HUMAN HEREDITY

Redfield

Date Due

	JUN 15 1966		
	[redacted]		
8 Ap'27			
1 Jun35			
25 Ja49 J			
31Jan'61			
23 Aug'62			
5Oct'62V			
NOV 18 1967			

L. B. Cat. No. 1137

Human Heredity

BY

Casper L. Redfield

Author of Control of Heredity, Dynamic Evolution, Great Men, Etc.

CHICAGO

Heredity Publishing Company

1921

CONTENTS

PREFACE

The things set forth in this little book are matters of fact, and not a philosophy or a set of opinions. If some person does not agree, his proper procedure is to find contrary facts to offset those here presented. As there is an ample supply of records, there is no excuse for applying denunciation instead of getting the facts.

For example, my tables show that the children born to fathers less than thirty are much more numerous than those born to fathers over forty. If anyone doubts it, let him go to the birth registry in any city, or to family genealogies to be found in any public library. In examining the pedigrees of intellectually eminent men I found that those born to fathers more than forty are much more numerous than those born to fathers less than thirty. The names of the men in my list are given in my Control of Heredity, and in my Great Men. If anyone questions the results let him make up another list of equally eminent men and tell us what he finds.

A person will not read this book unless he is interested in human welfare. If he is interested in human welfare, he is quite competent to form his own opinions from the facts as to what is the best policy to pursue. For example, if it clearly appears that improvements of the kind which distinguish the higher races from the lower ones come only through the children produced in the later reproductive lives of their parents, he will have no difficulty in forming an opinion of laws which permit a fourteen-year-old boy to marry a twelve-year-old girl, or of customs which control births by shutting off all but a few produced soon after marriage.

I have given a few conclusions when the context seemed to call for them, but for the most part I have left the reader to draw his own conclusions. In a good many cases they are so self-evident as to need no comment.

C. L. R.

March, 1921.

INTRODUCTION

Darwin wrote "The Origin of Species," and that title represents his contribution to science. While there are several races of men, it is generally considered that there is only one species. As we are not interested in producing a new species of man, or in increasing the number of races of men, the origin of species has only an academic interest for those persons who are looking toward human improvement.

Man has risen little by little from savagery to civilization, and the things we are here interested in are those characteristics which distinguish the civilized man from the savage. Going a step further, we are interested in producing in the entire human family more of those characteristics which distinguish such men as Newton, Shakespeare and Franklin from their feeble-minded neighbors. As these are not the things by which we distinguish one species from another, it should be evident that the Darwinian theory has nothing to do with the improvement of human beings.

Perhaps the reader will say that it is inconceivable that selection has nothing to do with human improvements. There are several answers to that. One is that selecting an improvement is not making it, and we are interested in the process of manufacture. Another answer is that Darwin knew his own theory better than anyone else knows it, and in his Origin of Species, (Vol I, p. 282) he says that "no one can solve the problem why, of two races of savages, one has risen higher in the scale of civilization than the other; and this apparently implies brain-power." A third answer is that selection for mental qualities has been carried on in the British peerage for about seven hundred years, and the result is failure.

Mendel crossed the tall pea on the short pea, the wrinkled pea on the smooth pea, and the pea of one color on the pea of another color, and then he in-bred the progeny. His followers have done the same things with other plants and with various animals, and have confirmed his results. These results are said to be important in human heredity.

Perhaps so and perhaps not. Just at present we are not interested in crossing the white race

on a race of some other color, and if we should do so the law would prevent us from breeding brother and sister together to get the Mendelian segregation. Up to the present it has not been shown that we can get pure whites and pure blacks by breeding Mulattos together. Also, we are not particularly interested in inches in height, color of hair, or shape of physical organs, and these are the things with which the Mendelian theory deals. In a political campaign, the political orator, in bringing forward the merits of his candidate, does not say: "Vote for my man, he has brown eyes and curly hair, and is much superior to the other fellow, who has red hair and a pug nose."

We are interested in improvements in mental power, physical strength and endurance, vitality, resistance to disease, and longevity. These are not unit characters at all, and consequently do not come under the Mendelian theory. On this point I will refer the reader to the New York Medical Journal for September 21, 1918.

A eugenic theory based on either the Darwinian theory or the Mendelian theory, is founded on a fallacy. Those theories relate to matters of no consequence in the rise of man from a

lower to a higher plane in the scale of evolution, and the matters of real consequence do not come under those theories.

In investigating these things in human beings, and elsewhere among living organisms, there are certain facts which stand out clearly, and which should be taken into consideration in any study of human improvement. It seems desirable to make here a brief statement of what some of these facts are.

1. The main things in human beings, and in many of our animals and plants, are matters of power, and not matters of structure or color. The powers of all living things, whether animals or plants, are increased by exercising those powers previously in existence, and in no other manner and under no other circumstances or conditions. A man cannot become an athlete by sitting still, no matter what he may eat.

2. The powers within any living thing decline when there is a reduction of the degree of activity which previously existed. An athlete gradually loses his physical powers when he takes up a sedentary life. A race horse retired to the breeding ranks gradually loses his racing powers.

3. The gain in power by exercise, and the

loss of power by idleness, are processes which may, and frequently do, extend through the greater part of long lives. There is no known limit to the increase of powers. The decrease of powers is limited only by death.

4. When the matter extends over two or more generations, improvements come through the offspring of old parents and not through the offspring of young parents. This means that the origin of improvements is to be found in something which occurs in the lives of parents between youth and old age, and not in some spontaneous variation occurring in a germ.

5. When the matter extends over two or more generations, improvements in a particular form of power, (as mental power, trotting power, resistance to disease, etc.), come through the offspring of parents who exercised that particular power to an unusual extent before reproducing, and not through the offspring of any other kind of parents.

6. When a man develops the muscular strength of his arms and hands by manipulating a pair of shears which he uses to cut off the tails of mice, the effect produced upon the muscular strength of the subsequently conceived son of this

man is not determined by examining the tails of the subsequently conceived mice.

7. The idea that the power of an organism is a function of its structure is the same fallacy that resides in the mind of a man who tries to make a perpetual motion machine. That man thinks that if he can get the proper structure he can get unlimited power for nothing.

A race is made up of individuals, and improvement of the race consists in improving the individuals which compose it. The improvement of an individual consists in developing (increasing) some one or more of his powers. An individual can come into possession of such an improvement only by exercise or by inheritance. But an individual cannot inherit from parents something which those parents did not have, and those parents could come into possession of the improvement only by exercise or by inheritance. Unless we are to accept spontaneous generation, or special creation, for the form of improvements here under consideration, we have to accept the idea that powers developed by exercise in one generation are inherited by the next.

Human Heredity

CHAPTER I.

PROCESS OF POWER CHANGES.

WHEN Darwin pointed out that offspring resemble their parents, that there is variation which makes that resemblance not exact, and that by selecting variations of one kind or another great changes can be produced in a few generations, he was simply putting into scientific literature facts well known to common people since long before the dawn of history. But bringing those well known but ignored facts into relationship to other well known facts brought about a revolution in our ideas about the animate world.

There is another set of facts which are the common knowledge of common people, and have been known to our ancestors since the days of the cave man. They are facts which are particularly well known to prize fighters, to horse jockies, and to sporting men in general, but they seem to be unknown to science. Certain it is that scientific literature ignores these facts almost

altogether, and a large part of scientific teaching is wholly erroneous because it is in direct conflict with well known facts which may be easily verified. I refer now to those variations which occur in the powers which distinguish the live animal or the live plant from the dead one.

When I say that these facts are known to common people and to scientists but not to science, I mean that it is known how variations in power capabilities are produced in individuals, but it is not known to what extent these changes may be carried. It is the intention here to show something of the extent to which such variations may be carried by deliberate purpose, and to bring into view isolated facts which are now buried in out of the way places, and to show that they are different phases of one and the same thing.

Men train for athletic contests, horses are trained for racing purposes, carrier pigeons are trained for long flights, and dogs are trained to perform work of many different kinds. When a man trains for a physical contest he takes severe physical exercise day after day, week after week, and month after month. The exercise is of an intensity which will make him weary each day.

A very common statement found in scientific literature is to the effect that when a man works hard for years he gets worn out, has his vitality sapped, and falls into an early grave. The statement is not at all true. The process of expending energy through bodily organs is one step in the larger process of building up energy within exercised organs. Instead of a man becoming worn out and having his vitality sapped by hard work, hard work is the thing that increases his powers and vitality, and extends the length of his life.

How far can this be extended in man? That we do not know as we do not have scientific records bearing on the point, but by personal experiment I have found that a man may add to his physical strength by physical exercise after he has past sixty years of age. But it is frequently said that a man does not really build up physical powers by physical exercise, and that all he does is make manifest inherited powers within. At this point we will go over to the trotting horse, where we have records which we do not have for man.

The trotter is trained for racing purposes, and that training consists in driving the horse at the trot day after day and year after year until finally retired from the track. A racing career lasts as long as it is financially profitable, and no longer. We will take the case of Goldsmith Maid as it is one of the longest of which we have full records. A horse is full grown at three or four years of age, and a few of them live more than twenty years. The record here begins at nine years of age because it was not until that age that she had developed the speed which would classify her as a "standard trotter."

Extreme Speed of Goldsmith Maid.

Age	Time	Feet per second
Nine years	2:30	35.20
Ten years	2:24½	36.54
Eleven years	2:22½	37.05
Twelve years	2:19½	37.85
Fourteen years	2:17	38.54
Sixteen years	2:16	38.82
Seventeen years	2:14	39.40

One thing to be noted here is that her gain in trotting power was not limited to the attainment of full growth, but continued year after year with the most striking improvements made in the evening of life. At ten years of age Goldsmith

Maid had developed more trotting power than ever existed in any ancestor, because, at the time she was conceived, no horse in the world had succeeded in trotting a mile in 2:24½, and those which had approached that speed were not in her ancestry. Yet after her trotting development under trotting exercise had passed the point of any possible inheritance, she made further gains for seven years under continued training. At seventeen years of age she broke the world's record four times in succession.

