# THE PHYSICAL BASIS OF CIVILIZATION

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A REVISED VERSION OF "PSYCHIC AND ECONOMIC RESULTS OF MAN'S PHYSICAL UPRIGHTNESS"

A Demonstration that Two Small Anatomical Modifications Determined Physical, Mental, Moral, Economic, Social, and Political Conditions; with Appendix Notes on Articulate Speech, Memory, Altruism, and a Search for the Origin of Life, Sex, Species, etc.

BY

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"There can be no alleviation for the sufferings of mankind except in absolute veracity of thought and action and in a resolute facing of the world as it is, with all garment of make-believe thrown off."—THOMAS H. HUXLEY.



CHICAGO
FORBES & COMPANY
1908

# PREFACE

A little over a year ago, a preliminary draft of the present work was, under the title "Psychic and Economic Results of Man's Physical Uprightness," submitted by the author for criticism to a select circle of one hundred university presidents, professors, and to other distinguished scientists[1] and philosophers, in the United States of America, Great Britain, Germany, France, Italy, Switzerland, Belgium, and The Netherlands. Eighty of these gentlemen replied; many of them by instructive criticisms and comments. These criticisms and comments have been utilized in so revising the preliminary draft as to produce this present book, under the title of "The Physical Basis of Civilization."

It traces the upright attitude, higher intelligence, monogamic marriage, the family, the home, the economic dependence of woman, differentiation of the sexes, warfare, primitive groups and hordes, and other physical, mental, moral, economic, and rudimentary political conditions to two small anatomical peculiarities of our brute ancestors, and throws

[1] The frequent application of the words "science," "scientists," in late years, to subjects obviously outside the range of the physical sciences, makes it necessary to state that in these essays the old meanings are *always* intended.

much new light on a number of the most important problems in ethics and public policy, which are pressing so urgently for solution in this present age.

Owing to the remoteness of the period under consideration, a number of the conclusions reached in these essays could not be corroborated by observations and experimental tests. *This, however, cannot impair their value or validity.* For rational minds do not, for such reasons, reject conclusions, based on sound premises, explaining facts otherwise not rationally explicable. If they did, then "the theory of the infinity of space," "of the eternity of time," "of the indestructibility of matter and of force," the belief that "two parallel lines never meet, no matter how far extended," "the nebular hypothesis," "the universality of the laws of nature," and many other *equally essential parts of rational science and thought,* would have to be rejected along with the conclusions reached in these essays, *for none of these can be verified by observation or experimental tests.* Nothing has been taken for granted in the argument except the proposition regarding derivation or descent stated in the third paragraph, Chapter I. Two paragraphs immediately after contain a brief summary of the enormous amount of careful investigation, verifying evidence, and exhaustive, unsparing discussion this proposition has received far beyond any other ever presented to mankind. From this proposition and

from the *established* facts and principles of science, as premises, the conclusions and deductions have been drawn by rational, coherent processes of reasoning. They explain phenomena otherwise *not rationally explicable. The demonstrations conform throughout to the rule of parsimony.*

The argument is coherent from first to last. Each chapter is devoted to a co-ordinate part of it. Twenty-two foot-notes are scattered through the book. They contain matters supplementary to the argument, which do not strictly form parts of it. Considerations of relevancy, reliability, and the fitting of expression to thought have not been so strictly adhered to in these as in the main text.

In Chapters I to and including VIII, discussion is limited to conditions existing before man had begun to use clubs and missiles. In Chapters IX and X this limitation has been disregarded.

On account of their remoter relations to the main line of argument, certain phases of "Articulate Speech, Memory, Altruism," have been treated in Appendix Notes.

Appendix Note IV,— A Search for the Origin of Life, Sex, Species, etc., is little more than a preliminary, crude sketch of a line of thought hereby submitted for criticism and review. Besides having important bearings on some of the problems presented in these essays, this note suggests new and promising fields for original research work.

If the opinion with reference to barrenness ex-

pressed in the last few paragraphs of this note should prove correct, then this will fortify the Darwinian Theory of the Origin of Species, to the extent of positive demonstration at a point where its insufficiency is now apparent.

The author cannot refrain from this public expression of the gratitude he feels toward Professor Frederick Starr of Chicago University, for directing his thoughts by a series of lectures to the problems discussed in this book; and toward his distinguished critics for the generous encouragement and valuable instruction contained in their letters. To them the credit is due, in so far as this work is free from errors. The author is responsible for those which he has failed to discover, and he sincerely hopes that unsparing criticism will remove all of them. Thus only can this book contribute to "a resolute facing of the world as it is with all garment of make-believe, thrown off."

T. W. HEINEMAN.

PASADENA, CAL., U. S. A., January, 1908.

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# CHAPTER I

## BRUTE-MAN'S HELPLESSNESS

With wider recognition of the influence of heredity on character and destiny, the interest in the genealogy of the human race naturally increases. Since, however, it is by no means the body of man, closely resembling the organisms of the creatures immediately below him, which distinguishes and exalts our race far above all others, since, on the contrary, it is the wonderful superiority of our intelligence and the nature of our moral, social, family, economic, and political relations and institutions; therefore it would seem that an investigation into the causes of these must prove vastly more interesting and instructive. To such an examination the following pages are devoted.

It is therefore proper to dedicate the far larger space and attention in these essays to the tracing of the causes and growth of these distinctively human faculties, relations, and institutions, while portions of the first two chapters only give special attention to the process by which the changes occurred which differentiate the human body from the organisms of man's immediate brute progenitors.

The argument is based on the proposition that all higher types of life have been derived or are

descended from lower, and that man's origin is no exception from this *unalterable* rule.

For evidences and arguments sustaining this law converge from every branch of the natural sciences, and from all the widely divergent fields of inquiry in which naturalists and investigators have been engaged; and although these evidences and arguments have been frequently contested, and with great ability, they have always been vindicated in the end.

Hundreds of institutions of learning, experts by the thousands, competent observers and thinkers, authors by the hundreds of thousands, have contributed corroborative facts and conclusive lines of reasoning. Tests and tests of tests, series after series, practically innumerable, have been applied more so than to any other problem ever presented for consideration to physical scientists, until finally the concensus *of the competent* has become unanimous.

Does this assert the evolution of man from lower forms of life? It does assert his descent, or derivation, but not his evolution. To assert the evolution of any organic type from another is a misuse of language, apt to lead to misapprehension.

The term "evolution" is properly applied only to that process by which inorganic and organic masses or individuals progress, by dissipation of motion and concentration of matter, from more or less indefinite, incoherent homogeneity, towards more definite coherent heterogeneity, which, in view of

the universality of natural selection among organic forms, implies a greater degree of specialization and adaptability. Such a process in sexually reproducing organisms obviously cannot be continuous from generation to generation. For a new individual of a new generation springs from the conjugation of the sperm cell of one organism with the germ cell or ovum of another. This conjugation is *the beginning* of the evolution of a new organism, and not a continuation of the evolution of either or both of the organisms from which these two different cells have come. Thus, higher forms of life are *not evolved*, but derived, descended from lower, by variation, through sexual reproduction. See Appendix, Note IV.

In sexual reproduction, the matter and force required to begin the growth of a new organism are derived from two parents. By the conjugation of the part coming from one with that from the other, a mixture is obtained competent to cause a new life to grow.

If both parents are of the same species, then fertile offspring are the result. Organisms of the same species must resemble each other in those congenital specific traits by which their species is distinguished, but in other congenital traits they can differ, and the probability is infinitely great that they will so differ. The reproductive matter and force from an organism which differs congenitally from another must differ from the reproductive matter and force

coming from that other. Two substances different from each other, when mixed, produce a mixture which differs from both. Sexual offspring being the result of such a mixture, therefore the probability is infinitely great that no such offspring can be exactly like either of its parents. And inductive experience confirms the conclusion thus deductively reached. Each generation slightly varies from the parent type. This is "variation"—*a result of heredity.*

Another kind of variation, so far as known only appertaining to forms of life lower than sexual, must now be briefly outlined, because it bears on future arguments.

The unit of life is the cell. It consists of a speck of the life substance, protoplasm, which has become segregated, or, so to speak, individualized, by the formation of a cell wall. The cell wall is formed by the differentiation of the external portion of the speck of protoplasm, through its greater proximity and therefore more energetic interactions with environing materials and conditions.

The efficiency of any force is in inverse ratio to the square of the distance from its source. No matter how infinitesimally thin a cell wall may be, yet is its thickness mathematically divisible into an outer half and an inner half. The forces and influences of the environment, therefore, react at the outer surface of the cell wall with four times the energy displayed at the inner surface. That is on

the supposition, that in their passage from the outer surface to the inner they do not by interactions with the substances through which they are passing part with any of their power. Since it is certain that the opposite is the case, therefore must another deduction be made, to obtain a correct estimate of the diminution which the external influences suffer in passing from the outer to the inner surface of the cell wall.

Since the first principle above specified would apply equally if the cell wall had been divided into three or four or any number of imaginary divisions, it is obvious that the application cannot be taken as representing literally accurate numerical results, but merely as establishing the principle that the efficiency of forces originating externally is greater at the outer and less at the inner surface of the cell wall.

If now, it is taken into consideration that the inner substance of the cell is divisible into an infinite number of mathematical strata laying between the inner surface of the cell wall and the mathematical center, then the conclusion becomes inevitable, that the outer substance of a cell must be to a very high degree subject to changes from interactions with environing materials and conditions; while the central substance, if at all, can be so only to a very small extent by comparison. And from this it follows that with the birth of a cell there begins a process which tends to the differentiation of its

external parts, and which leaves the central substance almost unaffected. The longer the life of a cell, the greater the opportunity for the concentration of like with like and dissociation from unlike within it. The greater the mass and size of a cell, the greater the freedom of the central substance from the disturbances by extenal influences. See Appendix, Note IV.

Since the motions, however, of the substances within the cell wall, by which the moving equilibrium of life is maintained, bring different portions of its matter from moment to moment near to the inner surface of the cell wall, therefore great caution must be exercised, as it is very easy to apply the conclusions above reached too rigorously.

But with due deductions made for this circumstance, there remains enough ground for the conclusion that the external substance of a cell is far more liable to modifications from environmental influences than the central substance. In the lower asexual forms of metaphyta and metazoa it is only required to substitute the word "cells" for substances or materials, and then the above arguments and conclusions apply equally to these. Thus the central cells retain, to a very great extent, the original characteristics of the substances and cells from which they have been derived,— they become the carriers of heredity. While the external cells are far more subject to modification from environmental influences, and therefore become the means for varia-

tion from the hereditary type. This is variation in forms of life lower than sexual, the result of reactions arising in the environment.

This kind of variation obviously is the cause of the origin of somatic cells,—cells which have so varied from their ancestral type that they have lost the power of reproducing the organism of the kind from which they have sprung, but which can reproduce their own type of cells, out of which the special organs of specialized individuals are formed. As these special organs are of survival value only when with otherwise specialized organs, each operating in its special line, they co-operate so as to ward off the dangers of external interference with internal conditions, and establish that harmony of function on which the life and welfare of all highly specialized individuals depend; it follows that this kind of variative influences can have but a slight effect, if any, on highly specialized forms of life. See Appendix, Note IV.

Limiting consideration in this place to the more important among his external physical traits, man is distinguished from the quadrumana mainly by:

1. Arms proportionally shorter.

2. Finger tips, fingers, and thumbs in the upper extremities, mainly specialized to sensations of touch, as distinguished from the corresponding organs of the quadrumana, which are almost exclusively adapted to prehension and locomotion.

3. Feet at the lower extremities, distinguished

from hands by having the hallux unopposable, owing to the altered shape of the entocuneiform bone. The hallux is long enough to serve as a fulcrum, standing or walking. This, in connection with the position of the occipital foramen magnum, a little back of the center of the base of the skull, is the essential condition on which the erect attitude depends.

Most scientists continue to call the posterior extremities of apes and anthropoids hands, and all apes quadrumana. This view has been adhered to in these essays.

There is, however, good anatomical reason for classifying these extremities, with Huxley, as feet. But since functionally they are hands, almost to the same extent as the anterior pair, and since the anthropoids, according to some observers, usually walk on the knuckles of these members, and according to others on the inside edges, it seems more rational to retain the former classification in these essays at least.

A foot form fit to support the body in the upright attitude could never have emerged from the posterior extremities of any of the typical quadrupeds. They have no proper heels. From the back ends of their feet to where the toes or claws touch the ground the distance is too short. To secure a stable equilibrium in this position requires a long axis from heel to toe. The differences between a human and a quadrupedal foot are so enormous, that

to develop the former out of the latter many intermediate forms must have occurred and been selected. The posterior prehensile hands of apes are so much more like human feet, that the conclusion seems unavoidable that the latter are a direct variation from the former.

4. Proportionally larger and more muscular lower or posterior limbs.

5. A body more slender in proportion, with smaller thoracic cavity, therefore necessarily less capacious viscera and vitals.

6. A larger cranium, therefore more room for brains.

7. Ear lobes, chin and lips.

8. Glossy bare epidermis covering almost the entire body, in lieu of the hairy hide of the quadrumana and quadrupeda.

It has been asserted with great confidence that at one time all men had hairy bodies; that the wearing of artificial coverings, first skins and then clothes, made hair unnecessary and interfered with its healthy growth; and that, therefore, men now have smooth skin, without hair. It is asserted that the exceedingly rare appearance of men with hairy bodies, and the prevalent hairiness of the Ainos of Japan, is proof that at one time the bodies of all men were hairy. There is *not a particle of evidence* that hairiness ever was general among men. The exceedingly rare appearance of a hairy man and the exceptional existence of one hairy nation is no evi-

dence; nor is the existence of fine, almost invisible hair all over the body; nor is the hairiness of the six-months-old human embryo. These facts can only be considered as evidence that by variation the "genus homo" has descended from hairy *non-human* brutes.

