) [47], who was son of Ebenezer Webster (1667—) [35].

WEBSTER, NOAH (1758-1843), an American philologist.

WEDGWOOD, JOSIAH (1730-1795) [43], an English potter, thirteenth and youngest child of Thomas Wedgwood (1687—) [27], who was son of Thomas Wedgwood (1660—).

WELLESLEY, ARTHUR (duke of Wellington) (1769-1852) [34], a British soldier, third son of Garret Wellesley (1735—) [45], first earl of Mornington, who was son of Richard Colley Wellesley (1690—), who was youngest son of Henry Colley Wellesley.

WELLESLEY, RICHARD COLLEY (1760-1842) [25], a British statesman, brother of the duke of Wellington.

WELLS, HORACE (1815-1848), an American dentist, a claimant of the discovery of anæsthesia.

WESLEY, JOHN (1703-1791) [41], an English clergyman, founder of Methodism, son of Rev. Samuel Wesley (1662-1735) [67÷2], a clergyman who was grandson of Rev. Bartholomew Wesley (1595—).

WEST, BENJAMIN (1738-1820) [A?], an Anglo-American painter, the youngest of ten children of John West.

WHARTON, PHILIP (1698-1731) [50], an English statesman, created duke of Wharton, son of Thomas Wharton (1648-1715) [35], eldest son of Philip Wharton (1613-1696).

WHATELY, RICHARD (1787-1863), an English prelate.

WHEATON, HENRY (1785-1848), an American publicist.

WHEATSTONE, SIR CHARLES (1802-1875), an English physicist.

WHITEFIELD, GEORGE (1714-1770), an English clergyman, son of an innkeeper and an orphan as a child.

WHITNEY, ELI (1765-1825) [25], inventor of the cotton-gin, son of Eli Whitney (1740—) [44].

WHITTIER, JOHN GREENLEAF (1807-1892), an American poet, son of John Whittier, who was tenth child of Joseph Whittier.

WIELAND, CHRISTOPH MARTIN (1733-1813), a German author, son of a clergyman.

WIERTZ, ANTOINE JOSEPH (1806-1865), a Belgian painter.

WILBERFORCE, ROBERT ISAAC (1802-1857) [43], an English clergyman, son of the philanthropist William Wilberforce (1759-1833).

WILBERFORCE, SAMUEL (1805-1873) [46], an English bishop, brother of the preceding.

WILLIAMS, ROGER (1599-1683), founder of Rhode Island, second son of William Williams.

WILLIS, NATHANIEL PARKER (1806-1867) [26], an American author, son of Nathaniel Willis (1780-1870), a journalist.

WOHLER, FRIEDRICH (1800—), a German chemist.

WOLCOTT, OLIVER (1726-1797) [47], an American jurist, son of Roger Wolcott (1679-1767).

WOLLASTON, WILLIAM HYDE (1766-1828) [107÷3], an English natural philosopher and inventor, son of Rev. Francis Wollaston, who was grandson of William Wollaston (1659-1724).

WOLSEY, THOMAS (1471-1530), an English prelate.

WORDSWORTH, WILLIAM (1770-1850), an English poet.

WORDSWORTH, CHRISTOPHER (1774-1846), an English clergyman, youngest brother of the preceding. He had sons Christopher (1807—) [33], and Charles (1806) [32], who were the eminent members of the next generation.

WREN, SIR CHRISTOPHER (1632-1723), an English architect.

WYCLIFFE, JOHN DE (1324-1384), an English reformer.

XIMINES DE CISNEROS, FRANCISCO (1436-1517), a Spanish statesman.

ZWINGLI, ULRIC (1484-1531), a Swiss reformer.

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