During the past century, thousands of horses have developed more trotting power than was called for by their inheritance because their development under continued exercise exceeded anything which ever existed in any ancestor. And on the race tracks of the United States during 1917, more than one hundred trotters over ten years of age showed more speed than they ever showed before.

There is another example of continued development of powers under continued exercise, and that is that of milk-production by cows. A cow produces a certain amount of milk per day when she has her first calf, a larger amount when she

has her second calf, a still larger amount when she has her third calf, and so on. We can see this a little better by reference to a table which will show the amount of milk produced by cows of different ages.

Holstein-Friesian Milk Production—Official Tests for Year Ending June 14, 1913.

Ages of Cows	Av. Milk in 7 Days
Under 2 years, 6 months	322.7 pounds
2 years, 6 months, to 3 years	348.8 pounds
3 years to 3 years, 6 months	400.3 pounds
3 years, 6 months, to 4 years	418.2 pounds
4 years to 4 years, 6 months	446.8 pounds
4 years, 6 months, to 5 years	459.2 pounds
Over 5 years (av. 7 years)	473.8 pounds

There were 5,961 cows in these tests, and the average milk produced by them was 3.4 pounds more than that produced by other cows of the same ages the previous year. Considering only the 473.8 pounds produced by the average cow over 5 years of age, this is 19 pounds more than similar cows produced seven years earlier. At the earlier date there were 455 cows over five years of age which were tested officially and are recorded in volume 6 of the Blue Book. I have analyzed these for the purpose of making a table which will show what happens beyond 5 years of age.

Cows Over 5 Years of Age—Holstein-Friesian Milk Production—Official Tests for Year Ending May 15, 1906.

Ages of Cows	Av. Milk in 7 Days
5 years to 6 years	433.75 pounds
6 years to 7 years	449.00 pounds
7 years to 8 years	449.51 pounds
8 years to 9 years	458.10 pounds
9 years to 10 years	468.71 pounds
10 years to 11 years	490.35 pounds
11 years and over	446.33 pounds

By an inspection of the details of which this table is composed, and by making another table which shows the same cows tested in successive years, I find that the actual increase in milk production from year to year is much more than that given in the above table. Also I find that actual increase extends up to twelve years of age, which is as far as these records reach on cows tested two years in succession.

A cow may not be full grown when she has her first calf, but she does not continue to grow in size up to the time she has her tenth or eleventh calf. Under continued exercise which is more than some minimum amount per unit of time, animal powers continue to develop up to some unknown point near the end of life.

A dope fiend suffers no inconvenience when taking a dose of poison great enough to kill several men. He does not survive the taking of such large doses because he was born with more powers than other persons. He does so because he began with small doses, such as any person might take and survive, and then gradually increased the size of the doses as his powers were developed by the exercise of fighting such poison.

Calmette and Fraser found that when small doses of snake venom, insufficient to cause death, are injected into an animal, temporary disturbance is produced; but after a few days the animal recovers, and a larger dose is required to produce any symptoms. By gradually increasing the dose the animal becomes more and more resistant, until a dose fifty times as great as would at first have produced immediate death can be injected without doing the animal any harm.

If we take some wild plant and attempt to reproduce it by cuttings, we are likely to find that it can be reproduced that way only with difficulty. But if we take a cutting from the first plant raised that way we find the second time it grows a little more readily. If we take a cutting from

the second plant to raise a third, we again find that it starts more easily, and so on time after time. By many repetitions the plant develops the power of producing roots abundantly from cuttings. By exercising the powers which it has it acquires powers which it did not have before, and which never existed in any ancestor.

There is no selection in this matter. No seeds are produced. The final plant is really a developed section of the original plant, but has powers which the original plant did not have. A large number of our greenhouse plants are now produced by cuttings, but originally came from stock which would grow that way only with difficulty.

Henslow says that the hypocotyl of a seedling sunflower, which would break under a weight of 160 grams, bore a weight of 250 grams after being subjected for two days to a weight of 150 grams. After some further physical training, the weight was increased to 400 grams without causing injury. Here we have in plants something which corresponds exactly to the development of muscular strength by muscular exercise in animals. Similar and even more pronounced results

have been found in the leaf stalks of black hellebore after five days of physical training.

The Binet system is used to measure the mental development of children. To measure anything it is necessary to have a standard for comparison. By testing a good many children, the Binet system establishes a certain degree of mental development as representing normal-mindedness for a five-year-old child; a higher degree of mental development as representing normal-mindedness for a six-year-old; a still higher degree of mental development as representing normal-mindedness for a seven-year-old; and so on.

The Binet system does not extend its standards into the mature years of adult life because the tests used are not suitable for that purpose, but we can reach the matter in another way. It requires mental power to learn a thing and remember it while learning a second thing. It requires more mental power to remember two things while learning a third; more yet to remember three things while learning a fourth; still more to remember four things while learning a fifth; and so on. From youth to old age we are continually learning things, and we carry

the learned things in our memories while we learn other things. These learned things are a load which requires mental power to carry, and the increasing number of things we thus carry is a measure of our growing mental power.

The converse of the gain of powers by exercise is the loss of powers by idleness,—the term "idleness" meaning a reduced degree of activity and not a total cessation of action. As a matter of fact, gain and loss are two operations which go on simultaneously in the body of each individual, but for simplicity we will consider them separately.

All plants raised for any considerable length of time by division, like tubers, bulbs, cuttings, buds or grafts, gain the power to produce roots abundantly, and at the same time they lose the power, sooner or later, to produce seeds. By continually exerting themselves along particular lines plants develop new powers along those lines, and by continued idleness along other lines (seed production) they lose the power they originally had.

Man took wild plants, and, by continually training them, developed their power of producing the things he wanted.

In the wild state these plants had to fight for existence in a world covered with other plants. When man domesticated these plants he protected them from weeds. As a consequence of not having to fight for room against other plants, our domesticated kinds have lost the power of so fighting, and are unable to maintain themselves when deserted by man. Idleness along that line caused a loss of power on that line. There is no selection in this. Man did not select plants because of their inability to protect themselves.

A seed is an inert object, but it contains germ-plasm and has the power, under proper circumstances, of developing into another plant like that from which it came. At least it has that power when it is first produced. But let that seed lie idle two, three, four or more years, and that power gradually declines and finally ceases to exist. The germ-plasm (the physical basis of heredity) is still there, but it has lost its power of developing into a new plant because of a failure to exercise that power for a considerable length of time. The loss of powers by reason of a failure to exercise them applies to the germ-plasm just the same as it does to the somatoplasm.

A plant which is continually raised from cuttings is not raised from seed, and consequently is not exercising its powers of growing from seeds. It may be exercising its powers of producing seeds, but the powers of producing seeds and the power of growing from seeds after they are produced are two different things. Now it happens that all plants which are continually reproduced by cuttings, grafts, tubers, or divisions of any kind, and not by seeds, gradually and certainly lose their power of producing seeds which will germinate, and ultimately lose the power of producing seeds at all. The germ-plasm cannot retain a power which it does not exercise, and it cannot transmit a power which it does not have.

The theory of the continuity of the germ-plasm is one of those fallacies which gains a wide currency because of a lack of knowledge of the fundamental characteristics of living things. It assumes that a living body can have a power which it never has exercised, and which was never exercised by any ancestor from which it was derived. Such a thing is utterly impossible.

Experiments have shown that when smallpox virus is taken from a human patient and inocu-

lated into a cow, it will take only about once in ten trials. In fact, the smallpox germ can survive in the cow only when it comes to some cow which, from some cause or other, happens to be in an unusually weak condition at the time. But when this organism has once succeeded in its fight for life in the blood reaction of a weak cow, it has built up its powers by its own efforts in fighting that kind of blood reaction and then can be passed along to and can live in a cow in whose blood it would have died if inoculated there in the first instance. Then it can be passed along from cow to cow in series, and each time it thus passes it further builds up its powers of fighting the blood reaction of cows by exercising such powers.

While the smallpox germ is thus busy developing its powers of fighting the blood reaction of cows, it is not fighting the blood reaction of man, with the result that if it be inoculated into a man after having passed through a series of ten or twelve cows, it is found to be cowpox and not smallpox. It has lost the power of fighting the blood reaction of man by not exercising that power, and is able to survive only a short time in

that blood reaction. And a man who is vaccinated builds up his powers of resisting smallpox by beginning his exercise on a weak form of it, with the result that he becomes able to resist fully virulent smallpox when it later puts in an appearance. But after he is vaccinated he ceases to exercise his powers of fighting smallpox virus because there is none present to fight, and the result is that these powers gradually decline. If he is to continue to be able to resist smallpox he must again exercise the powers he has by again being vaccinated.

Here we have a case of one kind of power being built up in the protoplasm of a germ by exercising that power, and simultaneously another power in the same protoplasm was permitted to decay by reason of a failure to exercise it. Also, we have the case of resisting powers being built up in the bodily cells of the man by exercising such powers as he had at the time, and subsequently the decline of the same powers in the same person by a failure to exercise them for some years.

When disease-producing bacteria are raised on some artificial food, as bouillon or agar, they do

not have to fight a hostile blood reaction, and as a consequence they gradually lose their disease-producing powers by failing to exercise them. By putting such weakened bacteria through a course of training in which they are forced to use these powers to a gradually increasing extent, their virulence can be increased to something greater than it was when they were first placed upon artificial food. These facts were first found by Pasteur in working on the anthrax bacillus, and have since been found by other persons working on other germs.

CHAPTER II.

SOME EMINENT MEN.

THE modern birth control doctrine is to produce fewer children and better ones. Their method of procedure is to have parents stop producing as soon as they have two or three children and give their attention strictly to the upbringing of those two or three.

If that practice had begun back in the Stone Age, we would still be in the Stone Age. The "we" of that statement does not mean the readers of this, because every one of us has in our ancestry a good many persons who were later than the tenth child. It means whatever might be alive as the result of that proceeding, and if anything human were alive they would be in the Stone Age because advancement comes through children produced late in the lives of their parents, and not otherwise. In this matter let us examine a few persons alphabetically.