Nor is it reasonable to suppose that the wearing of artificial covering has caused a hairy ancestry to bring forth a hairless progeny, for this is taking the transmission of acquired traits for granted.

Hairy coats collect and harbor fleas, lice, and similar insect pests on the bodies of animals, and also disease germs, and here these can multiply prodigiously. The secretions of the skin furnish ideal culture media for these germs, and the crawling and hopping insects can carry them around. Thus it requires but a slight accidental scratch or cut to enable the germs to invade the bodies of their hosts, and it is possible thus to spread devastating epidemics in herds or entire races.

Comparative hairlessness, such as exists in the human race, and which under natural conditions is such an inestimable adjunct to cleanliness, must for the reasons stated have been of survival value, and this makes it probable that this trait was naturally selected in the human race. At least it produces such a strong preliminary case in favor of this conclusion, as to throw upon those who deny it the onus of proving the contrary.

It is otherwise with the quadrumana when in their natural habitats. Woodticks, jiggers, and the

other insect pests found on the trunks and branches of forest trees and shrubs, so far as known, do not easily propagate in hair or fur. The insects and disease germs which are dangerous to brute life find conditions favorable to multiplication in moist and wet regions on the ground, but not on the trunks or branches of trees. Hairlessness, therefore, has no survival value for apes.[1]

It is, however, quite rational to believe that the wearing of artificial covering would make hairy men lose their hair, but the offspring of such would not, therefore, be born less hairy than their parents. Again, if men were formerly hairy and had only become hairless by the wearing of artificial covering, then those tribes and nations which have never worn artificial covering would still be hairy. But some of the savages of Africa and Australia, and some of the natives of India, have gone naked since time immemorial, and still do so; yet they are as free from hair as the people of Europe. Finally, why should creatures covered with fur or hair be supposed to wear artificial covering?

[1] It has never been investigated whether the Ainos are injured by their hairiness or whether conditions appertaining to their habitat or to their variety modify the results of hairiness.

The existence of this one hairy nation can therefore not be urged against the above argument. Nor can the fact that vermin sometimes infest the tufts of hair existing in several places on the bodies of human beings. For neither has this been adequately investigated.

Civilization has essentially altered the absolute and comparative values of various factors in survival. It seems, therefore, hazardous to apply to primitive man conclusions drawn from existing societies.

A disclaimer must, however, be entered here. Comparative hairlessness has been discussed in this place because it is interesting in connection with the human body. The subject has, however, very little bearing on the theses and conclusions in the essays, which will stand on as sound foundations if the views here expressed on hairlessness should be untenable.

Distinguished by the eight differences above noted from the genera most nearly related, the "genus homo," as a new type of life, had to share in the struggle for existence, battling with the unthinking, unfeeling forces of nature, and with great numbers and varieties of creatures fiercer and more powerful than he, which, in addition, were naturally armed and provided with means for protection, escape, and rapid multiplication. Was he well fitted for the trial? Few if any brutes were less so.

The adaptations by which animals when not otherwise disadvantaged *survive* in the struggle for existence may be broadly classified under these four heads: 1. Means of offense and defense; 2. Means of protection; 3. Means of escape; 4. Means of multiplication. Under all these heads, hardly a creature among the higher mammalia, birds, fishes, reptiles, and insects, would *rank as low*, for natural endowment, as man's brute ancestors did before they had learned the use of sticks and stones.

Considering the four classes of adaptations in the order above stated, it is found that:

Firstly, most creatures are naturally armed for offense and defense. They have horns, tusks, claws, stings, fangs, talons, poisons, sharp teeth, protruding jaws, etc., wherewith either to defend themselves against enemies, or to attack and pursue their prey. Man has none of these.

Secondly, most mammalia possess heavy fur, thick hides, or both, or some equivalent of these, which protect their bodies from scratches, cuts, or abrasions, which thorns, needles, stones, etc., or antagonists in the original habitats, might otherwise inflict. These means also protect them against changes of temperature, and from biting winds and biting enemies; from snow, hail, rain, etc. Man has no protection of this sort.

Thirdly, the hairy bodies of many mammalia match well with the prevailing tints in their usual habitats, and are, therefore, ready means of concealment from their enemies or prey. This increases their chances of escape and of obtaining sustenance. Primitive man's glossy, unclad, bare-skinned, tall, upright body made him a particularly prominent, easily perceived mark. The absence of hide and fur, which carnivora are forced to strip off before they can devour other creatures, made primitive man an easy, therefore attractive morsel for these predatory creatures.

Proportionally to the size of his body, the viscera of man are less capacious than those of most other mammalians. He is, therefore, caeteris paribus,

forced to take food oftener, and cannot uninterruptedly sustain efforts for as long a period as his enemies or competitors. This in an enormous disadvantage in the struggle for existence.

Fourthly, in the matter of multiplication, nature has excessively discriminated against man, for the period of pregnancy in our race is exceptionally long, and the number of offspring born at one birth is as low in our case as in any.

Besides the above-mentioned deficiencies in natural endowment, man is afflicted with numerous *special infirmities*, among which may be noticed the absence of valves from the venæ-cavæ and from the iliac, hæmorrhoidal, and portal veins. Quadrupeds have no need of these valves in these blood-vessels, but the lack of them in man produces frequent cases of congestion, strangulation, illness, and death. Many human beings are incapacitated annually, or lose health and even life, by femoral and inguinal hernias, appendicitis, varicocele, and varicose veins, brought on and aggravated by the upright attitude. The frontal exposure of man's femoral artery, produced by uprightness, annually demands many victims, even in these days of medical and surgical skill. In the primary ages of brute-man's existence, the sacrifice of life from these causes must have been enormous.

The disadvantages above recited react with like severity upon all specimens of the race, irrespective of sex or age. Others must now be explained which

are more dangerous to survival than these, although they directly affect pregnant women only.

The females of quadrupeds may during pregnancy carry a numerous litter of young in their bodies, and yet without experiencing an appreciable degree of increase in effort or in inconvenience; they can run away from pursuing enemies, make chase to capture prey or collect sustenance. For the fœtal burden is near the ground, horizontally distributed over the entire length of the abdominal muscles. These in turn are supported from above by the full strength of the vertebral column, to which, on the principle of the arch or truss in architecture, the abdominal muscles are attached by intermediate tissues. Even if a quadruped stumbles or falls, its under side is so close to the ground that the risk of injury is comparatively small.

It is very different with the pregnant female of the human race. The erect attitude concentrates the pressure of the fœtus-supporting tissues and enlarged uterus, at the lower forward end of the abdomen, making the bearing of offspring an *exceptionally incapacitating strain upon almost every movement*, thus increasing the risks of being overtaken by enemies, starving from inability to capture prey or gather sustenance, and of injury or death in consequence of falls or even stumbles.

In quadrupeds the anterior, posterior, lateral, peritoneal, and round ligaments firmly support the uterus, and prevent it from pitching too far forward

towards the diaphragm, but the upright attitude interferes with their doing this service in the case of human females, which accounts for the frequency in our race of painful and dangerous illness from prolapsus and various other displacements of the uterus. The same position and shape of the pelvic bones which makes parturition easy and painless in quadrupeds becomes in the human race the prolific cause of suffering and death to mothers and offspring.

The immediate progenitors of the upright brute ancestors of man must have resembled the quadrumana. These latter were descended or were derived from quadrupeds. Among these latter the horizontal attitude on all fours has been normal since unnumbered generations and *variations have been naturally selected*, during all this enormously long period *with reference to their adaptation to this position.*

Form and location of blood-vessels, of the valves in them, of the viscera, of the reproductive organs, etc., and of the bones, ligaments, muscles, tissues, which protect, support, and connect these parts, have slowly through the ages become beautifully adjusted to the position of the body on all fours.

The occurrence thereafter by variation through sexual reproduction of two slight anatomical modifications, whose nature and effects will be more fully discussed hereafter, *forced* our brute ancestors to abandon the horizontal and adopt the upright attitude. The advantages of the adjustments and

adaptations to the horizontal attitude just mentioned, which had been acquired through long ages by natural selection, this change suddenly turned into injuries.

For blood-vessels which before had run in a vertical direction were made horizontal, and vice versa. The valves in them, therefore, which before the change had aided circulation thereafter tended to congestion.

The bones, ligaments, tendons, muscles, which in the horizontal position of the body had screened and protected the vital parts, thereafter *exposed* them. The bones, ligaments, muscles, which in the horizontal had firmly supported the viscera, reproductive organs, etc., thereafter left them loosely dependent, unsupported, liable to shocks, lesions, and breaks.

This is the manner in which the erect posture produced the helpless condition of our brute ancestors.

## CHAPTER II

### ENORMOUS LENGTH OF THE ERA OF HELPLESSNESS

When was the birthday of the human race, or the beginning of that enormously long period during which the brute-sense of our first upright mammalian ancestry gradually grew into that higher intelligence possessed by the first club and missile using men?

When sexual reproduction among mammalian creatures resembling the quadrumana produced a variation in the entocuneiform bones of their posterior extremities, and shifted the occipital foramen magnum to a position a little back of the center of the base of the skull, then was the birthday of the human race and the beginning of the period referred to. For this variation in the entocuneiform bones, in connection with dependent changes in the muscles, tendons, nerves, etc., operating the metacarpals and phalanges, made a pair of big toes out of two opposable thumbs, and transformed a pair of prehensile posterior hands into two feet. These served admirably as supports for the body in the upright attitude, but were utterly useless for the grasping of branches. Our ancestors were therefore *forced* to abandon tree life. How could creatures unable to hold on to branches with their lower extremities

live or move about among the forest trees away above ground, and there compete for the necessaries of existence with apes, snakes, felines, and great birds? It was impossible! Our brute ancestors were therefore inevitably obliged, as soon as this transformation had taken place, to begin the struggle for existence on the surface of the earth. Could they do this on all fours? By no means! How could two hands in front, with fingers outstretched and thumbs nearly at right angles — and that is the only way in which the horizontal body can be supported on the flat of the hands — co-operate with two feet, each swinging in locomotion with natural ease around its hallux as a fulcrum? It would have required a new plexus of regulating nerves for each of the two movements, so vastly differing from the other, and these two nerve plexi would have needed new systems of nerve connections with the higher co-ordinating centers. Many generations would have to pass before all these new nerves and connections could come into existence, and in the mean time the creatures needing them must have died without leaving offspring. And even if it could have been accomplished, what a clumsy, waddling unmanageable mode of locomotion it would have made! The supposition must therefore be rejected.

It is obvious, then, that if any of the two-footed brutes persisted in attempting to move and live with the body on all fours in the horizontal attitude, then they must have perished so quickly as to leave no

offspring, and we who are alive to-day must therefore be descended from those who quickly resorted to the erect position.

Variations tending to the shortening of the arms, to modifications in the fibula, tibia, astragalus, calcaneum, in the muscular attachments to these bones, in the nerves operating them, and in various other structures more or less related to the upright attitude, must have begun to be naturally selected shortly after the occurrence of the changes in the entocuneiform bone, for it was this event which gave them survival value. These changes, however, may have taken many generations to attain that perfect adaptation to the upright attitude in which they are found to-day.

In this connection it is interesting to note the reports of naturalists who have sojourned in districts where monkeys abound. Of the anthropoids when in the upright attitude, they tell that these frequently walk on the knuckles of their posterior pair of hands, and at other times on the outside edges. Attempts to walk on their palms would obviously necessitate the outstretching of the fingers in front and of the thumbs at right angles. In this position slight irregularities in the surface of the ground, such as tend to deflect the weight of the body in the direction of the center line between the feet, would then, at the points where the thumbs join the hands, increase the strain to an extent, making liability to dislocations and fractures unavoidable. This cir-

cumstance emphasizes the vast difference which the modification of the entocuneiform bones produced, in the adaptation to standing, walking, or running in the upright attitude.

The angular inclination of the longitudinal axis of the head towards the vertebral column depends on the location of the center of gravity of the head and the place where the spinal cord passes through the bony plates of the skull. This opening is called the occipital foramen magnum.

In the human body it is situated a little back of the center of the base of the skull, so that only when the body is in the erect attitude can the head be easily supported without conscious muscular effort.

This is another reason why, after the variation in the entocuneiform, our brute ancestors adjusted themselves quickly to physical uprightness.

These two, then, the modification in the entocuneiform bone and in the position of the foramen magnum, are the Physical Basis of Civilization indicated by the title of these essays. Until they had occurred, natural selection among sentient creatures was mainly instumental in securing the survival of the strong, cunning, greedy, fierce, and cruel. For the low type of mind with which the most intelligent animals below man are endowed is inadequate to anything higher than obtaining for its possessors in the general struggle for existence with living antagonists the largest attainable share of the supplies and opportunities provided by *unaided* nature.

To improve the quantity and quality of these supplies and opportunities by the joint efforts of many consciously devoted to such an end is *utterly unthinkable* among brutes below man.

In their case even the conditions precedent are lacking on which the possibility of moral or social motives depends, and intelligence makes progress among them at so exceedingly slow a snail's pace that races and even species are evolved, as the phrase goes, flourish, and then disappear, without any perceptible improvement in intellectual power being apparent. Only by a perspective view across several geologic ages can evidence of intellectual progress among brutes below man be obtained.

To return to the original line of argument:

Two anatomical variations which, though great and wonderful in their consequences, were so small in their nature that it is almost thinkable that they might have occurred in the transition from one generation to another, *inevitably* led to the erect attitude, and to the disabilities, perils, and infirmities enumerated in the first chapter.