Alfred the Great, the greatest of British kings, was the fifth and youngest son.

Sir Richard Arkwright, the inventor, was the youngest of 13 children of parents too poor to give him an education.

"The great Arnauld," famous French theologian, was the youngest of 20 children.

Audubon, America's naturalist, was born when his father was 57, and that father was the youngest of 20 children.

Sir Francis Bacon, one of the most profound of intellects, was the youngest of 8 children.

Sir Charles Bell, famous surgeon, was the youngest of 6 children.

Bismarck, the founder of the German Empire, was the youngest surviving son.

Blackstone of law fame was a youngest son.

Robert Boyle, "the great Christian philosopher," was the fourteenth child.

Elihu Burritt, "the learned blacksmith," was the youngest of ten children.

The fact that mental eminence comes from the late progeny of a man rather than from the early progeny may be seen in the Lee family of Virginia. The story begins with Richard Lee (1646-

1714), who was certainly a younger and probably the youngest son of a "numerous household." He had five sons, the last two of whom became the progenitors of the eminent branches of the family. One of these was Thomas Lee (1690-1750), born when his father was forty-four, and the other was Henry Lee (1691——), born when his father was forty-five.

Like his father, Thomas Lee had five sons, the last three of whom were the eminent members. One of these was Richard Henry Lee (1732-1794), who was born when his father was forty-two and who became a statesman and orator. Another was Francis Lightfoot Lee (1734-1797), who was born when his father was forty-four, and who was one of the signers of the Declaration of Independence. And the third was Arthur Lee (1740-1792), who was born when his father was fifty, and who was a statesman and diplomat. These men all have places in the Encyclopedia Britannica, which is evidence that they were of more than ordinary ability.

From Henry Lee (1691—), son of the original Richard, the eminent line continues down through his youngest son, Henry, born when his

father was thirty-eight, his grandson, "Light Horse Harry," and his youngest great-grandson, Gen. Robert E. Lee.

What is presented here about the Lees is not family gossip. The persons named are not simply members of a prominent family. They are the most eminent members of an eminent family, with the emphasis in the superlative. The analysis shows where eminence does and where it does not arise in any line of descent from common ancestors. Using "eldest" and "youngest" in a generic sense to indicate early and late offspring from the parents, we may say that improvement comes through the youngest son of the youngest son, and not through the eldest son of the eldest son.

Benjamin Franklin was clearly one of the master intellects of the world. It is doubtful if there lived at the same time another intellect equally great. However that may be, it is certain that there were not a half dozen of them. Franklin tells us that he was "the youngest son of the youngest son for five generations back." Franklin considered that as merely curious, and others since then have thought the same thing.

But "curious" things analyzed lead to important truths. When there are many in a family, the "youngest" is the offspring of old parents. It was this way in the case of Franklin. Ben was born when his father was 51, the father was born when the grandfather was 57, and the grandfather was born when the great-grandfather was in the neighborhood of 70. The rest of the male line is not known, but Ben's mother was born when her father was 50. Here is an average of 57 instead of the normal average of 32.

Ben's father was a soap boiler, but he was a learned man. He was a studious, self-taught man, who got his education first and his son afterwards. The father of Ben's mother was a "learned Englishman," who got his education first and his daughter afterwards. Both of these men were studious men in the strict meaning of that term. But even a person who is not studious gets an education by mere contact with his fellow man. The person who is old when his child is born is one who has got his education first and his offspring afterwards.

George Washington was somewhat above the ordinary run of men. He is even considered to

have been superior to the prominent men of his day. He was born when his father was 38, and the next three generations cover 99 years. This is an average of a little over 34. But there is a suspicion that Washington's greatness came from his mother. She was Mary Ball, born when her father was about 60 years of age. There is a Ball pedigree extending back eight generations, but dates are not given. From Mary's birth back to the estimated birth of the earliest of these Balls, the average is about 40 years.

Henry Ward Beecher was perhaps the greatest preacher of the nineteenth century. At least, he was exceptionally brilliant. Henry was born when his father was 38, and that father was a Yale graduate and a learned man who got his education first and his son afterwards. The father, Lyman Beecher, was born when his father, David, was 35 or more years of age. And David was one of the best educated persons in New England, who got his education first and his son afterwards. Running out the male line to Isaac Beecher, born in 1620, we have five generations in 193 years. In the other parts of Beecher's pedigree we have the ages of seven other persons.

The average for the entire twelve is over 36. Among the other persons were one lawyer, one colonel and one general. These were all educated men who got their educations first and their offspring afterwards.

In the early part of the eighteenth century there was a poor French fisherman with a large family. Poor fishermen do not get much education in the ordinary significance of that term, but the work of fighting storms on the bay of Biscay and providing food and clothing for a large and growing family develops mental powers, and that is the kind of education referred to here. In 1723 that fisherman's twentieth child was born, and it is very certain that that fisherman had acquired a good deal of education before that twentieth child was conceived. That twentieth child rose to be an admiral in the French navy, a fact which indicates that he inherited mental ability from his parents, and that he acquired considerable education. By the time this French admiral had got education to the extent of 57 years he became the father of a child, subsequently known as John James Audubon, America's greatest naturalist.

Alexander the Great needs no particular introduction. He was the son of Philip of Macedon, and was born when his father was 26. But if we will look more at essentials and less at the spectacular we will observe that Alexander reaped where Philip had sown, and that Philip was the brains back of Alexander's achievements. Philip was born when his father Amyntas II was about 63, and Amyntas was born about 90 years after the birth of his grandfather, Alexander I. Including the 26 for Alexander the Great, the average is nearly 45 for four generations.

Men of unusual ability gravitated to Washington during the war, and were given unusual authority. Let us suppose that one of these men should be superior to others, and be given more authority than that given to any one else. How much superior would that person have to be before we abolished the republic, made that man an emperor, and gave him the honorary title of Augustus? But Octavius changed the Roman Republic into an Empire, and is known as Augustus of Rome. He was born in 63 B. C., and his great-grandfather was in the battle of Cannae, fought in 216 B. C. The least we can figure

gives an average of 57 years from birth of father to birth of son for three generations in succession. And his mother was the youngest sister of Julius Cæsar.

In the early days Rome was controlled solely by the patricians. Little by little the plebeians gained in power at the expense of the patricians. The most prominent member of the most illustrious plebeian family of the Claudia Gens was Marcus Claudius Marcellus. As evidence that we are not referring simply to an ordinary superior person, observe that double superlative. The average for seven generations in the male line to Marcellus is over forty years.

The Kembles were a famous family of actors and actresses. Recorded history begins with Roger Kemble, born in 1721, who was an actor and the father of eleven children, all of whom were more or less famous in theatricals. The famous grandchildren of Roger were Fanny Kemble, and Adelaide, also known as Mrs. Sartoris. Both were authors as well as actors. Now these famous granddaughters did not come from Roger's first child, or his second child, or his third child, or his fourth child, or his fifth child, or his sixth

child. They came from his eleventh and youngest child, Charles Kemble, who was born when his father was fifty-four years of age. Evidently the wife of Roger did not practice birth control, otherwise there would have been no Fanny Kemble, or Mrs. Sartoris. Neither would Fanny and Adelaide have existed if the wife of Charles had indulged in birth control, as one was born when her father was thirty-six and the other when he was forty-five.

It has been the fashion for some time to say that Lamarck advanced a false theory of evolution. But as the persons who say that have not yet succeeded in making an intelligent statement of what Lamarck's theory is, we may pass their opinions as unworthy of consideration. Lamarck was born when his father was forty-two and the next two previous generations cover something more than 110 years. This is an average of more than fifty years for three generations in succession.

William Thomson, afterwards known as Lord Kelvin, was a son of Prof. James Thomson, and was born when his father was 38. And James was born when his father was 48. This is a total

of 86 years from birth of grandfather to birth of grandson. This may not appear much, but if there is nothing in years of education given the father and grandfather before they reproduce, then it should be possible to find some other man as good as Kelvin, who was born less than 48 years after the birth of his grandfather. Try it.

Hereditary kings are not usually of much importance from the intellectual standpoint, but Gustavus Adolphus of Sweden is an exception. He was born 98 years after the birth of his grandfather, Gustavus Vasa. In ordinary populations, more persons are born within 44 years of the births of their paternal grandfathers than are born 98 or more years after. Normally, hereditary kings are the eldest son of the eldest son, and great numbers of them are born within 44 years of the births of their grandfathers. Just try to find one so born who is in any way comparable to Gustavus Adolphus from the intellectual standpoint.

In other contributions I have shown that Charles Darwin was produced by an ancestry which accumulated, in a few previous generations, an aggregate of more than fifty years of

extra education before reproducing. But Darwin does not carry off all of the glory. Alfred Russell Wallace did something. Wallace was born when his father was 52, and the father was born when the grandfather was 46. Here is another 98 years in two generations to match that of Gustavus Adolphus. What man born within 44 years of the birth of his grandfather is the equal of Wallace?

John and Charles Wesley were the founders of Methodism. There can be no doubt about the intellectual superiority of these men. They were the sons of the Rev. Samuel Wesley who was 40 and 43 years of age respectively when his famous sons were born. Now it is quite evident that the Rev. Samuel must have acquired a good deal of education before his sons were conceived. It also happens that the mother of John and Charles was Susanna, the twenty-fifth and youngest child of Dr. Samuel Annesley, a vicar. There can be no doubt but Dr. Sam had acquired a good deal of education before his twenty-fifth child was conceived. And where would Methodism be if birth control had got in its deadly work in the families of these two pious Samuels?

The steam engine and several other inventions of a high order are due to a Scotchman by the name of James Watt. James was born when his father was 38, and the father was born when the grandfather was 56. This is only 94 years for two generations, but only one person in 122 is born as great a length of time as that after his grandfather. And the grandfather of James Watt was a teacher of mathematics, a fact which shows that education before reproduction was not only long continued but was intense as compared to what exists in the general population.