In subsequent chapters the task will be to prove that from these as unavoidable consequences there arose, in the order here stated, the enormous increase in human intelligence, separation of the sexes, the family, the dependence of woman, the differentiation of the sexes in activities and character, including the natural selection of the true hereditary type of character for woman, and of the false or

robber type for men, introracial predatoriness, and finally the train of political, economic, and conventional conditions under which humanity exists in this age.

To state the results briefly: as heretofore shown, the erect attitude of our brute ancestors must have come so quickly after the modification of the entocuneiform and in the position of the foramen, that for practical purposes the two events were simultaneous. In all cases in which they were not, as before explained, additional disabilities, perils, and infirmities greater than those resulting from the erect attitude alone were incurred. These made the survival of that kind of creatures at least unthinkable if not absolutely impossible.

After the occurrence of these two anatomical modifications, our earliest brute ancestors therefore must have been very much like ourselves in body, and in mind like those brutes related to the quadrumana, which were their immediate progenitors. The erect attitude had arrived, but the superior intelligence of man had not yet come.

Some consideration must now be devoted to the complex process by which, among highly specialized sexually reproducing animals, traits that have arisen through variation are eliminated if they lessen adaptation and increased in degree and in the number of individuals endowed with them if they improve it.

It follows, from the general likeness in structures and outward appearances which prevails in higher

animals among individuals of the same race and variety which has remained practically unaltered since thousands of years, dating back even into the prehistoric ages, that in this class of creatures the changes which originate as above stated — and there is no scientific evidence that among them such alterations can originate or ever have originated in any other way — must come into existence at first by very small increments, which are then left to increase from generation to generation, or else to diminish until they disappear.

Since, then, from the present state of the evidence it must be admitted that new traits in such organisms can only arise from small increments produced by variation, therefore is it in this place unnecessary to consider the mooted problems of periods of extreme mutability, alternating with others of extreme stability, which have lately been suggested in connection with observations on toad-flax, evening primroses, and other plants of comparatively low organization. These problems will be carefully discussed later in this chapter, and on that occasion no efforts will be spared to demonstrate as clearly to the mind of the reader as it is to the mind of the writer that the inferences drawn from these observations cannot rationally be applied to the more highly specialized animal organisms, and therefore not to this argument.

When such new traits produce better adaptation, then as a matter of course individuals affected by

them have an advantage in the struggle for existence over those which have traits that do not, and therefore a chance to live longer and reproduce more numerously.

This in the long run of succeeding generations must, caeteris paribus, result not only in an actual increase in their numbers, but also in an increase in the proportion in which this number stands toward the entire numerical strength of the race to which they belong.

When the alterations are unfavorable to adaptation, then the reverse takes place; viz., those affected tend to die earlier and to produce less numerous offspring. This must, in succeeding generations, cause a gradual diminution of their number, and therefore a lessening of the proportional relation in which this stands toward the sum total of individuals in the race.

Since these new trait individuals, being comparatively few, are at first greatly outnumbered by the average race type, therefore it is, caeteris paribus, much more probable that they will sexually mate with these far more numerous specimens. Mating with the average transmits the new traits to the next generation, from *one parent only*, therefore, in lessened degree. Then these specimens, which possess only an impaired quality of the new traits, will most probably and in most cases again mate with the far more numerous average type, and thus the new traits appear still more feebly in the next

generation. After this process has continued during a longer or shorter series of generations, and there exists, caeteris paribus, *no known cause*, which could interfere with its *uninterrupted continuation* to the end, it must inevitably lead to the utter disappearance of the new traits. To the process thus sketched in mere outline, August Weissmann has given the name of "panmixia."

In this process the factor which counts is the outnumbering of the new trait individuals by the average type, and since this applies equally to all those endowed with any new traits, whether they are favorable or unfavorable to adaptation, it would seem that, other things remaining equal, panmixia must exterminate all new traits in the course of a longer or shorter series of generations.

It would of course take longer to eradicate favorable traits, because the individuals endowed with them live longer and reproduce more. They therefore in the next generation not only increase in numbers, but also in the proportion which their number bears, to the sum total membership of the race. So to speak, however, *other things do not remain equal*, in such cases. Sexual relations exert an influence which varies according as traits are favorable or unfavorable. For among all higher sexually reproducing animals, both sexes display an unmistakable preference for the more perfect, that is to say, the more adapted specimens of the opposite sex.

To illustrate the effect of this preference, let the "new favorable trait individuals" be symbolized by the letter *a*, the average race type by the letter *b*, and the "new unfavorable trait individuals" by *c*. Both sexes of *a* then have a preference for each other, only interfered with by the great numerical predominance of the *b*'s. The *b*'s have a preference for the *a*'s, which is made more effective by the vast numerical predominance of the *b*'s, but adversely affected by the preference of the *a*'s for each other. The *c*'s have a preference for the *a*'s, and their next choice is the *b*'s. Their preference for the *a*'s is fully balanced by the preference of the *a*'s for each other. Their preference for the *b*'s is greatly assisted by the vast numerical predominance of these, but hindered because the *b*'s prefer each other to the *c*'s. From this analysis it follows that sexual selection counteracts the tendency of panmixia to exterminate new traits when they are favorable to adaptation, and assists it when they are unfavorable.

Mating with each other of those with favorable traits transmits these from both parents, therefore in increased degree, just as the mating of those afflicted with unfavorable new traits with the average type transmits these traits from one side only, therefore in lessened degree.

The above considerations make it clear that between these two agencies, viz., panmixia and the dying earlier through the possession of unfa-

vorable traits, the former is far more efficient and rapid as a factor in the extermination of either unfavorable traits or varieties of organisms affected by them. Panmixia is the important, decisive element by which extermination is accomplished.

If unfavorable traits, or varieties of creatures afflicted with them, can be exterminated by the direct results of these traits alone, that is to say, without the occurrence of panmixia, then such traits must be of so excessively destructive a nature that no two creatures of opposite sex afflicted with them can survive long enough for a chance of reproduction.

If in each generation, during many generations, but one pair of the afflicted type remains alive, that is entirely sufficient to preserve the variety, and even to increase and accentuate the unfavorable traits, provided only that there is no panmixia. For in each generation the offspring of the one pair would then inherit these unfavorable traits from both parents, therefore in increased amount and accentuated quality. So that these qualities unfavorable to adaptation would continue to develop more and more ad infinitum, provided only panmixia can be prevented.

But can this be done? Excepting only man's power to control domesticated animals and plants, is there any agency in nature that can prevent closely related varieties from interbreeding? So far but one instance, presently to be mentioned, has

been found in which such a thing has occurred in the natural course of events. This one having been overlooked in the past, the rule that "no traits can be preserved or enhanced unless they are of advantage in adaptation at every step in the process,"[1] that is to say, in every generation, has heretofore been regarded as holding without exception. The question then arises, under what kind of contingencies, if any, in the natural course of events could the last few of an unadapted form of life be prevented from interbreeding with the variety from which they are only distinguished by slight

[1] The validity of this rule, which has been maintained by scientists since more than a century, rests, firstly, on an enormous array of observations which establish these two points, viz., that the normal average types of the organisms of highly specialized species and races, since time immemorial, have tended to persist and prevail most tenaciously throughout changes in outward conditions; that new traits, on the contrary, are frequently found to be modified by such changes; secondly, the rule follows, also, as an inference from the inherent results of time and the general commotion of all things in the universe. These two, reacting on the intricately commingled forces and materials of organic individuals, must inexorably tend to a concentration within them of like with like and dissociation from unlike. From this dissociation or expulsion of the foreign results a purification of the constituent materials and forces. The longer the time during which a type has existed, the longer this process has continued, therefore the greater this purification. The greater their purification, the more confirmed and established the inherent tendencies of the original constituents of an organism must become, and the less liable they must be to disturbance.

Since new traits must be the result, of either new materials or new molecular or structural arrangements which have not had time to become confirmed or established, therefore must they be exceedingly liable to modifications and unable to resist modifying influences. They therefore can only continue if they are favorable to adaptation and therefore naturally selected. For better comprehension, see Appendix, Note IV.

and recent modifications which are very unfavorable to their survival? Only if the new traits inexorably forced upon those affected, firstly, an entire change of habitat, away and apart from where their nearest relatives of the previous generation exist; and secondly, if in addition they inexorably enforced an equally absolute differentiation in actions and habits related to the more important requirements for sustaining life,—only then could panmixia be prevented in the natural course of events. And such radical changes in habitat and modes of life seem unthinkable, if not impossible, of occurrence, in a few brief generations, unless modifications have arisen which resemble in their rapidity and violence, those sudden mutations which have been reported to take place among the lowliest forms of animal and vegetable life. As to these, however, as already mentioned, it will be proven later in this chapter, that among higher animals they are impossible without rapidly fatal results to those affected by them, and they are therefore incompatible with survival.

There remains, then, but one possibility in which panmixia can be prevented in the natural course of events among closely related varieties, and that is when structurally slight modifications possess the power of producing tremendously great and wonderful consequences. This last phrase is exactly descriptive of the unique phenomena which occurred when the "Physical Basis of Civilization," referred

to in the title, had by two slight structural changes brought the human race into existence, and thereby at the same time set in motion the process which made those tremendous consequences mentioned in the last paragraph, page 32, inevitable. For these two structural changes forced our progenitors to abandon tree life, yet forest trees were the natural habitat of their ancestors; they forced them to live on the surface of the ground in the upright attitude, which involves modes of life, in the most important essentials, utterly different from those of their immediate forefathers. Panmixia between them and their ancestral type was therefore entirely out of the question.

Therefore, provided only that they produced two offspring of opposite sex, which survived them, it is quite thinkable that one male and one female may have been the sole adult representatives, of our race in every one of many generations. Even so scanty a remnant as that would have been sufficient for the steady improvement of all peculiarly human characteristics.

If the reader bears these facts and inferences in mind, then it will not be difficult in later arguments to reconcile the conclusion that the growth of the human intelligence was the sole means which saved our race from extermination, with that other seemingly contradictory deduction that this growth, under the determining influence of natural selection, by which the fittest only survive, was largely brought

on by the infirmities and defects of the physical structures from which our earliest upright brute ancestors suffered.

The detailed statements contained in Chapter I, of a few of the more important disabilities, perils, and infirmities attaching to brute men, must now be recalled. On account of the severity of the struggle for existence, with living contestants in that early period, proof of which will be found in the fourth chapter, any one of these disadvantages would seem sufficient to doom our race or any other type of life to rapid extermination. When two or more affect the same variety, speedy extinction seems unavoidable, unless the effect is balanced by a rapid and copious rate of multiplication.

The "genus homo," however, was afflicted with all the vicissitudes enumerated in the last chapter, while the rate of multiplication in our race is the slowest known and the farthest removed from copiousness, excepting only the elephant, eagle, and a few other types; and with reference to these it is noteworthy that although they are supplied with natural means of offense, defense, protection, and escape, and man is not, they yet exist in scanty numbers only, not very far removed from extinction.

Humanity's survival, therefore, falls little short of seeming miraculous. For the most painstaking survey of our physical organism reveals absolutely nothing that could possibly account for the preser-

vation of the race, and its wonderful supremacy on earth. In all physical attributes man is obviously the inferior of the higher mammalia; and to account for his survival and supremacy one involuntarily turns to the one faculty in the quantity and quality of which he so greatly surpasses all known forms of life; viz., to his intelligence.

The opinions of the competent seem to agree that the changes in consciousness which comprise the activities of the mind correspond with and are dependant upon parallel changes occurring in the nervous system. The special class of mental activities, which is distinguished as appertaining to the intelligence, is with equal unanimity held to be co-ordinated with parallel changes occurring somewhere in the brain. Broadly speaking, then, the brain may be called the organ of intelligence to this extent at least, that morbid conditions excepted, there exists a variable, but yet indubitable proportion, between the intellectual capacity of any creature and the quantity and quality of the brains it possesses. So that future arguments may appear in due proportions and be given their proper bearings, it will be useful to clarify thought firstly with reference to the average quantity and quality of brain possessed by our very earliest upright brute ancestors; secondly, with regard to the difference between this and the kind with which our *distinctly* human progenitors were endowed when they began to arm and warm themselves artificially; thirdly, with reference to the length of the period

during which variation and natural selection accomplished this change. See Appendix, Note V.

By measurements and from data morphologically deduced from observations on fossil remains, it has been determined, firstly, that, the brains of some of the earliest club, missile, and fire using men were, if at all, then not much inferior in mass to those of the average civilized person of the present era; e. g., the *quaternary man of the Dordogne;* secondly, that the brains of the most primitive upright creatures were little, if any, greater or better than those of the average adult gorilla, gibbon, chimpanzee, or orang. This follows, also, from the fact that, being the immediate offspring of creatures physically like these anthropoids, there is until after the modification of the entocuneiform and in the position of the foramen *no rational ground* whatever for the conjecture that they ranged intellectually higher than these. For until these changes had come, such creatures had no occasion whatever for higher intelligence, being well fitted for the struggle for existence, having no special incentive to make use of their intelligence, nor either of the three causes which forced its growth in our race; all of which will be more fully explained in this and in the next chapter. The brain weight of the anthropoids averages from about two-sevenths to nearly one-half of that of civilized persons. When the proportion between the weight of the body and the weight of the brain is taken into consideration, the disparity is even greater.

Gradually small accretions arising through variation had to be naturally selected, until after practically innumerable generations, there emerged out of a brain not much better than an ape's the magnificent organ of intelligence, which club, missile, and fire using men must have possessed.

The brain mass had to be more than doubled. Without entering into the merits of the questions involved, since the brain has been called the organ of intelligence it seems permissible for purposes of linguistic convenience in this argument to call intelligence the function of the brain. Increase of function has survival value when it aids adaptation. Whenever increase of function has survival value, then the smallest increase or improvement in the organ which supplies the function will be naturally selected. Therefore will the average size and quality of an organ keep on increasing in any race or variety so long as increase of function of that organ aids adaptation. Intelligence being the function of the brain, therefore, whenever intellectual energy and acuteness can aid adaptation, then will even the smallest improvement in brain mass or quality be naturally selected, and the average size and quality of brain in that race will keep on increasing from generation to generation. Intelligence aids adaptation and has survival value when its exercise is required in adjusting the organism to the environment, provided the organism is adapted to such adjustments. Whenever, therefore, the environment

demands from a race having suitable bodies adjustments to an infinite variety of ever-changing conditions, then even the smallest improvement in brain mass or quality is certain to be naturally selected, and brains ever increasing in mass and quality must, caeteris paribus, necessarily emerge in that race. If a race, species or genus, however, is *physically well adapted* to its environment, and if its organisms are *not adapted* to an infinite variety of highly complex concerted movements, and if the changes in its environment can ordinarily be met by its natural physical adaptations, then increasing intelligence has comparatively little if any survival value.

The conditions first mentioned, prevailed among the upright brute ancestry of man, those described in the last sentence among brutes below him.

The almost unchanging sameness of the relation which has existed during thousands and thousands of years between brutes below man, including apes and elephants, and their environment, indicates the excessively slow rate at which the number and variety of new adjustments of their organisms to environment makes progress, and the enormously long period of time required before even the slightest perceptible addition is made to their brain mass or intellectual power.

Differences in brain quality come still more slowly. For while the increase of mass progresses by the smallest quantitative addition, differences in quality can only come into existence after whole tracts or

sections of brain have undergone intrinsic and essential changes. Considering the enormous difference in brain mass and quality, the slow rate at which intellectual power increases, the exceeding smallness of the addition *possible* in the transition from one generation to the next, the conclusion seems inevitable that an enormously long period was required for the gradual substitution for the brute sense of our earliest upright ancestors of that superior intelligence which men must have possessed *when they began* to arm themselves artificially.

The validity of this conclusion has been assailed on two grounds; viz., on the *supposition* or *hypothesis* that the highest mammalians are subject to transformations by sudden freaks, sports, and mutations similar to those which have been reported to occur among the lowlier forms of vegetable and animal life, and that the earliest upright ancestors of man may have received their enormously enlarged and developed brains and intelligences by these same means; and on the *assumption* that these same first specimens perceived the advantages of clubs and missiles, and began quickly to use them.

Since the *hypothesis* has been current in scientific and the *assumption* in quasi-scientific literature, they are both entitled to conscientious, impartial, and thoroughgoing discussion in these essays.

The hypothesis derives plausibility from the reports of sudden mutations in the markings, colors, forms, and sizes of various parts of evening primroses,

toad-flax, and other varieties of plants, which are stated to have occurred after changes in nutrition, etc., and which are reported to have been transmitted by heredity; and also from the rapidity and ease with which, in lowly organized forms of animal life, alterations in environing conditions are stated to have produced changes in the nature and form of organs and tissues, and in the part of the organism where these occur; heads having been reported as forming where tails usually are, and vice versa.

When in such cases the environmental changes and the mutations continue for several generations, then it is probable that these modifications were produced in each generation de novo, and therefore is their reappearance then no evidence of hereditary transmission. But if such mutations reappear, after environmental conditions have reverted to the original state, then a probable case of hereditary transmission can be asserted.

In higher mammalia, structures and functions have reached an orderly degree of complexity, specialization, and co-operation. When in such organisms, therefore, every one of the numerous differentiated structures maintains a nicely adjusted balance with all the others, then the creature can continue in life and health. Small and rare irregularities are not without their risks. But greater ones may produce pathological conditions or death. On account of the degree of co-operation between organs on which life and health depend, it is un-

thinkable in such animals that the organs through which nutriment is ordinarily taken could be transformed at other times to serve for respiration, or that what ordinarily are respiratory organs could be used for locomotion, or vice versa.

If there are degrees in inconceivability, then it is still more inconceivable that the digestive organs could be changed so as to serve for reproduction, or vice versa. And yet, as above stated, similar exchanges are reported to take place freely among lowly organized forms of animal and vegetable life. In some of the latter, when the respective positions of roots below ground and branches and leaves above have been reversed, roots have been reported to have changed into branches and leaves, and vice versa. Tissues ordinarily devoted to nutrition are stated sometimes to take up reproductive functions, and vice versa. Considerable portions of a plant can be morbid and others absolutely dead, while other parts of the same plant continue to live and reproduce normally. Changes come easy in the latter cases and extremely hard in the former, owing to a wide difference in specialization reached in these two different realms of nature, and this emphasizes, firstly, the small amount of interdependence existing between various parts of organisms of a low type; and secondly, the absolute dependence of the welfare and life of every part in highly specialized organisms, on nearly exact normality in the performances and conditions of all other parts.

In organisms of the type of amœba, for instance, any part of the body is equally capable of attending to any of the principal vital functions, such as capturing food material, enclosing and digesting it, assimilating the fit and excreting the unfit, to locomotion, reproduction, irritation, reflex action, etc. Gradually higher and ever still higher organisms, *when fit*, have emerged from such low forms through variation and selection. In some of the lower of these forms, which are a little higher, each of the principal vital functions has become segregated and localized in a special part or organ of the body. During the next steps *still* higher, these principal vital functions begin to be progressively subdivided and resubdivided, and each subpart of a part as it segregates becomes localized in a structure or tissue more and more *exclusively* adapted to its *particular* functions only.

This makes it clear, that the progress of specialization in substance and function is from composite homogeneity throughout to diversity of parts, each of which latter in the highest stages retains only one special kind of the composite material from which it has been segregated. Since function depends on substance, the disentanglement of substance must make progress pari passu with segregation of function.

A part cannot be equal to the whole. Therefore must the scope of responsiveness to environing substances and conditions, which resides in a sub-

substance, be less than that of the composite material from which it has been segregated, but the sum of all the scopes of responsiveness of all the different sub-substances segregated from a composite material, such, for instance, as that of the body of an amœba, must at least be equal to the total scopes of responsiveness of the original composite material from which the sub-substances were derived.

Since higher forms of life are derived from lower, and these again at their lowest from an original undifferentiated life material, viz., protoplasm, by the progress of specialization above outlined, therefore it follows inevitably from the above line of reasoning, that the undifferentiated organ of the more primitive type must, in the scope of environmental changes with which it can interact, surpass any of the more highly evolved structures which are found in higher types of life. See Appendix, Note IV.

In highly specialized forms, each one of the many different organs, sub-organs, tissues, and substances is exquisitely fitted for the efficient performance of one special kind of functions or interactions with a specific kind of environing material or conditions only. If environing conditions vary from this, then other specialized organs, tissues, or materials have to do the interacting, or it is not done at all.

For instance, lung-cells are adapted to hold atmospheric air of normal composition and pressure, blood corpuscles to interact with the oxygen this

contains. If the composition or pressure suddenly changes to any great extent, then neither can perform its normal functions, and serious organic disturbances are likely to occur.

Since, then, in the lowliest forms of life any part can perform almost any of the functions ordinarily falling upon other parts, the organism can adjust itself easily and rapidly to sudden mutations. For deficiency in or addition to the function of one part is balanced by increase or decrease in kind or amount of another. So that comparatively slight local or temporary advantages to the organism, arising from changes in the environmental constituents, may easily become the transitory causes for these sudden structural or functional modifications set forth in the accounts of sudden mutations. But in highly specialized organisms, where each organ, structure, etc., is exquisitely fitted and narrowly limited to its specific performances, and where the health and life of the whole organism and of every part of it depends on the co-operative harmony in the functioning of all parts, and therefore an exact performance of every part, a slight change in one part causes so serious a general disturbance, that sudden great mutations could only be conducive of *equally sudden fatal results. The transmission of such by heredity*, in highly specialized organisms, is therefore *impossible.* Such changes in such organisms, when they come at all, must obviously begin with very slight modifications through variation, which then,

if they have survival value, increase from generation to generation by natural selection. See Appendix, Note IV.

The above argument, however, does, of course, *not* apply to *non-essentials*, that is to say, not to changes in structures or functions which only slightly affect the co-operative harmony of the organism and its chances of survival.

Referring to the assumption mentioned in the last two paragraphs on page 47, it cannot be denied that a two-footed upright brute is organically better fitted than the quadrumana are for the clever use of clubs and missiles, and if creatures so fitted have the intelligence to comprehend how, when, where, and with what effect these appliances can be used, then they are well prepared for the struggle for existence with living antagonists, though in other ways badly disadvantaged.

Brutes quickly learn the benefits of those means of offense and defense which nature has supplied to their *bodies*. But to teach them the use of *artificial* appliances requires either a developed hereditary instinct, or long training joined to a high degree of intelligence. Could the two-footed upright brute from the beginning have reasoned out the advantages of sticks and missiles and the manner of handling them?

This question implies a degree of intelligence utterly unthinkable in the case of these primitive brutes. Only by *being repeatedly put through the*

*several steps* in the process can brutes be taught new tricks or habits. Civilized man teaches children and ignorant adults. But wild brutes have, with a few exceptions, such as when parent birds teach their young how to fly, only nature for a teacher, and these exceptions seem to be owing to naturally selected hereditary predispositions. And how could nature teach a brute to go through the motions of breaking off a branch, trimming branchlets off for a stick, then grasping and uplifting it and striking blows, not at random, but carefully aimed, at a definite object, with premeditated purpose? Then to realize in mind what it had accomplished, and by what means, and to retain the remembrance of it as an inducement to repeat these actions voluntarily in future. Such a complex purpose and line of reasoning is unthinkable in the case of the stolid, primitive, two-footed brute.

The unimpressionable stolidity of the intellectual faculties of average savages is a well-known fact, and usually this peculiarity differs directly as the time-distance from civilization. How dense, then, must have been the dullness of our brute ancestors!

Nature teaches by frequent repetitions of incidents (so-called accidents) which *directly induce*, step by step, the various consecutive, coherent motions or actions which, when compounded in a certain order with duly adjusted emphasis, constitute a habit or habitual mode of action. It surely is a reckless abuse of the representative faculty to imagine that

a complex and lengthy series of accidents, such as could induce a stolid brute to go through the motions and mental changes recited in the second paragraph above, would be accidentally repeated in the same order, etc., so frequently as to teach that brute the habit of making those motions deliberately.

It is very different, however, with an instinct or predisposition; for these originate by variation, are transmitted through heredity and increased by selection. In sexually reproducing organisms variation produces an infinite variety of types and of structural arrangements within their bodies. No specimen among these organisms and structures is in *every* particular *exactly* like any other. The vast majority of them is either not, or at best but poorly, adapted to their environing conditions. At rare intervals specially and wonderfully adapted specimens occur. This applies to races, individuals, organs, tissues, and structural arrangements. It applies to the nervous system, to nerve substance, and to structural arrangements of nerves.

Among the rarely occurring structural arrangements of nerves some have happened capable of initiating motions, which, under suitable conditions, favor the reproduction and survival of the type of organisms possessing these structures and performing these motions. Such nerve structures are the causes of so-called instinctive actions, which, being selected, are then transmitted as race instincts.

The wonderful instinct of a certain wasp, which

stings a particular kind of caterpillar in nine definite places, just where the nine principal ganglia of the creature are situated, and then deposits its eggs in the body of the animal, is of this sort. The stinging of the nine ganglia completely paralyzes the caterpillar, but does not kill it. The grubs, developing from the eggs deposited in the body, feed on the living flesh of their host, and are thus enabled to survive. These caterpillars live in hot countries. If, instead of being paralyzed, they were stung dead, then their flesh would rapidly putrefy, and the young wasp grubs, instead of being nourished by wholesome food, would be poisoned. That kind of wasp would become extinct.

Undoubtedly myriads of varieties of wasps died out, because they did not sting in the exact places where the nine ganglia are located. At last one kind was born with nerve structures so precisely adjusted that the nine stings were performed in the exact localities where the nine ganglia are situated. That kind of wasp has survived. Thus nature works out these wonders in *infinite* time, with *infinite* variety, through *infinite* waste, by natural selection.

Can reason supply any explanation of so wonderful an instinct? Indeed, the explanation seems obvious. There must exist a natural attractive affinity (chemical or otherwise) between the substance in the wasp's sting and the substance in the caterpillar's ganglia.[1] This affinity, ordinarily inac-

[1] Although the author believes that in future so-called at-

tive or only potential, becomes active when stimulated by the wasp's catching sight of that kind of caterpillar.

But the teaching of a habit to a creature, by many repetitions of a series of accidents is a very different matter. This has neither infinite time to work in nor infinite variety to work with, but is limited in its educational possibilities: to the lifetime of the creature it works on; to the narrow capacity of that brute's intelligence; to the vicissitudes of its stolidity and inattention; and to the *infinitely great improbability* of a series of natural accidental inducements being frequently repeated exactly alike in quality and in the order of their occurrence, under similarly adjusted environing circumstances.