Some of these persons who do not like to have facts of this kind presented to the public may come along and say that Confucius was his father's eldest son. Quite true. All of the other children were girls, and the father was 71 when the famous son was born. Also, the father was a learned man and a chief magistrate. Also, the mother was the youngest daughter of another learned magistrate.

Or, the objector may say that Cuvier, the French naturalist, was an intellect of the first order, and was his father's eldest child. Correct again. But it happens that the father was a

younger son, was trained as a military officer, and did not get married until he was fifty years of age. Intense education long continued led to the production of this remarkable Frenchman.

In the same year that Cuvier was born, Alexander Von Humboldt was born, and no one can say that there was any lack of intellect in Humboldt. As in the case of Cuvier, Humboldt was the son of a military officer, and this officer was 49 when Alexander was born. Just as many children are born to fathers 22 and under, as are born to fathers 50 and over. It will be interesting if someone will find some Cuvier or Humboldt born to a father 22 or less.

The same year that produced Cuvier and Humboldt also produced Napoleon Bonaparte, born when his father Carlo Bonaparte was 23 years of age. Does the reader think that I have met my own suggestion? That will depend upon the meaning applied to human superiority. Napoleon was doubtless far more famous than either Cuvier or Humboldt, but how about intellectual superiority as distinguished from mere fame? Does anyone think that in the realm of pure intellect Napoleon was the equal of either Cuvier or Hum-

boldt? Probably not. In his life-time, Humboldt was recognized as an authority on every known science, and he was the last man to be so recognized. At the present time, the sciences are too numerous and comprehensive for even the mind of a Humboldt.

In the field of science it is doubtful if it is possible to name any persons superior to Cuvier or Humboldt, and it is doubtful if anyone can say either of these men was superior to the other. But as a military chieftain and conqueror, compare Napoleon with Genghis Khan, who lived six hundred years earlier, and Napoleon shrinks to small potatoes. Napoleon tried literature but was unable to produce anything of value in that line. As a chess player he was inferior to several of his generals. He was a brilliant commander of small armies, but that is practically all. There is nothing to indicate that he was a master in handling armies of more than one hundred thousand. There is every reason to think that he would be wholly incompetent to handle such vast armies as those recently fighting in Europe.

The pedigree of Napoleon stops with his parents. We have no information about either set

of grandparents. If Napoleon was born a short time after the births of his grandparents, then some of his numerous biographers should have found and given us the facts about those grandparents. The fact that no biographer has told us about those grandparents indicates that they were so far in the past that, when the biographers got busy, there were no living persons who knew those grandparents and could tell about them. The difficulty in finding records increases with their distance in the past, and one reason why we know so little about the ancestors of eminent men is due to the fact that they are the final product of old parentage repeated two or three or more generations in succession.

Biographers can rarely tell us about the grandparents of eminent men. Compare that fact with the fact that investigators have no great difficulty in tracing the Jukes, the Ishmaels, the Kallikaks, and other inferior families for three, four, five or six generations. The difference is due to the fact that in one case the generations are far apart and in the other case they are near together.

CHAPTER III.

THE AGE OF PARENTS.

IN what has gone before we have cited a number of eminent men as the product of slowly moving generations. Citing instances is often persuasive, but it is hardly conclusive. What we want is some kind of evidence that it is not possible to find contrary cases to offset the cases given. This we can do by the establishment of standards and the use of statistics.

When we speak of slowly moving generations we refer not only to the ages of the fathers when the eminent sons were produced, but to the ages of the grandfathers when the parents were produced, and the ages of the great-grandfathers when the grandparents were produced. We also refer to the mothers, and grandmothers, and great-grandfathers, but unfortunatey our human records do not give these facts, and we have to use what we can find.

Practically every pedigree extended for three or four generations has in it some young parents

and some old parents. A pedigree extended that far and composed of all old parents or all young parents is very rare. The terms "old" and "young" as here used is somewhat vague, but means a few years more or a few years less than the average. The average in the white race is about 32 for fathers when children are born. If we take five years above and below this as representing old and young, we may then say that it is rare to find a pedigree in which all males in three or four generations are either above 37 or below 27 when the next generation is produced.

The first step in this proceeding is to find the normal distribution of births in normal pedigrees in a normal community, and then compare that with what is found in the pedigrees of intellectually eminent men. The normal distribution was determined by tabulating births as they occurred in the 18th century in New England, and as they are recorded in family genealogy. The table for that is our standard for comparison.

In the cyclopedias were found 571 eminent men in whose pedigrees it was possible to get dates of births for one or more ancestors in each pedigree. A tabulation of the distribution

of births in the pedigrees furnished the material to be measured by normal distribution as a standard. The results are given in the following table:

Percentages of Births to Fathers of Different Ages.

Age of Fathers	In Normal Pedigrees	In Pedigrees of Eminent Men	Relative Value of Father Age
24 and under	9.06	1.63	1.000
25 to 29.....	23.05	9.77	2.356
30 to 34.....	26.00	16.63	3.557
35 to 39.....	19.67	19.19	5.426
40 to 44.....	13.39	20.23	8.406
45 to 49.....	5.50	14.53	14.670
50 to 54.....	2.22	10.12	25.328
55 to 59.....	0.72	4.30	33.138
60 and over.	0.39	3.60	51.562
	100.00	100.00	

This table shows that normally more than 9 per cent of all children are born when their fathers are less than 25 years of age, but that in the pedigrees of eminent men less than 2 per cent are the offspring of such young fathers. Normally more than 23 per cent of children are born after the fathers are 25 and before they are 30, but in pedigrees of eminent men less than 10 per cent are the offspring of such young fathers. Continuing the comparison, it is seen

that eminent men are not produced in the same manner that ordinary people are produced.

The last column is calculated from the other two in a well-known manner. It shows to what extent added age in the father helps to give the son a good mental inheritance. Putting that last column into the form of a diagram we have what is shown in Fig. 1.

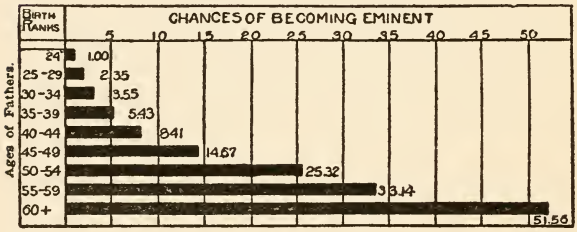

Fig. 1. Relative chances of becoming eminent, as measured by age of father at birth of son. From "Great Men," by Redfield.

The preceding table gives the distribution of births as they occurred two hundred years ago. In recent years there has been a decline of births, which has been ascribed to birth control. For the purpose of determining just what was happening, a similar tabulation was made from the birth registry in Chicago for the year 1913. The

result is shown in the following table, in which all three tabulations appear:

Percentage of Births to Fathers of Different Ages.

Ages of Fathers	In Pedigrees of Eminant Men	Normal	In Chicago
24 and under....	1.63	9.06	15.83
25 to 29.....	9.77	23.05	31.20
30 to 34.....	16.63	26.00	24.67
35 to 39.....	19.19	19.67	15.30
40 to 44.....	20.23	13.39	8.06
45 to 49.....	14.53	5.50	3.55
50 and over	18.02	3.33	1.39

Is it really necessary to comment on that table? Is it not perfectly plain that birth control as it is being practiced in Chicago is carrying the race backward?

It is recognized that from powerful-minded parents we get powerful-minded offspring, and from feeble-minded parents we get feeble-minded offspring. It was shown before that mental power in human beings continues to develop from youth to old age. Hence, the same normal-minded person may be relatively feeble-minded *as a parent* in early life, and relatively powerful-minded in later life. We have examined powerful-minded persons and have found that they

came from the late lives of their parents. Let us look at the other side of the picture.

During the Revolutionary War a twenty-year-old boy, now known under the fictitious name of Martin Kallikak, Sr., came into contact with a young girl of unstated age. The result was an illegitimate son, now known as Martin Kallikak, Jr. As Martin, Sr., and the girl were both much below what is normal-mindedness for the standard parent, it will be seen that Martin, Jr., was by two feeble-minded parents. As we get only feeble-minded children from feeble-minded parents, Martin, Jr., was born feeble-minded and became the founded of a feeble-minded family.

Martin, Jr., started life with some degree of feeble-minded handicap, but even a feeble-minded person can develop to some extent as the years go by. We may suppose that Martin, Jr., could reach or nearly reach the standard for a thirty-year-old, even if he did not arrive at that point until he was fifty years old. Martin, Jr., had several sons, the eldest of whom was born when his father was far below the thirty-year standard. He was below that standard partly because of his inheritance, partly because of lack

of schooling, and partly because of lack of years when the eldest son was born. The eldest son is said to have been feeble-minded, and the head of the principal feeble-minded branch of the Kallikak family.

The second son, born after Martin, Jr., had come nearer to the thirty-year standard, was also feeble-minded, but to a less extent. Some branches of his descendants are said to have been normal-minded or doubtful. The third son, born after Martin, Jr., was still nearer the thirty-year standard, is said to have been normal. Martin, Jr., also had several daughters. The earlier ones were all feeble-minded, but the last two are said to have been normal. The parents had acquired mental development between the births of their first and last children.

Let us return to the history of Martin, Sr. About ten years after the contretemps which resulted in the feeble-minded Martin, Jr., Martin, Sr., married a girl of good family and one who had a good or fair education. At this time Martin, Sr., was nearly thirty years of age, and was much nearer to what is normal-mindedness for average parents when the average child is

born. He had several children by this marriage, all of whom are said to have been normal.

Martin, Sr., was a feeble-minded parent when Martin, Jr., was conceived, but was substantially normal-minded when his other children were conceived. We have feeble-minded stock coming from the first union, and normal-minded stock from the second. Of course, some of the difference was due to the individuality of the mothers, but the first one was feeble-minded for the same reason that her partner was, and the second was normal-minded for the same reason that Martin, Sr., became normal-minded at a later date.

"The Ishmaels" is a named used to designate a group of degenerate families which are located in and near Indianapolis, and which came mostly from Kentucky, Tennessee and North Carolina nearly a hundred years ago. In a statement made about thirty years ago, McCullock catalogs 1,750 criminals, paupers and prostitutes among them, fifty-seven of whom were in the *sixth* generation from the original importation. McCullock states that he personally knew three generations of beggars among them. His descriptions make

the average parents, generation after generation, less than twenty years of age.

Another famous group of degenerates is known as "The Jukes." The story begins with a girl known as "Margaret, the mother of criminals." She was an eldest child, born when her parents were quite young, though their ages are not given. In 1784, while Margaret was in her teens, she had an illegitimate son. In turn, this illegitimate son became a father at the age of fifteen, and the son of this fifteen-year-old father became the founder of one of the worst branches of the Jukes family. Observe the *three successive generations* of unusually young parents, one of which was a male only fifteen years old when his son was born.

The records of the Jukes show that one girl became a mother at the age of twelve, and several others at thirteen and fourteen. One boy contracted syphilis at the age of thirteen. He was born only thirty-six years after the birth of his paternal grandfather.

Remembering that the different races and tribes of men freely interbreed, and consequently are biologically close cousins, and that apes and

other animals are somewhat more distant cousins, it will help some to make a table which will represent, approximately, the length of time elapsing from generation to generation in the male line.

Approixmate Average Age at Reproduction	
Rabbits	1 year
Cattle	4 years
Horses	10 years
Apes	16 years
Digger Indians	21 years
Eskimos	23 years
Polynesians	26 years
Chinese	29 years
Chicago in 1913	31 years
New England in 18th Century	33 years
Fathers of 571 Eminent Men	40 years
Fathers of 10 Extraordinary Men	58 years

It will be worth the reader's while to study that table, and to take notice of the fact that it might have been very much extended by including within it many other tribes and races of men, and many other lower animals, with regard to which we have fairly reliable informa-

tion. What is given, however, is sufficiently comprehensive to make it evident that the advance of many animals in the scale of evolution is quite accurately represented by the length of time elapsing from one generation to the next.

Due consideration of the table will make it evident that selection has nothing to do with bringing about the kind of improvements which distinguish the higher animals from the lower ones, and consequently nothing to do with the improvement of the human race. To have selection, a pair of parents must produce more than a pair of offspring, and the greater the number of offspring, the more the opportunity for selection to get in its deadly work. Also, the more frequently the generations follow each other, the more is the selection. Lengthening the time between generations cuts out selection and its opportunities for accomplishing anything. Looking at that table it is seen that we get improvement by a process which necessarily results in eliminating selection. If selection had anything to do with the matter, then rabbits should very quickly overtake and pass human beings.

CHAPTER IV.

FROM SAVAGERY TO CIVILIZATION.

IN the early stages of social organization, men became divided into tribes. A vast number of tribes have existed at one time or another. A few of those tribes have advanced from savagery to civilization and have become organized into nations; others still remain as tribes at the present time; while the remainder, and by far the larger number, have become extinct. As examples of extinction it is only necessary to mention the disappearance of Indian tribes in North America, and the disappearance of other tribes in other parts of the world invaded by the white man. But the white man is not the sole cause of tribes becoming extinct. Neighboring tribes frequently exterminate each other by warfare, the stronger killing off the weaker. In South America, Humboldt saw a parrot which was the sole living thing capable of speaking the language of an extinct tribe.

Travelers have found among surviving tribes of savages many bizarre customs. Many explanations have been offered as to the origin, meaning and usefulness of these customs to the tribes practicing them, but we are not here concerned with the origin of any particular custom. We may simply assume that each custom arose from some particular circumstance without troubling ourselves to inquire what those circumstances were. If a custom adopted for any reason whatever proved advantageous to the tribe in its struggle with other tribes we may assume that the tribe adopting the custom would be likely to survive. If a custom adopted proved disadvantageous, the tribe adopting it would become more than ordinarily liable to extinction. Hence, we may assume that those customs which we now find widely prevalent among surviving tribes are, in some way, advantageous to the welfare of the tribes adopting them.

One of the widely prevalent customs among savages is that of "exogamy," a term proposed by McLennan for the custom of compelling marriage out of the tribe. It is the converse of "endogamy," which is the practice of compelling

marriage within the tribe or community. Endogamy was probably a very early custom, but is now found only among very low races, and those protected by their locations. Exogamy is widely prevalent among surviving tribes, and those which appear to be advancing. We may therefore assume that there is something about exogamy which makes it more advantageous than endogamy. The most common explanation of this advantage is that it prevents in-breeding, a practice which is said to be injurious. The practice of exogamy is supposed to be the forerunner of our customs and laws which prohibit the marriage of close relatives.

There is another reason why exogamy is more advantageous to a savage tribe that endogamy. When the wife is to be had within the tribe, she is convenient, and any ten-year-old boy can get one when he wants her without the least trouble or effort. When the wife must be "captured" from some other tribe the case is different. She is not so convenient and cannot be had so soon. Furthermore, he is put to considerable trouble to get her, and has to do a good deal of extra work and planning before he accomplishes that

result. Exogamy is one of the many ways employed by different races to interfere with early reproduction and to compel the would-be husband to do an extra amount of work before he can have his mate.

Races of men have risen from savagery to civilization by interfering with the mating instincts of the young in such a way as to postpone the actual age at which production begins, and by the introduction of customs which compelled an extra amount of physical and mental effort to be expended before reproducing. Whenever such customs were introduced and maintained, the tribe introducing them rose, generation by generation, to a higher level of intelligence. Whenever a tribe failed to introduce some customs having these general results, that tribe fell by the wayside unless it was protected by isolation from competition with other tribes.

Exogamy represents one of these methods of interfering with early mating. The custom of purchasing brides is another form of interference. The young man who must purchase his wife must first spend some time acquiring the purchase price, and the effort to get the price

would not normally begin until the desire for a bride became urgent.

The introduction of elaborate marriage ceremonies is a method of compelling the members of the tribe or clan to do a considerable quantity of work, mental and physical, more than is necessary for meeting the requirements of mere existence. Customs of display, and religious customs of all kinds are other means for causing the members of the community to do extra work. Warfare, and the feasts and celebrations associated with warfare, are still other devices for causing extra work.

There are many tribes of savages, semi-savages and barbarous people in the world today. Those people have a great variety of customs, many of which have been declared to be absurd and ridiculous by civilized people. When we review these numerous tribes and their customs, one by one, we find one general result. The lowest tribes are those which interfere with natural reproduction the least, and the highest are those which interfere the most. Going over the scale as a whole, it is found that the advancement of any tribe is an accurate reflection of the average

amount of work that the members of the tribe perform before the average child is born. When we review historical cases of tribes suddenly advancing in civilization we find that such advancement followed immediately upon the introduction of some custom which delayed marriage and caused extra work.

In looking over the centers of civilization we find them beginning in semi-tropical countries and then gradually moving northward. After Egypt and Babylonia came Greece, a little further to the north. Next the center of civilization moved to Rome, slightly further north. From the time of the fall of the Roman Empire to the present there have been many shifts, but gradually the center of civilization and power has moved northward until now we may say that it runs along northern Germany and France, England and the northern part of the United States. There is, of course, no definite center of civilization at the present time, but we all recognize the fact that the principal part of human progress occurs in sections which are well to the northward of Greece and Rome.

When we look at individual wars we find that the tribe or nation whose habitat is further to the north normally defeats the tribe or nation whose home is further to the south. Looking closer, we find that the victor, when other things are equal, is the people who live in the colder climate, and the defeated is the people who live in the warmer climate.

From a consideration of the various facts involved, we may say that a cool or semi-cold climate promotes the development of intelligence and bodily vigor in those peoples who live in such climates. Amateurs coming upon this fact would normally give this out as the latest determination of science, whereas it is not science at all. It is only an item with which science may deal. The matter comes into the domain of science only when we can explain that fact in the terms of some other facts of a known kind. Human advancement has moved northward step by step and at the present time the most vigorous and intelligent people are those who live in comparatively cold climates, and whose ancestors lived in the same kind of climate for many generations. Why?

Man needs a habitation of some kind. In a warm climate a tent or cheaply constructed hut or house serves every purpose. In a cold climate a man must, or usually does, build a more substantial house to protect himself in winter. This more substantial house requires more mental effort in planning and more physical labor to construct.

In a warm climate man needs fuel only for cooking purposes. In a cold climate a man must provide fuel to warm his house in winter, and that requires extra effort on his part. In a warm climate a man needs but little clothing. In a cold climate a man must provide extra clothing for winter protection, and providing this extra clothing demands extra labor. And so on for many things. The people who live in cold climates must and do exert themselves mentally and physically to a much greater extent than do those people who live in warm climates.

When a man goes into a gymnasium and swings Indian clubs and dumb bells, he exercises certain muscles, and those muscles gain strength as a result of the exercise. The fact that muscles gain in strength as the result of exercise is

well known and is used by athletes in preparing for physical contests. It is also used by governments in preparing soldiers for war. And it is used by drivers in training trotters for racing. In this last case we have definite records which show continued development of muscular strength for many years in succession.

As a result of various investigations it is learned that the offspring inherits that particular muscular or mental development which existed in the parents at the time the offspring was conceived. For muscular development this has been traced very accurately in the trotting horse for a period of about one hundred years. In improving lines among these animals, each generation in succession inherited more trotting power than was inherited by its predecessor. But an offspring cannot inherit what the parent did not have. If the offspring is to inherit more than the parent inherited, the question arises as to how the parent got that which he did not inherit.

When we take the best trotting stock of the present day and run their pedigrees back four or five generations, we find that these superior animals were not produced by any ordinary method

of breeding. We got these improvements only from parents, grandparents, great-grandparents, etc., who developed their trotting muscles to an unusual extent before reproducing. This fact is seen partly from the individual histories of the progenitors in those pedigrees, and partly from the high ages at which they appear as sires and dams.