But one of these two-footed upright brutes, in an effort at climbing, might grab a branch for support, and then this branch might accidentally break off and remain in the brute's hand. Would not that teach him the use of a stick? By no means! To begin with, the chances are many times many that the branch on account of branchlets would not be suitable for a stick. Then what should make the brute retain it in his hand? Not any intellectual expectation of making use of it. That is inconceivable in advance of experience, and to assume antecedent experience is to beg the question. And

tractions will be interpreted as propulsions toward the points of meeting, yet since this view, without lengthy explanations, would leave the argument somewhat obscure, therefore the word "attraction" has been retained. See Appendix, Note IV.

since all wild creatures avoid avoidable efforts, it is more than likely that brute-man would drop the stick immediately upon becoming aware that he had missed his hold. Furthermore, on the branch breaking, the recoil would startle the brute and perhaps make him angry or afraid, and all the more likely to drop the stick. To teach him the use of a stick, it would have to be further assumed, that, immediately after grabbing it and after the recoil from breaking, another accident made him accidentally lift the arm and then strike a blow. Then, by further accidental coincidence, the blow would have to fall in just the right place, on some creature or object happening to be there, at the exactly right moment, and that this combination of exact accidents achieved so impressive a result in the life of the creature as to determine his stolid nature to remember and voluntarily repeat these actions on future occasions. He would have to say to himself: "This is a stick. Sticks come from trees, when you want to climb and happen to miss. Sticks must first be lifted and then brought down violently. That kills some animal good to eat, or one that might have killed and eaten me unless I had first struck it with the stick." Then this complex series of coincident and precisely adjusted accidents must be repeated frequently before a single man-brute could acquire the habit.

Even so comparatively simple an accident as that a grabbed branch, fit for a stick, should break off

and remain in the hand, not to mention the subsequent series of necessary accidents, must have remained of *exceedingly rare occurrence* in the life of any one of our two-footed ancestors. For they were *not fitted for tree life.* Their two feet made them unfit for it. Their proper habitat was the solid earth. On this their conditions were sufficiently against them, but up in the branches of trees apes, serpents, felines, and great birds had them at much greater disadvantage.

The assumption that brute-man used sticks as weapons, before his intelligence had made considerable advance, is for these reasons untenable.

Passing from sticks to stones, it seems even more improbable that the two-footed brute should have learned the use of missiles from the frequent repetitions of accidents competent to induce the motions involved in the seizing and throwing of stones at a mark.

For, while standing or moving, the hands of the two-footed upright creature dangle from eighteen to thirty inches above ground, and at that elevation *can never* come *accidentally* in contact with stones. When in a sitting or horizontal attitude, the accidental contact with stones is more probable; but what accident should induce a brute in either of these two postures to lift, swing, and throw a stone at a definite mark, with a definite purpose, *in advance of experience?* While the contact might be accidental, it is utterly unthinkable that from

a sitting or prostrate position the lifting, swinging, throwing, etc., could be so. It must, if occurring at all, in those positions always be *on purpose.* And purpose presupposes antecedent experience, which is begging the question; besides, these attitudes are not adapted to the successful throwing of missiles. This argument applies equally to sticks and stones.

The same line of reasoning holds here, a fortiori, which was followed in detail in the matter of sticks, and it leads to the same conclusion; viz., that such an assumption is untenable.

And yet it is a well-known fact that apes use sticks and missiles. Their *natural relation* to these appliances, however, accounts for this fact in a way which is *not* applicable to the man-brute. For whether resting or moving in his natural habitat among the aboriginal forests, an ape is distinguished from the two-footed upright brute by generally having one or more of his hands grasping the branches of trees. From the weight of his body or the muscular pressure of his hands, it must frequently happen that one of these branches breaks and remains in a hand. Nor would he then be as liable to receive the recoil and consequent perturbation as the man-brute. For he supports himself by holding on with several hands to various parts of a tree, and when by the breaking of a branch one hand loses its hold, so that the body would be unbalanced, then reflex action causes each

of the other three hands to tighten and readjust its grip. With the frequent natural repetitions of such incidents, it seems not at all improbable that an occasional coincidence might induce the lifting of a stick and striking of an accidental blow. Therefore would the two-footed brute *not*, but the ape might, be taught the use of sticks, *in the natural course of events.*

As to missiles, it should be further observed, that apes are almost continually among the branches of trees, where fruits and nuts grow and where dead branches occur, and that, therefore, it cannot be a rare experience for these creatures to observe a fruit, nut, or dead branch break off and fall to the ground. Occasionally a fruit or nut, singled out or seized by one, may drop, or a branch which is held may break. Then, if the falling object happens to strike a creature below, that is a lesson in the effect produced by missiles. Actions done ordinarily for a purpose are sometimes playfully repeated without a purpose. So fruits and nuts may be plucked playfully and with no purpose of eating them, and then dropped. This might teach how fruits and nuts can be used for missiles. Sometimes a fruit or nut after being plucked may prove unsatisfactory, and then the ape may throw it away in anger. Whether the thing so thrown away strikes another creature or not, it is very likely to teach a lesson in the effect of missiles. It follows, therefore, that accidents and incidents *of frequent*

*occurrence in the natural course of events in an ape's life* are particularly favorable to making these creatures familiar with the nature and uses of clubs and missiles, but *the very opposite* is true with reference to the two-footed upright ancestors of man.

It is all the more wonderful, and calls for explanation, that apes handle these artificial tools and weapons so rarely and so clumsily, while evidence is not lacking that primitive man already in the paleolithic period used them universally and skillfully.

In their natural habitats, up among the branches of the forest trees, apes, by the possession of four hands, to which, in the case of a large division, a prehensile tail is added, are the supreme masters of the situation and have no need of arming themselves artificially. Even if they happen to be on the ground and there meet with a creature they wish to capture, or one they are afraid of, it is ordinarily easier for them, and far more promising of success, to swing themselves up among their native branches and do battle from above; and travelers tell of orangs and gorillas which, from a low-hanging branch on which they rest, watch for creatures that pass underneath. Then they reach out, grab the passer around the throat and lift him from the ground until he dies from suffocation.

The occasions are very rare when sticks or missiles are of any real use to apes. Neither have they the

intelligence to suspect the multiform potential applicability of those articles. Besides, they are not organically fitted to make skillful use of them. The difference between their bodies and that of the two-footed upright brute is sufficient to make them rather clumsy and inaccurate in handling them. Such habits have no survival value for them.

Though they had learned their applicability long before the upright brutes, yet have they, probably for these reasons, never become articles of common use among them, nor have they, as far as evidenced, ever improved themselves in the manner of handling them.

How were the upright brutes taught to avail themselves of these arms and tools? They learned their application probably from observing the clumsy and rare use made of them by their ape relatives. Since it has been proven that these habits could not have been acquired by the occurrence of accidents or incidents in the natural course of events, they must have been learned by some indirect method. No *other* indirect method is so simple, so natural, so suggested by the facts known in this case. Therefore, on the rule of parsimony, this explanation should not be rejected until a better one has been found.

This leads to a discussion of the nature of the imitative faculty. This inheres in the nervous system, and directly differs in degree as the sensitiveness of its owner. It tends to reproduce in him

motions which he has observed in other creatures, and does this because the perception of these motions in another excites the corresponding nerve tracts in the perceiving individual. Sympathy differs from this faculty only in this, that it reproduces feelings, emotions, and thoughts perceived in another. But since apes live in trees and the man-brute on the ground, since the former are well fitted by nature for the struggle for existence and the latter are not, the opportunities must have been few and rare when our brute ancestors could observe these habits so as to be induced to imitate them. Neither would our brute ancestors be likely to perceive how these habits could be made useful, seeing that apes handle sticks and missiles clumsily. Only after many generations, when a higher order of intelligence and a developed imagination enabled our ancestors to foresee from the clumsy movements of apes how greatly they might be benefited by the skillful use of clubs and missiles, only then does it seem possible that the brightest of them may have experimented how to handle them.[1]

[1] Sir John Lubbock, in "The Origin of Civilization, etc.," tells of monkeys which use stones to crack nuts, of one who used a stick to open the lid of a box, and that the house of the chimpanzee is equal to some of the rude habitations of savages.

The following report, if reliable, indicates unexpectedly high intellectual, social, and moral faculties among some of the anthropoids.

For the purpose of observing these brutes, Margaret Selenka spent considerable time, with her husband Emil, in the aboriginal forests of the Sunda Islands. The two had for a long time made unsuccessful efforts to capture a living specimen of the gibbons. One day in the forest, she perceived, crouching

*Hundreds or thousands of generations must have passed before that status was reached!*

This impartial discussion of the hypothesis and assumption, stated on page 47, shows both to be *without foundation in either fact or reason, and utterly untenable.*[1]

on one of the branches of a tree, an adult female gibbon with her baby. She noiselessly touched her husband's arm and pointed to these two. Quickly he aimed his rifle and fired, and the wounded female, still holding her baby, dropped to the ground near the trunk of the tree. Immediately thereafter they saw a large number of gibbons of various ages scamper away from that part of the forest and disappear. Then they set to work to capture the wounded female, who fought furiously. While they were thus occupied, their attention was attracted by a noise much like the approach of a crowd of people, and on looking in the direction they beheld a troop of about fifteen full-grown gibbons, all males, making directly toward them with obviously hostile intent. The rifle being unloaded, they had no desire to encounter these angry brutes, and fled, observing from the distance that the troop proceeded no further than the wounded female and her young, which they lifted up tenderly and carried away. Apparently these males had simply taken their females and young to a place of safety and then returned to rescue their wounded.

The same traveler reports that it is an inspiring sensation to hear the sound of the long-drawn-out musical laughter with which the gibbons salute the dawn of daylight; that it entirely relieves the sense of extreme isolation which civilized people sometimes feel when sojourning during lengthy periods in the depth of the aboriginal forest.

[1] If it be contended that there exists an interdependence between two feet and hands on the one side, and the possession of a high degree of intelligence on the other, then the reply is, firstly, that this phase of the argument will be part of the subject-matter of the next chapter; secondly, that there cannot be a direct dependence of one on the other, but only an interdependence between intelligence and the elevation above ground of the organs of sight, hearing, smell, and touch, and that the extent of this elevation is dependent on the upright attitude.

The scope of these sense organs, except touch, on account of the nature of space, increases as the squares of their elevations above the ground. But since the impediments to the passage of light and sound increase very rapidly the nearer the surface of

The argument may, therefore, be resumed with increased confidence where it was interrupted.

Since the brutes below man are adjusted to the conditions of existence by their natural physical attributes, conduct plays but a small and unimportant part in their survival. But it was very different with the upright brute ancestors of man. For since they were physically unadapted to the struggle for existence and afflicted with many special infirmities, *conduct was the only means* by which they possibly could escape extermination. No other faculty is of such universal, infinite applicability in adjusting the conduct of a creature to its environment as intelligence. To creatures having organisms adapted to an infinitely great variety of compound concerted motions, intelligence must therefore be of great importance. Therefore, to show the overwhelming survival value of intelligence in the case of the primitive brute ancestry of the human race, it only remains necessary to ascertain whether or not, during the long interval referred to above, there existed anything in their organisms which acted as a natural and continuous incentive for the exercise and use of their intelligence.

the ground is approached, therefore the real ratio of increase is much greater than the ratio above stated, and probably at least equal to the cube of the altitude.

No observer of four-footed animals can have failed to notice that the mentally energetic and intellectually superior among them make frequent efforts to elevate their heads for the purpose of hearing and seeing, more especially when their curiosity or apprehension is aroused, having learned, by experience no doubt, the advantage of this mode of conduct.

It is probable, from the disabilities, etc., named in Chapter I, and the absence of hair, fur, and thick hide, that during this long interval our brute ancestors frequently served as a choice article of diet for the great contemporary monsters and carnivoræ, which rarely permitted isolated specimens to reach that age when the bones had been hardened sufficiently to make them difficult to masticate.

This inference derives strong support from the extreme scarcity of human fossils. At the same time it offers a plausible explanation of this unique phenomenon.[1] Under such circumstances, if any of our brute ancestors of that period were distinguished by any peculiarity not possessed by other creatures,

[1] Organic remains can only be fossilized when air, germs, water, etc., are excluded, or when the remains have been hermetically sealed. But this applies to all such remains equally, and therefore does not explain the unique scarcity of fossil human remains; neither can this be explained by the assumption that the upright brute is the most recent form of mammalia. For in the scarcity of human fossils we have very nearly the only evidence and argument to support the above-mentioned assumption. This would be reasoning in a circle. If it is contended, however, that because the upright brute presents the most evolved form of life, therefore it follows from the theory of evolution that it must be the most recent, then the reply can be justly made that a most evolved form must be the most adapted to its environment, and that the first chapter of these essays proves most conclusively that the upright brute, of all mammalian types at the time of its first appearance, was the least adapted. That adaptation only came after the unadapted natural form had been supplemented by artificial means, viz, clubs and missiles. It is not at all improbable that the two-footed brute is a variation from a kind of brutes now extinct, which were the ancestors of the quadrumana as well as of the bipeds. This, in fact, is a belief expressed by Charles Darwin and a number of his most eminent contemporaries and followers. On this theory the human type may be the more ancient of the two, and it requires evidence to prove its assumed recency.

tending to stimulate them in the use of whatever degree of intelligence they were endowed with, then this slight difference in incentive to its use and the urgent need of it might offer a point of departure, a plane of cleavage, where the small end of the wedge of natural selection might enter, and this, in practically infinite time, might lead to a degree of intelligence such as is displayed by the most advanced minds of our generation.[1]

For when, during a long period, measured in this case probably by hundreds of thousands if not millions of years, destructive agencies eliminate the great majority of certain creatures before they can reach the reproductive age, then, as more fully explained earlier in these essays, natural selection is able to work on a *very small margin*, and, still by the accumulation of many of these small margins from generation to generation through many ages, to accomplish astonishingly cumulative results. For

[1] To account for the wonder of the survival of the two-footed upright brute, it has been suggested that, in the earlier generations, before the expansion of intelligence and the use of sticks and missiles had begun, our ancestors dwelt in some favored spot where no fierce or powerful competitors or enemies existed; that there they acquired a high order of intelligence and became proficient in the use of tools and weapons, and thereafter issued forth to conquer the earth. This is obviously a purely arbitrary guess suggested by the story of the Garden of Eden. Only a miracle could have kept such retreats from being overrun by man's competitors and enemies, or from leaving some evidence of their former existence to posterity of these asylums. Furthermore, the unique and enormous expansion of human intelligence would seem miraculous, if the helplessness of our ancestry and the absence of such hypothetical safe retreats sufficiently extensive for the habitat of the whole race had not been the inevitable exciting cause of it.

natural selection affects both sexes, and the small margin possessed by each individual joining in the reproductive act gives to the offspring an hereditary tendency of two such small margins. The old story of the grains of wheat asked for by the inventor of the game of chess is a striking illustration of the stupendous cumulative possibilities of such a process of addition, which makes progress as the powers of two.[1] The nature of this incentive will be discussed in Chapter III. See Appendix, Note V, on the relation between brain weight and intelligence.