When we turn our attention to human beings we find the same facts there. Intellectually eminent men come from old parentage and not from young parentage. While an eminent man is sometimes the son of comparatively young parents, he is never the son of young parents who were the children of young parents. In pedigrees of eminent men the average age of one thousand fathers, grandfathers, etc., was over forty years. When we analyze the distribution of births in the pedigrees of eminent men, and compare that with the normal distribution, we find that the older the father is when the son is born the greater is the inherited mental ability of the son. When we look back at the fathers and grandfathers of these eminent men to see what kind of lives they lived before reproducing, we find

that it is not the abstract age of the father which determines the matter. It is the extent to which the father developed his mental powers by mental efforts. The age of the father is simply a factor in measuring the amount of his efforts, and consequently a factor in measuring the mental development coming from those efforts.

To enable them to exist with any degree of comfort, men living in cold climates must work much harder than men living in warm climates. This extra work is both mental and physical, and the result of such work is a corresponding development of mental and physical powers. At the time of reproducing, the man of the north is somewhat more developed than his brother to the south, and their sons inherit the difference. This is repeated generation after generation until small differences grow to be great differences. Then, when there comes a clash of arms, the southern man falls before the man of the north.

Warlike tribes and warlike nations have always been noted as being superior, mentally and physically, to their more peaceful neighbors. Why? Looking at the matter closely we can see that it is for the same reason as that before given.

A tribe or nation which spends much time in the practice of war must necessarily do much mental and physical work which would otherwise be undone. This extra work causes extra mental and physical development, and children coming from such developed persons have better power inheritances.

Where war spirit and war preparations become a part of national existence, as in Sparta, Rome and modern Germany, another factor enters into the matter. The soldier is trained when young and is not permitted to marry at as early an age as his ancestors married. As a result, there is a rise in the average age at which parents produce their children, and the status of any tribe or race of people is determined by that average. The lowest tribes are those which reproduce at the lowest average age, and the highest are those which reproduce at the highest average age. This is, of course, modified by the degree of activity. Each increase in mental and physical activity on the part of parents causes a corresponding increase in the inherited capabilities of the offspring, even when there is no increase in the age of the parents at time of reproducing.

Wars have caused the death of many of the best men of the nations at war, and the men so killed have been eliminated from the general stock. Yet it is a plain fact that those tribes, races and nations which have lost the greatest numbers of their best men, yet not enough to cause extermination, are the tribes, races and nations which have advanced most rapidly from a low to a high stage. The explanation is simple but it is not that of the eugenist doctrine. Good men were killed, but the extra efforts caused by warfare gave to the survivors an extra development which more than balanced what was lost by deaths. The next generation was produced by these survivors and inherited their acquired development.

War is and always has been a destructive agent, but the preparations for war and the activities growing out of war have been a constructive agent. We learned this first fact from war itself, but the second fact we learn from other sources. Now that we know what it is that brings about progress, we can have that progress without any of the disadvantages of war. One of the first things to do is to shut off

marriage by minors so that we will not be producing inferior stock by undeveloped parents. Another thing to do is to introduce more physical training into our schools so as to check a growing tendency toward physical degeneracy.

CHAPTER V.

EVOLUTION OF INTELLIGENCE AND LONGEVITY.

AT some time in the past there was a common ancestor for man and the ape. We do not know that common ancestor, but we have some concepts in regard to him. We are not concerned here with how tall he was, how much hair was on his body, or what color that hair may have been. The immediate things under consideration are those qualities of mind and muscle which enabled him and his descendants to meet the conditions involved in the struggle for existence.

Considering the things we have learned in archaeology and palaeontology it is highly probable that the nearest common ancestor of man and the ape was less intelligent than is the ape today. Still, for the sake of our argument, it will be assumed that the ape of today is the same in intelligence as was that common ancestor. With that assumption we have the case of hu-

man beings of high intelligence descended from ancestors which were mentally lower than those human beings we now call feeble-minded.

The eugenists tell us that from feeble-minded parents we can get only feeble-minded descendants and are urging that we segregate or sterilize all persons below some illy defined standard of mental development. Evolution tells us that the best we have came from ancestors lower than what we now call feeble-minded.

The eugenist professes to believe in evolution, and at the same time he preaches a doctrine which denies evolution. When confronted with this contradiction and asked to explain it, the eugenist assumes that at some time in the distant past, when there were giants and fairies in the world, things just happened which don't happen any more. Try to find out from a eugenist or biologist just what happened or how it happened, that intelligent descendants came from unintelligent ancestors and one runs into ideas so vague and nebulous that they are matched by nothing short of the superstitions of savages.

Let us go back to that common ancestor of man and ape and picture to ourselves some of the steps by which man was evolved. That early ancestor was of low intelligence, reproduced at an average age of some twelve or fifteen years from birth of parent to birth of offspring, and normally lived some twenty or thirty years. Little by little as the ages went by, this animal reproduced at later and later average ages, rose step by step in intelligence and lived greater and greater lengths of time.

These three things, average age at reproduction, inherited powers, and normal longevity, are indissolvably linked together and an examination of the relationship between them shows how they are linked and how they may be brought under human control. Between natural longevity and the average age at which reproduction takes place, the relationship is direct, as far as it is possible to determine by facts available. In the different races of men, and in different species of lower animals, the natural longevity is approximately twice the average age at which reproduction takes place.

Does natural longevity follow variations in the average age at which a race of animals reproduces, or does the average age at which they reproduce follow variations in natural longevity?

The question is fair. The facts of evolution say that the two go together, and logic requires that one be the leader and the other the follower. We know that reproduction is spread over considerable parts of the lives of parents, and that any kind of circumstances may limit the survivors to offspring produced at early or late parts of life. We also know that tribes and races of men at many times in the past have adopted marriage customs which changed the average age at which the race reproduced. Such changes usually had their foundation in some military expediency, and certainly were not changes following or caused by previous varitions in natural longevity. In other words, we know definitely that changes in the average age at which a race of animals reproduces may be, and frequently are, wholly independent of previous changes in the longevity of the individuals of the race.

If changes in longevity follow changes in the average age at which reproduction takes place,

then we know the circumstances which produce the original changes, and can control them. If changes in longevity is the leader in this matter, then we must assume some mysterious agency as being the cause. To say that an increase of longevity over what existed at some earlier date is a "mutation," is such an assumption of the mysterious.

We have a little direct evidence on this matter in the history of races of men at present living. Some are much longer lived than other ones. They are also the ones which reproduce at the latest average age. When we go back into the marriage customs of the past we find that those races in which longevity is greatest today are those which are descended from people who long ago introduced exogamy, wife capture, wife purchase, and other tribal customs which raised the average age at reproduction. Those races which are lowest and in which longevity is least, are those races which have not artificially delayed the average age of reproduction. They are the races in which boys and girls are free to reproduce as soon as they are so disposed.

There is no uncertainty about this matter. Average age at reproduction and average longevity have changed in races of men now living, and changes in one have followed changes in the other. We know that the direct or immediate cause of change in average age at reproduction has been usually some military necessity or tribal custom based upon military necessity. We cannot assume that this military necessity grew out of some spontaneous variation in the germ-plasm which increased natural longevity. The only logical conclusion is that natural longevity is determined by the average age at which ancestors have reproduced during several preceding generations.

To get a line on this matter I made a direct test of the length of life of different brothers and sisters in the same family. A person's natural longevity is not determined by the length of time he lives, because practically no one lives the full term of his natural life. Each person is either killed or kills himself before he reaches the point of dying of old age. While age at death is no criterion of a person's longevity, still, by taking a large number of persons prop-

erly classified, age at death may be used to determine relative longevity as distinguished from actual longevity.

It is not possible to explain here all of the steps taken to eliminate errors in an investigation which is bristling with potential errors, but a few points will be mentioned. The material taken consisted of large families of brothers and sisters who lived into the reproductive age beyond twenty-five. The average family consisted of a little more than six persons, and the total number of persons was 1,105. These persons were made into a composite family in which there was a direct comparison between the age of the father when the child was born, and the age of the child at its death. All known cases of violent deaths were eliminated, and care was taken to eliminate as much as possible all families of a distinctly pathological character. Also to get a line on variations in health of parents. The final result may be set forth as follows:

As long as parents retain their health and strength, the older they are when their children are born, the greater will be the natural longevity of those children. The figures showed that each

four years added to the age of the parent when the child was born, added one year to the normal longevity of the child. The actual table is as follows:

Expectancy of Life at Age of 25 for 1,105 Brothers and Sisters of Composite Family.

Ages of Fathers at Birth of Children	No. of Children	Average Age of Childen at Death
Under 25.....	83	62.63 years
25 to 29.....	233	65.20 years
30 to 34.....	266	65.28 years
35 to 39.....	199	65.41 years
40 to 44.....	165	68.02 years
45 to 49.....	88	66.28 years
50 and over.....	71	70.27 years
	1105	65.89 years

There can be no doubt that lengthening the time from birth in one generation to birth in the next adds to the longevity of the descendants, but the figures given must be considered as approximate only. There is a high degree of probability that the approximation is pretty close, but to determine the matter accurately would require a more extended investigation, and one extending over several successive generations. This

matter cannot be determined by anything so superficial as ordinary tabulations.

It is well established, but not yet widely known, that the age of the parent at conception of the child has a profound influence upon the natural intelligence of the child. The superior children come from the older parents and not from the younger ones. Those persons who, a few years ago, denied this fact, are now reduced to the point of trying to find some explanation which is not inconsistent with their preconceived ideas.

Passing by all explanations, we have the definite fact that superior children come from older parents, and when we have old parents for two or three generations in succession, we get stock which is much superior to the normal stock. There is also the fact that increased longevity, as well as increased intelligence, follows increase in time between generations.

When a person exerts himself he expends certain foot-pounds of energy, and the energy must be in his system before he can expend it. If the efforts which a person makes are moderate, within the ordinary meaning of that term, then the foot-pounds of energy withdrawn by exer-

tion are soon replaced by other foot-pounds of energy derived from food.