[1] The story runs that the inventor, when requested to name his own reward, asked for two grains of wheat for the first square, double that for the second, double that for the third, and so on to the sixty-fourth. To express, in grains of wheat, the price of the sixty-fourth square, requires a figure of twenty-two integrals, and by doubling this figure the price of all the sixty-four squares is obtained. From an estimate of 200 grains of wheat to the cubic inch, obtained by trial, it follows that for 1,000,000 grains it takes three cubic feet, and the whole number of grains of wheat necessary to pay the reward requires a space of 20,000,000 cubic miles to contain them. To form an idea of so enormous a quantity of wheat, it may be helpful to state that it would be sufficient to cover the whole surface of the earth, both land and water, to a depth of about 300 feet.

# CHAPTER III

## FORCING INTELLIGENCE

In the two previous chapters the aim has been to make it clear to the reader that, firstly, with the beginning of those slight physical differences which distinguish mankind from the quadrumana, the race would have been doomed to inevitable extermination, except for the absence of panmixia and the slow but steady progress of human intelligence; secondly, that a higher type of intelligence, like all other new traits involving great physiological changes in highly specialized forms of life, must have emerged from small beginnings through variation by sexual reproduction; thirdly, that a special incentive must have existed in the human race, which is not found in any other, to make our brute ancestors exercise their intelligence more extensively than other genera, species, or races do. This incentive will be the next object of consideration.

It has already been mentioned in foot note to page 65, that the higher elevation of the organs of sight and hearing increases their potential availability directly as the square of their distance from the surface of the earth, and that in the human race this exceeds the height at which most other creatures,

even those much larger than man, habitually carry these sense organs.

Excepting possibly the giraffe, the largest quadrupeds which habitually carry their eyes higher than man are yet at a disadvantage compared with him, because in looking backwards or sideways his head pivots easily on the erect vertebral column. They, on the contrary, in executing these movements, have to curve or even double the joints in the backbone horizontally. Thus has the upright attitude directly caused man's erect ancestry to survey a wider field of vision, sound, and odor, and therefore to perceive a greater variety of phenomena in his environment than do any of his competitors. This constant influx of a much greater variety of experiences cultivates activity and energy of the mental processes, and educates the mind to greater knowledge of the relations and connections between phenomena, and thus the upright attitude becomes a *constant incentive* to the use of the mental faculties.

For a race not possessing any of the usual physical adaptations to their environment, for a race afflicted, as heretofore shown, with many extraordinary infirmities and defects of structure, for a race which at the same time possessed an organism which, by the upright attitude with hands above and feet below, was especially adapted to an infinite variety of compound concerted movements, for a race which, for the reasons above given, was exclusively dependent on the conduct of its individuals for escape

from extermination, this tendency to notice a greater variety of objects, if properly used, has obviously much survival value. This value differs among creatures quantitatively, exactly as their intelligence; thus, if there is less intelligence[1] (less perception, less adapted conduct influenced by such perception), then there is less survival value. If greater intelligence, then greater survival value. Therefore, given conditions in which the great majority perish before the reproductive age, and, cæteris paribus, only the most intelligent of both sexes survive. A very small margin of intelligence above that possessed by others is sufficient to make them survive. These most intelligent specimens of one generation, according to the law of progressive accumulations explained in the last paragraph of Chapter II, would then reproduce a new generation, inheriting a still higher order of intelligence, of which, again, the most intelligent only would survive to reproduce another generation, inheriting still another increase of intelligence, and so on for many, many generations.

As explained in the second chapter, such a process, in the course of a long series of generations and in the absence of panmixia, is capable of enormously improving and increasing the special traits and tendencies possessed by any form of life subject to it.

[1] The word intelligence is used in the text, to designate the faculty by which experiences are acquired, preserved, compared, classified, etc., and combined into conceptions, inferences, conclusions, etc.

Thus, the incentive supplied by the erect stature is, by itself, sufficient to account for the *emergence* from variations, by selection, of quite an intelligent type of two-footed, upright creatures, much more competent to battle for existence against living antagonists than earlier generations were, but it does not explain the existence of a creature so enormously in advance of every other in intelligence as to acquire undisputed supremacy on earth and the control of those inexorable forces of nature which, although they were once the merciless masters of every living thing, our ancestors included, are now our tools and slaves to serve us as we choose. To account for this other causes must be searched for.

When looking at specimens of nude art, one is often impressed with the grace and dignity of the human form in the upright attitude. Oblivious of the efforts and pains it costs babies, invalids, and tired people to maintain this position, the mind, at such times, seems inclined to dwell only on the natural ease and unconcern with which it comes to healthy persons. Indeed, those unfamiliar with anatomy may perhaps be surprised to learn that the muscles, tendons, bones, nerves, etc., concerned in maintaining this attitude constitute a mechanism of higher complexity and greater adaptability than any found among the higher mammals below man. This wonderful adaptability of motions and conduct of the human organism to the rarest and most delicate mutations in the environment becomes most

strikingly impressive by the fact that the bodily parts above indicated interact and co-operate with arms, hands, thumbs, fingers, limbs, feet, and toes.

The creatures below man can, on the contrary, only respond by conduct to comparatively few general and fundamental demands made on them by the environment, such as recur with comparative regularity and frequency, to which they attempt to adjust themselves by defense, flight, pursuit, retirement to shelter, etc. Nor is the high degree of adaptability of conduct possessed by man required in their case. For their bodies are supplied with natural coverings, which change in density to correspond with the variations in the climates of their habitats. Besides this, they are supplied with natural means of offense, defense, and escape, and therefore susceptible to only a *minimum* of risks as compared with the *maximum* to which brute-man was exposed.

For these reasons did the survival of the two-footed brute depend, from the very beginning, much less on the natural physical adaptation of his organism, but much more on the *adjustment of his conduct* to those changes, both great and small, in the constantly varying order of the environment which occur from moment to moment. Conduct such as this cannot be accomplished by creatures less fitted than man for an almost infinite variety of compound concerted movements.

Before the bearing of the above considerations

on the growth of human intelligence can be fully shown, mention must be made of the fact that some currents of energy in passing through the nervous system produce *changes* in it. It is not known whether these changes are more chemical or more structural, but that they endure for periods of varying lengths, sometimes even from childhood into old age, is evidenced by the phenomena of memory, habit, and character. Some of them merely facilitate the passage of subsequent similar currents through the system. Others endow it with the power of reproducing movements and experiences like those caused by the passage of the currents which originally produced the changes. These last-mentioned results are usually not entirely accomplished by one passage of currents of a certain kind, but require sometimes less, sometimes more numerous repetitions for efficiency. Much depends on the incident force with which the first currents entered the system, and on the degree of complexity in the movements and experiences or both which they provoke. The changes which reproduce experiences and movements constitute the physical basis of memory, habit, and character.

For memory cannot be rationally explained, except as the result of the activity of structures, which by occurrence of such currents of energy as produce experience have been modified in such manner that, when excited subsequently, they recall and repeat these experiences. Nor can habit be

rationally conceived, except as a tendency to reproduce conduct by the activity of structures, which on former occasions were modified by conduct producing currents of energy; and to account for character, the mind is forced to assume similar modifications in structures whose function it is to coordinate and subordinate conduct. See Appendix Note II.

Exposition of the details of the process by which these changes in nerve structures are produced, and of the parts these changed structures subsequently play in the phenomena of life and mind, belongs to psychology and is too voluminous for these essays; but an outline of that part only which relates specially to *the growth* of the human intelligence must be inserted, because it has bearing on subsequent arguments.

Whenever any kind of complex external conditions for the first time interacts with an organism of the more highly specialized kinds and thereby generates currents of energy in its nervous system, then these currents begin by flowing inwardly along afferent nerves, and thereafter they pass through various ganglia and nerve centers. Next they cause changes in consciousness, such as sensations, feelings, experiences, thoughts, comparisons, judgments, preferences, will, etc., etc. By some of these, and mainly by judgment and will, currents of nerve energy are then sent over efferent nerves, etc., into muscular tissues. The muscular tissues are contracted in

various ways by this influx. Correlated, concerted, compound motions are produced by these contractions, which motions, under the direction of judgment and will, become conduct. The progress of this series of physical and mental activities just outlined *consumes time and effort.* More particularly are these consumed in effecting the transition from each step to the next.

When similar kinds of external conditions thereafter react on the nervous system, then the passage from one step to another consumes *less* time and *less* effort. From this fact it is an inevitable inference that the *changes* occasioned in the nervous system by the first occurrence of these external conditions, and of the currents they generated, facilitate the passage of subsequent currents. Many repetitions reduce time and effort to such an extent that before long judgment and will, and at last even consciousness, are *eliminated* from the series. Thereafter the mere incidence on the organism of a single term or item in the complex external conditions, which produced the original changes in the nervous system, is competent to reinaugurate the correlated, concerted compound motions, the conduct, which were produced, when the whole series of external conditions reacted for the first time on the nervous system of the individual, but they now occur without the intervention of judgment, will, and frequently without consciousness. From the above, the *inevitable inference* seems to be that the various nerve currents, motions, and modes

of conduct by which the individual responded to the external conditions, when they first interacted with the organism, have, by repetitions, become *organically connected* with the changes in the nervous system which these external causes then produced, and that the various parts or sections of these changes have been similarly connected by the same process.

If the series is simple, consisting of few terms, then very few repetitions suffice; if it be complex, consisting of many terms, then more numerous repetitions are required before the organization is accomplished.

It follows, then, that the few simple, often repeated, and similar adjustments by conduct, which creatures *below man* are either competent or required to perform, will quickly become organized, and that, therefore, the occasions must be rare when their incipient intelligence, will, or judgment is called into action.

By contrast, the infinite variety of highly complex, co-ordinate *actions* and conduct, by which alone human life can be maintained, demands the frequent exercise of all these faculties to their utmost capacity. And since the extent of adaptation must necessarily be proportioned to the degree of development attained by these faculties, therefore has their higher development important survival value. Thus did the complexity of the human body favor the natural selection of every individual possessing even the smallest advantage in the matter of intelli-

gence, and thus have the physical disadvantages under which our ancestors labored become the factors by which their intelligence was pushed forward. Let the reader bear in mind that this complexity of organism is an inseparable concomitant of the upright attitude, and a condition precedent on which the possibility of this posture depends.

The sense of touch is the only means by which creatures may become intimately acquainted with the qualities or attributes of things.

By touch we become aware of size, form, hardness, softness, roughness, smoothness, rest or motion, sharpness, dullness, hollowness, solidity. Of these attributes of things none of the other senses can directly inform, but certain impressions on them are invariably connected with experiences of touch which yield direct knowledge of these qualities. Because of this *invariable connection*, our minds *automatically infer these qualities* from actions on the other senses, even when the direct evidence from the sense of touch is absent. It may seem as if hollowness and solidity could be distinguished by sound, but *if touch* had not taught *their nature* beforehand the respective sounds never could. Touch, even here, supplies the primary experience and familiarity.

By sight we can only distinguish *lights, shadows, and colors*. The extremely diminutive areas of lights, shadows, colors, marked off on the retina by changes in external things and conditions, cannot

possibly be congruent or even proportionate to the general properties, dimensions, special relations, or forms of these.

If they all had *only length and breadth, no depth or height*, and were all located at the same distance from the beholder, only then would this be possible. And external things and conditions never are and never can be that way; for space has three dimensions.

The sudden appearance of extraordinarily strong light sometimes causes a nerve shock or a pain in the eye. Intensely deep, large shadows may produce a less acute but similar effect; so may also certain combinations of colors. But these shocks or pains cannot yield knowledge of the special properties of the things and conditions they are derived from.

Only when the same external causes frequently react on the senses of sight and touch simultaneously and if, in the manner explained in earlier paragraphs of this chapter, the images on the retina have by repetitions been organically connected with the sensations of contact, which were provoked simultaneously with them, only then can lights, shadows, colors, by memory or suggestion, lead to those complex states of consciousness, such as conceptions, thoughts, etc., which are the forerunners of knowledge. Therefore will the infant, in whose organism the connections above mentioned have not had time to become organically connected when excited by vision, stretch out his hands to grasp the moon.

The sensations of sight form organic connections with hearing, smelling, tasting, by the same process heretofore described as with touch. The auditory, olfactory, and taste sensations are, however, for imparting conceptions or knowledge of properties, dimensions, etc., greatly inferior to those of sight. Their relations to the growth of human intelligence is therefore disposed of, a fortiori, when that of sight has been.

The conclusion, then, is safely established, that if touch had not previously made man familiar with things and their qualities, the seeing only of lights, shadows, and colors would give him little if any knowledge of their nature.

The feelings of muscular tension produced by expansions and contractions of the iris, also those caused by the shiftings of the axial direction of the eyes, may seem capable of directly inducing knowledge of size, form, etc.; but on reflection this is perceived to be an error. For the former movements are caused by changes in the amount of intensity of light, and the latter indicate *relative* location only, so that objects differing widely in magnitude may at different distances, if they subtend the same angle of vision, look as if they were the same in size. A line of reasoning similar to the above would apply, a fortiori, to the senses of sound, smell, and taste. It follows, then, that touch is the *only* sense by which we acquire *primary* experience and familiarity with things and their qualities.

*Never before*, but only after, this original experience and familiarity has been acquired can the other senses save us from the slow and sure process of identification by touch. Often a glance or a sound, more rarely a taste or a smell, will instantaneously inform us of a thousand things, qualities, relations, possibilities, originally made familiar by touch. Thus these other senses, and more especially sight and hearing so far as knowledge is concerned, are merely useful in extending and multiplying the uses of the sense of touch. Sometimes the sensations received through sight or hearing inform us of the nature and qualities of objects great distances away. At other times they leave us seriously in doubt as to these. In such cases the aim is to approach near enough to touch, and after touching the information obtained by the sensations of contact are regarded as absolutely trustworthy. Thus all human knowledge *primarily depends* on the sense of touch. The other senses would have left man forever deplorably ignorant of the nature of the world around him were it not for the acuteness of this sense, specialized in human hands, fingers, and thumbs, and operated by them in conjunction with the arms.

How was the unique superiority and acute sensitiveness of the human sense of touch originated and preserved? Whether running, walking, jumping, climbing, or standing, the human body is supported in an upright attitude by resting, by means of the legs, on the soles of the feet. This prevents the

finger tips, fingers, and hands from becoming calloused, or from having their sensitiveness impaired by frequent contact with the ground, or by friction or concussion against it, or by serving as supports to the body. Their use can thus become *more exclusively* devoted to handling, pulling, pressing, *feeling*; the latter being an ever-present, unavoidable element in every one of these other actions.

Thus a sensation indicating the nature and properties of the things touched accompanies every use made of the finger tips, fingers, and hands. Man is taught the nature and properties of his environment while handling, pulling, pressing, etc., and human knowledge increases, in spite of carelessness and inattention, by every use made of hands, fingers, and finger tips.

This opens a veritable new realm, an inestimably great reservoir of experiences, of close intimacies with the peculiarities and properties of the infinite variety of existencies which are around us. It gives opportunities for the multiplication of primary impressions. And these are, metaphorically speaking, the elementary atoms, out of the infinite compounding and recompounding of which conceptions and knowledge, are obtained. To what an enormous extent the expansion of knowledge thus made possible surpasses that derived from other sources can hardly be over-estimated. Given an ignorant and helpless brute with the human body, and the upright attitude naturally and necessarily follows. Given the

upright attitude and, cæteris paribus, the growth, cultivation, preservation, and selection of an ever more acute, more sensitive sense of touch is assured. This, as above explained, assures multiplication of primary impressions and close intimacies, and therefore an enormous expansion in the variety of our conceptions and the range of our knowledge. No other creature has this advantage; *none ever could possess it*, without combining in its physique the upright attitude, with the comparatively short arms, fingers, thumbs, and hands as formed in the human body.

It is possible that to delicate differences in impressions the sense of touch in bats, moles, elephants, etc., may be as susceptible as man's and even more so; but to acquire knowledge of the nature of form, size, of the dimensions of space, of the quantitative and qualitative relations existing between different parts of the same thing and between separate entities, must be very difficult *if not most frequently impossible* to creatures with a sense of touch, localized either, as in the bats and moles, in the end of the nose just above the anterior extremity of prognathous jaws, or, as in elephants, in a finger-like organ at the end of the trunk.

Observe the contrast between such a sense and man's organ of touch! At each side of the body, ordinarily less than two feet apart, are two jointed compound levers: the arms. Each of these is between two or three feet in length and has the

equivalents of ball and socket joints at two points, thereby admitting vertical, horizontal, and intermediate movements. At the other end of each of these levers is a beautifully complex organic instrument called the hand, possessing in addition to the possibilities of changes in position attained by connection with the arms those derived from its own infinitely mobile mode of attachment. At the extreme outer end of each hand are the fingers, triple jointed, separate compound levers, each joint about one-third the length of the hand, the hands being about one-half the length of each of the two sections of the arm. These varying lengths have their advantages. The finger joints are admirably adapted to familiarity with relations between objects or parts of objects of small size. The hands answer the same purpose for larger ones, and the arms for still larger, until proportions are reached which can only be estimated by the locomotion of the whole body. It is obvious that by such an apparatus magnitudes both smaller and greater than those which are measurable by contact can be brought within the range of consciousness.

In addition to the great diversity of movements made possible by arms and hands, the fingers can independently move in the horizontal and vertical direction and in compounds of these two. The distance between the outer ends of the fingers can at will be made to vary from about six inches apart to actual contact. The angular direction of each

finger towards any can be changed in many ways. This practically infinite variety of relations and positions undergoes *infinite multiplication* by the opposability of the shorter, thicker, more sensitive thumbs. These hands, these fingers, thumbs, and their extreme ends are covered with a highly plastic and equally elastic material, replete at its outer surface with highly sensitive nerve filaments and end bulbs, etc., susceptible to every kind of touch, from the infinitesimal ether vibrations called heat, electricity, etc., to the violent collisions with hard and sharp objects.

As a means of educating and forcing the growth of intelligence, the superiority of this kind of touch over that residing in the end of a nose just above a prognathous mouth is so vast that comparison seems impossible.

Then consider that the attaching sockets of the large levers operating this human sense of touch are in adults situated about five feet above the ground, in a place favorably located for deriving the utmost advantage from guidance and correction by and co-operation with the senses of sight, hearing, smell, and taste.

Adults who have been blind and who then receive their sight are at first only confused and made helpless by the lights, shadows, colors which they perceive. *They cannot interpret them.* They have to be taught by others the nature of the things indicated by the lights, shadows, color, which they

see. These others have learned the meaning through the sense of touch. Gradually, in babyhood, early childhood, etc., they have by repeated experiences become habituated to connecting the qualities perceived by touch with the entities indicated by lights, shadows, colors, revealed to them by sight.

The same lesson is taught by observing very young babies, who as eagerly grab at knives, needles, and wire brushes, etc., as they reach for the moon to which they are equally *attracted by seeing them;* who strike eagerly at hard, sharp, rough objects perceived by sight, only to lacerate their tender hands and fingers; who gaily and on purpose bring their delicate bodies into collision with objects seen and thus severely injure themselves. The experience, the knowledge derived from contact is lacking and sight cannot teach the nature of size, form, quality, etc.

A little introspective analysis of the conceptions brought into consciousness by seeing things teaches the same lesson. These conceptions are found to be more or less intricate compounds of anticipations and recollections of impressions made by contact with the things seen.[1]

How much sense of touch do the creatures below

[1] That newly born creatures find the teats or breasts without previous touch, only proves that the natural attraction, or possibly the attraction that is set up by smell, is sufficient to guide them in the right direction, but it *does not imply in the least* that this yields any knowledge whatsoever of the thing thus sought and found. It is merely the satisfaction of a primary impulse by direct attraction.

man possess? Aside from those mentioned and the quadrumana, hardly any. It would cause suffering and incapacity to quadrumana if they possessed a developed sense of touch in their finger tips and thumbs. For these, in their case, touch the ground or the tree in locomotion. *Not* delicate skin, covering a fine net-work of specialized sensitive nerves, is needed here; but, on the contrary, tough, thick skin, callosities, and nails to protect against cuts, scratches, etc. Natural selection, therefore, seems to have eliminated in these four-handed creatures whatever acuteness the sense of touch may have formerly possessed.

Other sub-human mammalia can hardly be supposed to possess any sense of touch worth mentioning. Their thickly calloused toes, armed with long, sharp nails, etc., cannot be supposed to *supply sensations* indicating the qualities of things they come in contact with, more definitely than we experience when in a certain social game we are blindfolded and made to examine the faces of persons by means of a long-handled spoon held in the hand.

Some of the anthropoids and quadrumana can stand erect, but it is not a natural or comfortable position for them. Most birds naturally have an erect posture, but only rudimentary sense of touch.

Cats, rats, mice, many snails and insects, and some other animals have long hairlike processes on their faces, popularly supposed to be organs of touch, called feelers. They can, however, serve no such

purpose as the human fingers and thumbs, because of the isolation of the protruding fibres and the distance between them.

It appears then, that man alone has specialized, in his finger tips and thumbs, a highly developed, acute sense of touch, adapted to distinguish a wide range of sensations, indicating many and various properties and powers possessed by the objects in his environment; knowledge of which must forever remain inaccessible to the rest of the living world. This unique power possessed by man, obviously has great survival value, which differs in individuals according to the degree of the general intelligence possessed by them. Here, then, the third and greatest of the agencies which forced the growth of human intelligence has been discovered.

Thus the emergence of an ever higher intelligence has been forced, in the human race, by the convergence of three separate agencies, viz., the erect body, the exceptionally complex organism on which the possibility of the erect body depends, and the highly specialized sense of touch which is impossible without the erect body, and, therefore, a unique feature peculiar to the human race. For this reason has it been impossible in the past, and seems impossible for all future, that any living creature of any past or present type could ever develop an intelligence comparable in extent or quality to that possessed by average humanity since the dawn of history; but many thousand generations before that dawn

man's growing intelligence had already become an important element in his make-up, on which his survival depended.

Thus the conclusion is reached that those same slight structural changes in the ento-cuneiform bone in the foramen magnum, on which the upright attitude depends, which brought so many evils upon our two-footed brute ancestors, were the efficient agencies to force the wonderful growth and manifold expansion of the primitive intelligence with which they were originally endowed. See Appendix Note I, on articulate speech.

# CHAPTER IV

## SEPARATION OF SEXES

Reptiles of the crocodile type can do considerable injury with their tails; and horses, asses, and their congeners, possess a mighty means of defence in the hoofs of their hind legs. Allowing for these and a few other unimportant exceptions, it may however be laid down as a general rule that for attack, protection, and defence the forward end of quadrupeds is the effective part. For protection there are here the shoulders, breast-bones, forelegs, and skull, which form, figuratively speaking, a strong rampart or protecting screen behind which the lungs, heart, stomach, and other viscera and vital blood vessels may repose in comparative security.

Being in addition shielded by the dorsal bones and vertebræ from above, by the hip-bones and hind legs from behind, these vital organs are practically free from liability to direct injury by either an attack, collision, or impact, unless it comes from underneath. In this forward end are also situated the natural armaments of the creature, that is to say, the means for inflicting injury and death. Here are the sharp incisors for biting and tearing: the tusks, horns, fangs, claws, etc. Therefore, if a four-legged brute can but manage to keep his front

turned toward his antagonists, his vitals are in the safest possible position, and his powers for inflicting injury and death are at the points of greatest availability.

The same holds true of birds; but by no means of the two-footed upright creature, primitive man. Nature, which has so bountifully supplied other mammalia with the means of offence, defence, protection, and escape, had left him naked and entirely unprovided. Hampered besides by a deficiency of valves in the blood vessels where they are needed, and a surplus where they are worse than useless, with exceptional liability to femoral and inguinal hernia, with his vitals, including the femoral artery, prominently exposed right in front, etc., etc., his condition was desperate indeed. The more so, since these exposed parts are situated at nearly the same elevation above ground as the sharp teeth, tusks, horns, claws, and other natural means of offence possessed by his most common competitors and enemies. Even sheep and goats and other timid or poorly armed creatures, which he probably pursued for prey long before he domesticated them, might claim these advantages over him.[1]

[1] It has not been thought necessary to include the frontal exposure of the reproductive organs among the disadvantages of the upright attitude. But it is a feature unique in the human race. In quadrupeds, these organs are concealed and protected equally with the vitals, and by the same means mentioned before.

Does not this frontal exposure of the reproductive organs explain the existence of a psychic peculiarity which distinguishes the human race from other brutes, viz, sex modesty? This

In those early days, before our brute ancestors had learned to arm themselves artificially, the struggle for existence among the higher mammalia, in so far as it depends on race and individual competition, must inevitably have been of far greater severity than indicated by present appearances.

Wild brutes were much more abundant in tropic, semi-tropic, and temperate climates than they are to-day. For, since those times, there has been an agency at work incalculably more destructive of mammalian life than all other known causes, viz., the murderous ingenuity and energy of our artificially armed brute-ancestors. Other predatory brutes, even the fiercest and most cruel among them, take life or inflict bodily injury only when impelled by the primary instincts of self or race preservation. They kill creatures of other races than their own for food. They defend their own bodies and their lives against the aggressions of enemies. They fight with the males of their own race for the possession of females. They defend the food they have captured, the place in which food or water may be found, the security of the cave, nest, or other abiding place which they have occupied or constructed, and the bodies or lives of their females and young, against

explanation is the simplest and most natural and conforms to the rule of parsimony.

Chastity is quite a different thing. For it refers to the exclusive reservation of the reproductive organs of one individual to the use of a special individual of opposite sex. Only the absolute power of man over woman could have originated and selected such a trait.

any aggressors. But a primary instinct or necessity is *always* the motive or cause of any and all their destructive activities. Obviously, therefore, the results of their life-destroying energies must be narrowly limited in extent so long as life in general remains abundant; and it must remain thus when no other destructive agencies are at work. For all the higher mammalia are admirably fitted for the struggle for existence by being abundantly supplied with means for offence, defence, protection, escape, and rapid multiplication.

But now there enters upon the scene a creature most miserably discriminated against by the physical forces of the universe. A creature absolutely void of all natural means of offence, defence, protection, escape, and with a pitiably slow rate of multiplication. A creature afflicted with numerous perilous natural disabilities, infirmities, defects, and disadvantages of physical structure. A creature *by nature* utterly unfit for the physical struggle for existence, and kept, therefore, during many times many generations, close to the limit of extermination, escaping only by a very narrow margin; naturally selected, therefore, during these long generations, on the line of greatest muscular strength, greatest agility, greatest toughness, courage, ferocity, and cunning.