But it is known that a man by great efforts long continued may cause his own death as a result of nothing else than his own exertions. This means that death is caused by withdrawing from the system more than a certain amount of energy, and that in turn means that life itself is a form of energy. We identify electricity as being a form of energy, even though we do not know precisely what this form is. In the same way we can identify life as being a form of energy, even though we are unable to determine the essential nature of this form as distinguished from other forms.

But it is not the intention here to elaborate on the ways of identifying life as a form of energy. I have done that to a considerable extent in other contributions. It is sufficient for our present purpose to point out that energy within the body is the source of the foot-pounds of work that a person may perform, and that if more than a certain amount of this energy is withdrawn at one time, death results. The manner in which the

energy within the system is built up was the subject matter of a previous chapter.

The table for longevity was made up from large families. The parents of large families are well along in life when their later children are produced, and the strenuous efforts in caring for earlier ones built up their powers before the later ones were conceived. The later children live longer than the earlier ones because they inherit the powers which their parents acquire in the years between the production of the earlier children and the later ones.

Does some one think that adding to the longevity of children by causing the parents to develop their own powers by exercise before producing the children is a freak idea which has no foundation in fact? We can determine that matter positively by going to the records of the trotting horse.

We have a record of 39 stallions of the trotting breed who lived to be 30 or more years of age. These horses were all born between the years of 1804 and 1887. During that period of horse history, not one stallion in a hundred was trained and raced sufficiently to enable him to

obtain a standard record of 2:30. This should be evident from the fact that no stallion ever trotted in standard time before 1858, and that it was not common to train and race stallions until after 1890. On the mere matter of probabilities, not one of these 39 stallions should be a horse with a race record, or the son of such a horse. As a matter of fact, 18 of them were horses with race records, and 11 of them were sons of horses with race records.

CHAPTER VI.

DISEASE AND IMMUNITY.

THE verb "to acquire" means to obtain by effort, exertion, exercise, or performance of work of some kind. The verb "to educate" means "to exercise the mental faculties, as by instruction, training and discipline, in such a way as to develop and render efficient the natural powers." It also means to exercise physical powers, as we have such a thing as "physical education." And "education" means the "systematic development and cultivation of the mind and other natural powers."

From the biological standpoint, an education consists of the development of powers by exercising them, and not the things learned. This is plain enough in physical education, but is generally confused in speaking of mental education because of the common use of that term "education" in another sense. The biological education is the thing acquired, and the only "acquired character" which has any right to that term is

some increase of powers by the exercise of those already in existence. A negative acquirement would be by the loss of powers by idleness. Such things as mutilations and sunburns are "thrust characters" and not acquired characters.

When a man winds up a spring, punches a bag, runs a foot race, or performs physical labor of any kind, he expends certain foot pounds of energy, and foot pounds are something well known in science. Those foot pounds of energy come out of the muscles of the man who makes the efforts, and they must be in those muscles before he can expend them.

A mathematical calculation represents an operation of the intelligence. But a calculating machine driven by a steam engine will do the same work, and things which are equal to the same thing are equal to each other. The object here is to show that physical energy and mental energy are special forms of that energy which we know elsewhere as heat, light, electricity, etc.

When a man swings Indian clubs or dumbbells he exercises certain muscles and expends certain foot pounds of energy. As the swinging continues, he gradually becomes tired and has to

stop for a rest. After resting for a few minutes he can resume his exercise, but soon becomes tired and must rest a second time. After another short rest he can begin the exercise a third time, and so on time after time for perhaps several hours. Each period in which the man was taking this exercise consumed the available energy in the muscles being exercised, and during each period of rest the supply in the exercised muscles was partially replenished by drawing upon the store existing at the time in other organs.

The fact that severely exercised muscles in the arms may draw upon the reserves in unexercised parts of the body is evident from the fact that a person who has become tired by swinging dumbbells is in no condition to compete in a foot race or in a debating contest. Each organ has in it a store of energy normally appropriated for the use of that organ, but in emergency, a severely taxed organ may draw upon the supplies in other organs.

The fact that one organ of a body when under strain may call upon and receive assistance from other organs represents one of the great advantages a multicellular organism has over the uni-

cellular. In multicellular organisms, strain is never thrown directly upon all of the organs of the body at the same time, and those not under strain can help those which are. And mental powers are not exceptions. They may be expended as common foot pounds through other organs.

When a man takes up a course of physical training, or does other work which is more than has been customary or habitual with him, but an amount which is less per day that his system can restore from the food he consumes, he not only gets back the energy he expended, but a little more. The result is that he gains some in strength and endurance and can do a little more work on the second day that on the first one. If he gradually increases his work as his powers develop he can continue to gain up to some point which has never been determined.

But if the man expends a little more energy per day by his exercise than his system is capable of restoring from food, then he is a little weaker the second day that he was the first. If he repeats this operation day after day, he

grows weaker and weaker until finally he dies from sheer exhaustion.

The distinction here is between a load and an overload. If the load is something more than it was before, and is continually increased but never raised to the point of becoming an overload, the man, or other animal or plant, continues to gain in powers for an indefinite period. If the load is raised to an overload, then the man becomes progressively weaker. This last is, in its essence, the same as disease.

Several examples of the development of powers were given in a preceding chapter. A few more given at this point will help in an understanding of the relation of powers to health and disease, and to everything which makes life worth living.

The flagellata are unicelluiar animals. During a period of about six years Dallinger subjected these animals to gradually increasing temperatures. Beginning with those normally living in water at 60 degrees Fahr., he found that they began to die as soon as the temperature rose above 73 degrees. But by holding the temperature for about two months at this point he found

he could raise the temperature still higher. At 78 degrees he found another sticking point which he could not get by for eight months without causing deaths. But past this point progress was much more rapid. Several other sticking points were found, but he finally got these animals to live in water at 158 degrees, when the experiment was terminated by accident.

Here is an example of these little animals developing their powers of resisting the action of heat on their protoplasmic substance by exercising such powers as they had in the beginning, and such as they acquired on the road. In that process they gained powers continually under increasing load, but they died when the load was raised to an overload.

Czerny found that by a very gradual addition of salt he could get amœbæ to live in a four per cent solution, but that none could survive when placed directly in a two per cent solution. The two per cent solution was an overload for amœbæ which had lived in pure water, but four per cent of salt was less than an overload after the amœbæ had developed their powers by exercising them.

Davenport and Neal raised three lots of stentors,—one in pure water and another in a very weak solution of corrosive sublimate. After two days both lots were put into a killing solution which was twenty times as strong as the weak solution. Those raised in pure water died in 83 seconds, while those raised in the weak solution lived for 304 seconds, or nearly four times as long. No deaths occurred in the weak solution, but the animals there had to exert themselves to resist the action of corrosive sublimate, and in doing this they acquired powers they did not have before, and powers which never existed in any ancestor. The third lot was kept in a solution twice as strong as the weak one, or one-tenth of the strength of the killing solution. These last died more quickly than those raised in pure water.

Here we have a case of one lot of stentors subjected to a load which was within the powers they had originally, and another lot subjected to a load which was in the nature of an overload. When the load was greater than anything to which they had been subjected before, but was within their powers, those powers were built up

by their exercise in carrying that load, and they were able to survive much longer under a killing load. When the load was an overload, that overload absorbed part of the powers they had originally, and they died more quickly when placed in the killing solution.

In sexual reproduction, two germ cells unite and afterwards develop into a new individual by growth and repeated divisions. This union of cells and subsequent growth and division is a dynamic process which calls for greater or less exertions on the part of the cells involved. If the two germs cells which unite come from parents of the same breed, these cells are much alike and can unite and subsequently divide with a minimum of effort. If they come from different breeds, then these germ cells are somewhat unlike and it requires greater efforts on their part to successfully fit themselves together and then divide into new cells which constitute proper divisions of the united differences. If they come from different species or different genera, then the uniting cells are still more unlike, and this increased unlikeness calls for still

greater efforts on the part of this living substance in making the proper union and divisions.

One of the phenomena of hybridization is that the hybrids are commonly more vigorous than either parent. This extra vigor does not come from nowhere out of nothing. Vigor means physical power of some kind, and powers are developed in living organisms by exercising those previously in existence, and in no other manner. Primarily, the vigor of hybrids is increased power of growth, and increased growth means increased power of cell division. We can trace this increased power in hybrids directly to the extra efforts (increased exercise) which the unlike germ cells had to make to form a proper union and then proper divisions of the mixture of differently organized substances.

Another thing observed in hybridization is that the extent to which the hybrid is more vigorous than the parents increases with the wideness of the cross up to a certain point, after which there is a decrease of vigor in offspring. In wide crosses the offspring are abnormally weak, and if the cross is still wider there is a failure to develop. In some wide crosses, as in the mule,

there is a gain in physical strength but a loss in fertility. In other wide crosses, particularly in plants, the new individuals are both stunted and sterile. In extremely wide crosses in some fishes, there will be a union of germ cells but a break down in segmentation soon afterwards, so that the embryo never is completed.

The explanation is simple. Each increase in load increases the efforts of the individual to carry the load, and powers are increased in proportion to the extent to which they are exercised. This is true up to the point at which a load becomes an overload, beyond which point each increase of load decreases powers and hastens death. Increasing the wideness of the cross increases the load upon the cells of the new individual until the load finally becomes an overload and causes a breakdown and a failure to develop.

Pasteur found that the anthrax bacillus could be raised on an artificial medium, as bouillon at blood temperature. When so raised the bacilli do not have to fight for life in a hostile blood reaction, and because they do not have to fight they gradually lose their power of fighting, which is their virulence. He used two cultures, a very

weak one produced by a long period of idleness in life on artificial food, and one not so weak produced by a shorter period of idleness. He then inoculated an ox with the weaker culture, and twelve days later with the stronger culture. An animal so inoculated was immune to fully virulent virus. Here we have the progressive decay of powers in the bacilli by idleness, and the progressive development of powers in the ox by exercise.

But Pasteur's experiment went still further in this matter. By long cultivation on artificial food he got anthrax germs so weak from the lack of exercise in fighting for food that they were unable to survive even in a mouse. But by taking such weak virus and inoculating a very feeble animal, as a guinea pig a day old, and then passing it along by inoculation to stronger and stronger animals, he found that the strength of the virus was built up step by step with each inoculation until it was powerful enough to attack the strongest animals. Here we have a case of absolute control over the gain and loss of powers in the same organism by controlling the amount of its exercise.

When Pasteur got anthrax virus so weak that it could not survive in the blood of a guinea pig a month old, the powers of the guinea pig were an overload for those germs. But when he came down to something as feeble as a guinea pig a day old, then those weak germs were an overload for that young guinea pig.

Now the difference between a guinea pig a day old and a guinea pig a month old is a difference in physical powers developed by normal activity in the interval between a day and a month, and not a difference in inheritance. Guinea pigs do not do any inheriting after they are born. A load is measured by the powers necessary to carry it, and as powers increase or decrease in accordance with the extent to which they are exercised, it is evident that what may be an overload at one time may not be an overload at another. Also, powers may be decreased by simply shutting off the power supply, in which case a load which was less than an overload might become an overload. For example, a load which a person could carry with ease and not even be aware of its presence might become an overload by reason of an insufficient supply of

food, or of some ingredient of food. An animal weakened by starvation is more than normally likely to fall a victim of some disease.

When a person is worn down or exhausted from long continued physical exertions he is much more susceptible to bacterial infection than when not so exhausted. Also, after a man has been through a long illness due to some bacterial infection, he is worn out and weak. These are facts which show that the same energy used in a physical struggle is the energy used in fighting bacterial infection. The burden thrown upon a man's powers by bacterial infection is called disease, but the similar burden thrown on the same powers by an opponent or by some physically observed and fully understood circumstances is not disease. But wherein is the difference? In both cases the physical powers are exhausted by efforts which expend energy of the same kind. Does a disease cease to be a disease when the millions of cells which a man fights are organized into large bodies instead of being separate entities?

We can convert work fully and completely into heat, but we can make the reverse transforma-

tion only in part. As a consequence, heat is called the degraded form of energy, and is always a product of work performed. When a person takes violent exercise, as in a foot race or a wrestling match, his temperature increases and may rise to 105° F., or more, and such appearance of extra heat is evidence of the exertion he makes. A fever represents an increase in the heat form of energy and is evidence of a physical struggle of some kind which is invisible because it is within the body. The invisible struggle which produces a fever is said to be disease, and the visible struggle of a foot race which correspondingly raises temperature is not disease. Is a question of disease to turn upon the degrees of visibility? Is a bacterium to be considered as the cause of disease because he can be seen only with a microscope, and an opponent in a wrestling match not the cause of disease because he can be seen with the naked eye?

Resistance to disease consists of power to fight off whatever it is that causes disease. All persons are more or less resistant to diseases of all kinds. If they were not, then they would die the instant a disease touched them. Even in case

of terrible scourges, the actual deaths are only a small fraction of the entire population, a fact which shows that the average resistance is greater that the average powers of attack by whatever parasite it is that causes the disease. It is well known that some races of men have greater resistance to certain diseases than have other races, and that some members of any group have greater resistance to certain diseases than have other members. It is also known that the same person has greater resistance at some times than at others, as is evidenced by the fact that he will contract a disease at one time and not at another, even though exposed.

When the resistance to a particular disease is of a high order, it is called immunity. Thus, the negroes of the West Indies are practically immune to yellow fever and malaria, the Chinese are said to be immune to cholera, the buffalo and Texas cattle are relatively immune to the disease caused by the Texas fever tick, the native American grape-vines are highly resistant to the phylloxera, which has played such havoc with European vineyards, and Asiatic chestnuts are

resistant to the fungus which is destroying our American chestnut trees.

During the 16th, 17th and 18th centuries smallpox was a terrible disease, the mortality from which is said to have been "almost incredible." With the introduction of vaccination about a hundred years ago, the disease decreased both in frequency and mortality. The disease is still present, but as compared to the virulence of the past, it is mild in form, even among the unvaccinated. The reason why a person suffers only slightly from such a disease as smallpox is because he has powers of resisting that disease. The only way in which a person can come into possession of such resistance is either by inheriting it, or by acquiring it through vaccination, or by having the disease itself. But a person can inherit such resistance only from an ancestor who had it, and that ancestor could get it only by acquiring it or by inheritance.

Now it happens that this notable inherited resistance to smallpox begins only after the practice of vaccination became general. That inherited resistance cannot be due to "selective death-rate," because smallpox is known to have

been a periodical plague from the 9th century on, yet "smallpox was probably never more prevalent than during the 18th century," and never more deadly. Recently previous generations acquired resistance by vaccination, and observable inheritance of resistance comes first in the immediate descendants of those who acquired it. The offspring inherited the exact thing that the parent acquired, and there is no appearance of such inheritance until after the acquirement became general by repeated vaccinations. Nine hundred years of selective death-rate applied to the entire population of a whole continent produced a minus quantity. Less than one hundred years of acquirement before reproducing has brought forth something very definite.

When a person suffers from the measles, he does so because he did not have the power necessary to resist the attack. But in fighting the disease and overcoming it he develops a power he did not have before, and thereafter he is immune from attack. The same thing is true of many other diseases. The thing to be noted is that by exercising the powers which he had there

are developed (acquired) powers which he did not have.

Measles is a common disease of children, and is normally not serious. But when it is first introduced into tribes or races of men not before subjected to it, it is a deadly scourge. Measles is not serious to the white child because he inherits a resistance which enables him to overcome it with small inconvenience. It is deadly when first introduced among Indians or other tribes because they do not inherit such resistance. But resistance to this disease is something which is acquired by the exertions or efforts used in overcoming it, and the white child inherits the exact thing which his ancestors for generations had acquired. It is quite certain that the child cannot inherit something which its ancestors did not have, and it is also certain that ancestors could not come into possession of powers of resistance in any other way than by exercising such powers as they had before.

In Europe prior to the 19th century, smallpox would ravage a district and then disappear completely for many years. By the time it came back again, those who were immune or partly

immune before would have lost their powers of resistance by reason of the fact that there was no occasion to exercise them. The disease would again sweep away thousands and again disappear for years. But when vaccination came into vogue there was no long idle period for an entire population, or even for a small part of it. The powers of resistance became inherited as far as such powers existed at the time of reproducing.

The difference between measles and smallpox in this matter is that measles did not come by epidemics separated by many years in which there were no cases in a community of considerable size. Usually measles has been continually present, with the result that some part of the population was continually becoming immune. The child caught the disease and was thereafter immune. By the time the next generation came along, the immunity had declined sufficiently to leave the child subject to a new attack, but not enough to make the disease dangerous. The mere fact that there is a germ between parent and child does not affect the matter in the least. In those powers which are built up by exercise

and lost by idleness, the child is what the parents were at the time of reproducing, and not what they were at some earlier date or will be at some later time.

When we examine cases of natural immunity to specific diseases we find that it exists only in those animals and plants which have lived for several generations in contact with the disease producing parasite. Zebu cattle from India are said to be immune to the Texas fever, but this immunity is to attacks by the tick rather than to the disease as such. This is not the kind of immunity we have under consideration. What we want to know is why the range cattle of Texas, when bitten by the Texas ticks, do not suffer from the fever as do northern cattle when taken to Texas. Also, why the West Indian negro does not get yellow fever when bitten by the proper mosquito; why the Balkan Ziginars are not stricken with typhus fever when bitten by the Balkan lice; why native American vines resist the American phylloxera.

In any epidemic, a considerable proportion of the population appear to escape attacks, and of those attacked, a considerable proportion re-

cover. Assuming that the disease is new to the community in the sense that it has not been present for a considerable number of years, there are three things which enter into the proposition. The first is the resisting power of the individual as measured in his general energy supply which may be called upon to combat the disease. The second is the virulence of the particular strain of parasites producing the disease. And the third involves the magnitude of the attack as represented by the number of parasites which initially gain entrance or are produced before the system rouses itself to repel the unexpected attack.

Those persons who die during the epidemic are those who have become previously weakened, and who are subjected to a very heavy attack. Those who are ill for a time and then recover are those who are weakened to a less extent or who became inoculated with fewer bacteria.

In any epidemic, many persons appear to escape attack entirely, but frequently this must be more of appearance than of reality. Given a normally healthy person bitten by a single insect which inoculates him with only a few pathologi-

cal germs, his blood reaction easily wipes out the few germs which did gain entrance, and in doing that his system develops slightly its powers of meeting and killing this kind of germ. A little later he is bitten again, and again is inoculated, but does not know it. In overcoming this second slight attack his powers of combating this particular germ are still further developed. If the disease is continually present in the neighborhood he is continually being attacked, and in continually fighting such attacks he develops his powers of resisting this particular disease until he is fully capable of resisting such attacks, no matter how great they may be.

Real but unnoticed attacks by disease producing bacteria must be quite frequent. Postmortem examinations show that this is true of tuberculosis. The system, in fighting such attacks, builds up its powers of resisting that particular disease the same as fighting the virus of cowpox builds up the powers of resisting smallpox. And the same thing must be true in the vegetable world. For example, when phylloxera first attacked the American vines, there must have been some cases in which the attack was so light as

not seriously to injure the vine. In fighting this light attack the vine would build up its powers of resistance so that later it would be able to resist a more severe attack.

Resistance to disease is an inheritable thing which passes from parent to offspring. But an offspring cannot inherit from a parent something which the parent did not have. We know that a parent can build up his general powers by general exercise, and that he can build up his powers of resisting a particular disease by fighting that disease or some modified form of it. Briefly, the offspring inherits the identical thing which the parent acquires by his effort and exertion, and there is not a particle of evidence of any kind that any animal or plant can come into possession of powers of resisting disease in any other way than by direct acquirement or inheritance of such acquirement. Natural immunity is nothing else than an inherited power coming from an ancestor who acquired that power by effort and exertion.

INDEX