This creature, after a long period, learns artificially to arm himself with clubs, missiles, and with fire, and applies all the qualities slowly acquired by

selection to the use and handling of these artificial appliances. He kills not only for the purposes above mentioned which move other creatures thereto, but he kills and tortures for pastime, for amusement, for practice in the skill and art of killing and maiming, and for the fun of competing with others practicing the same art and skill. All this practicing cultivates his passion for such activities, and that passion must be fed by more practice, and so it grows and increases. "It's a grandly beautiful day, full of life and joy, let's go and kill something" — is a distinctively human sentiment, which has been too exclusively ascribed to the English nation.

And how innumerable are the applications and extensions of this love for killing, maiming, and torturing. Man kills to exterminate pests; to stop interference with his claim of supreme control of the earth and of its resources, and of the application of all that lives and grows on it to his own special purposes, uses, and whims. He kills some creatures for their feathers, others for their hides, others for their furs, still others for their horns, antlers, tails, tusks, jaws, brains, livers, testicles, or even for the oils, fats, and other secretions of various glands, etc. He not only kills, but exterminates whole races and genera. Only the infinitely small have thus far baffled his ingenuity and passion for killing. Man follows these cruel and destructive practices, has the character adapted to them even to-day, after being for at least several thousand years under the

influence of "religion, law, government, social and family relations, industry, commerce, co-operation, art, literature, education," etc., etc. What must have been his character and conduct before any of these agencies had even begun to modify it? What must it have been when the most miserable and helpless brute of all was, by the use of clubs and missiles, suddenly transformed into the most powerful? What fearful wholesale destruction of life must have inevitably resulted therefrom?

Against the above line of reasoning it may be objected that the struggle for existence naturally divides into two specifically distinct sections, viz.: the part acting against the inanimate environment and the one against living antagonists; that the former being the most severe and responsible for the extermination of innumerable forms of life, therefore the above argument must be condemned as laying too much stress on the less important.

To which it may be replied that success in the so-called struggle against the inanimate environment is not dependent upon the *efforts* of the living contestants, but upon the powers inherent in life and in the resources and processes of nature. The infinite possibility of new forms arising from variation, the rapidity and copiousness of reproduction, the survival of the fittest, such are the means by which success in this so-called more important part of the struggle for existence is gained. Inclemencies of climate are resisted mainly by the growth of hide,

fur, hair, and adipose; deficiency of nutritive material in food or irregularity in the amount accessible, by particularly large receptacles within the body and organs specially adapted to mastication and maceration; widespread and virulent destructive diseases, by phagocytes, leucocytes, etc., and rapid and copious reproductions, etc. In fact, that so-called part of the struggle is only metaphorically entitled to the name. When by natural selection, through the survival of the fittest, by infinite multiplication of forms through variation, the emergence of the highest types of mammalians, birds, fishes, etc., of the tertiary era had been accomplished, then the so-called struggle against the inanimate environment became less and the real struggle against the living antagonists far more important, and that seems to have been the time when the first upright creatures came on the scene, and the period to which the above argument alludes.

Quite a number of species and varieties of mammalian creatures have been exterminated by man within the last two centuries. Many more, not now existing, we find mentioned in the literature of earlier centuries; and it seems worth while considering whether the accounts given in myths, traditions, and earliest literatures of the monsters and dragons of the primal age, killed by heroes, are not more rationally explained than heretofore by believing them to be accounts tainted by the inaccuracy and tendency to exaggeration of untutored minds, but yet

of creatures which have really existed and have been exterminated by man.

Many instances are credibly reported since historic times when certain districts were, for a decade or two, stripped of all human population, and later found *overcrowded with many kinds of wild mammalian brutes.*

Because it is not true, therefore, can it not be fairly objected, to a small and unimportant part of the above argument, that cats, which have caught mice, sometimes show as cruel a disposition as man. Whenever cats hunt mice they are moved thereto by the primary instinct of a carnivorous animal. The playing of the cat with the mouse before killing it is obviously the *artificial result of domestication*, which supplies the cat with more than enough food to satisfy hunger, and yet cannot abolish the primary instinct which makes her catch mice. Then domestication cultivates in the cat the desire for human approbation, and to obtain this she shows off her pranks with the live mouse. Besides, a cat has not the intelligence which would restrain cruelty by a sense of the suffering inflicted.

To recapitulate: The natural enemies and competitors of man's brute ancestors were all so well supplied with means of offence, defence, protection, escape, and multiplication, that the ordinary natural agencies which tend to keep life within bounds were insufficient to prevent their increase to the extent of crowding the area over which our early progeni-

tors had scattered. When these latter had learned the use of clubs and missiles, however, they devoted themselves to the destruction of life with such wonderful ability and passionate energy and perseverance, that the contrast between the redundancy of mammalian life before that period and its scarcity afterward must have been enormous.

The conclusion then is safely established, that when our brute ancestors *first* learned the use of clubs and missiles they lived in a habitat densely crowded with mammalian life, among which the larger carnivora must have been a numerous class, because the creatures on which they habitually feed were so very plentiful.

A crowded habitat necessarily implies *severe and close competition* for the primary necessaries of existence, such as food, drink, shelter, opportunity to reproduce, etc., etc. Severe and close competition is the condition which makes the second part of the struggle for existence *most intense*. When the struggle for existence is the intensest, natural selection is *most exacting*. Only the most competent among the races and varieties survive, and within these, again, only the most competent individuals. Such conditions could only react favorably upon the average excellence and numerical strength of the higher mammalia, which are so well provided with means of offence, defence, protection, escape, and multiplication. But our brute ancestors, while selected most exactingly with reference to strength,

toughness, agility, courage, ferocity, and cunning; and while existing, perhaps, by ones, twos, and in small family groups scattered over a large territory, could, obviously, maintain their lives only by the almost *unremitting exercise of all their physical powers*, under the direction of their rapidly increasing degree of cunning.

And what was the general character of the conduct by which these few succeeded in maintaining a brief existence against such fearful odds? Self-evidently cunning could *not* be exercised in the manner in which it is used to-day. They were probably not fighting against each other, unless on rare occasions. They could not outwit their fellows, competitors, or enemies, by shrewd bargains, keen deceptions, legal trickery, etc. Clearly, their cunning could only be made available in directing their conduct in contests with or in flights from enemies or competitors, pursuit of prey, securing food or drink, and selecting places for shelter and maintaining these against other creatures trying to dispossess them. These limitations of conduct imply *violently energetic running, striking, kicking, jumping, leaping, etc.*, on the physical side, and alert, circumspect and cleverly concerted arrangement of these motions on the mental side. Evidently only the most competent could maintain themselves by such conduct. The lame, the halt, the infirm, malformed, deformed, or those in any way *hindered, hampered, impeded, or interfered with by any physical departure from com-*

*pactness, co-ordination, or perfect adaptation to violent movements, were evidently incapacitated — utterly unable and unfit to maintain* their lives in the struggle. And what is the bearing of these conclusions on the survival chances of the human brute-females in the last stages of pregnancy?

Evidently the natural protrusion and extreme distension of the abdomen, at such times, intensified the risks arising from the exposure of the vital parts. The increase in weight, bulk, and pressure, in the lower forward part of the pelvic region caused the body to be easily unbalanced. The anterior, posterior, lateral, and round ligaments, which in quadrupeds prevent the gravid uterus from pitching too far toward the diaphragm, are at least insufficient, if not entirely unadapted to such a purpose, in the upright human female. Sudden, vigorous, or violent motions accurately adjusted to their purposes and severe and continuous efforts are, therefore, if not impossible, at least so very dangerous to the life of the mother and embryo as to be *incompatible with race survival.* But it has been demonstrated above that such movements and efforts were *absolutely necessary* to maintain and obtain the barest primary daily prerequisites to the continuation of life. If, then, none of these actions necessary in defence of life, pursuit of prey, of food, or in obtaining water, or in escaping from enemies, were possible to the pregnant females, *how* could they then save their lives by intellectually initiated conduct at all? The

race was doomed, and its higher intelligence utterly unavailing, unless they could thus save themselves.

The males, immature females, and virgins might be ever so able to preserve their lives, *yet that could not secure the survival of the race*, for in the end this *unavoidably depends exclusively* on the preservation of the pregnant females and embryos. And since the pregnant females were prohibited by their condition from resorting successfully to any of the modes or class of actions before mentioned, there remained but one line of intellectually initiated conduct *possible for them* with chance of success, and this was the selection of suitable places for their own concealment. Cæteris paribus, and in average cases, only so long as they continued in concealment might their lives and those of the embryos within them remain available for the perpetuation of the race.

Even if it had not been demonstrated in a previous chapter that the assumption that man's two-footed brute ancestors used clubs and missiles from the very beginning is utterly untenable; that is to say, if this supposition, for the sake of argument, is assumed to be true, that would not avail the brute-woman in the last stages of pregnancy. For the violent motions required, in the effective defensive use of these weapons, would be as dangerous to the lives of the females and embryos as the enemies against which they were supposed to use them.

How did the needful tendency to hide arise in the natural course of events? During the last three or

four weeks or months of pregnancy, the violent efforts required from them in contests with competitors and enemies, or in attempts to escape from them by flight, must daily have become more difficult of execution, more barren of success, more productive of painful and distressing symptoms to the females, until the limits of endurance were reached. At this point the victims, under an overwhelming sense of their desperate helplessness, would be unable to prevent their natural intrepidity from giving way to a supreme desire for seeking safety by hiding. For this impulse had been increasing, pari passu, with their helplessness. A tendency to hide during the last stages of pregnancy under conditions then existing, obviously had *great survival value.* After coming into existence, either in the manner above outlined or in any other, it would, therefore, gain strength and fixity by natural selection. The validity of the above arguments is not affected by any assumed brevity or length of the female's period of incapacity, whether it lasted days, weeks, or months, nor by the degree of it. *The unavoidable admission* of some impairment of their full vigor, for a brief or long period, is sufficient to sustain them.

Conditions similar to those above alluded to, which made the hiding habit of the pregnant females a necessity in the primeval era of the human race, do not exist in the case of the anthropoid apes. It is true that these creatures can stand and move about in an almost erect attitude. However, they

have not feet (distinguished by the hallux forming a natural fulcrum in walking), but hands, on their lower or posterior extremities; nor is their foramen magnum situated, as in man, as it must be for convenient and natural uprightness, *a little behind the centre of the base of the skull.* It is, therefore, more natural and far more easy for them to be and move about, on all fours. Their pregnant females, in this latter attitude, are no more liable to injury from falls and stumbles, and their vitals no more exposed, than those of ordinary quadrupeds or baboons. The extraordinary great capacity of the thoracic cavity of these animals, and the massive strength of the bony structures surrounding it, and the adaptation of the pelvic bones and ligaments to keeping the uterus securely and comfortably in position give them an advantage in the struggle for existence: to which another must be added, viz., their long, strong arms and limbs, supplied at the extremities with hands, specially adapted to grasping and holding on to branches, which give them chances of escape only surpassed by flying creatures. And these latter are at a disadvantage compared with them, for it requires constant and great effort to sustain themselves in the air; but apes and anthropoids can be at rest and comfortable after escaping to a place of security in the trees, and can live and feed and breed there. Their hairiness and tough hides protect them against injuries from accidents, violence, changes of temperature or climate, and

at the same time does their color make concealment easy for them, when in the foliage of their natural habitats. In no way are there any parallelisms between their condition and that of the dangers and disabilities of the child-bearing human female.

To sum up the argument: the perils and disadvantages resulting from the upright attitude would have determined the struggle for existence against the survival of man, if his superior intelligence had not initiated various modes of conduct, competent to balance, partly balance, or more than balance, the physical advantages possessed by his competitors and enemies. None of these modes, however, although useful to other members of the race, could be made available for the pregnant females. There remained, to them, therefore, but the one saving resource of continued concealment. However, as no kind of creature can escape extinction unless its pregnant females are preserved, and since the human race has survived, therefore, the conclusion is justified that at a very early stage in the existence of our race the females acquired the habit of concealing themselves during a part of the period of pregnancy, and that this was one of the means by which the race escaped extinction.

A point has been reached here, where a differentiation in habits and activities on the sex line may be looked for, because the males had no occasion to practice self-concealment, but could continue active lives in the open.

# CHAPTER V

## NATURAL SELECTION OF MAN'S DEVOTION

Animals in a state of nature may usually find drinking water in ample quantities, in fixed locations, and contained in hollows which are self-replenishing. Creatures which have found water are, therefore, but rarely compelled to go in search of new places or supplies, but may, whenever necessity or desire prompts them, provided they possess the intelligence to recall the whereabouts, return to the spot where they first slaked their thirst. Moreover, the act of drinking is of comparatively brief duration. It is therefore not necessary for feeble or timid creatures, which are hunted by the more powerful, to run special risks in relieving their thirstiness, for during the hours when their enemies are drinking they can avoid the places where water is found, and resort to them at other times.

The case stands differently with food. The competition for this is usually far more severe, and the quantities of it are not self-replenishing with available rapidity. Many brutes, therefore, are obliged to expend much time and energy, and to risk both limb and life in obtaining and consuming food. Brute-man must be included in this class.

For he could not feed on grass or herbage, as cattle do, nor could he maintain a fruit diet with anything like the ease of monkeys, squirrels, or other tree-inhabiting brutes. For his upright attitude, and feet unadapted to clasping, grasping, or holding on, particularly unfitted him for tree life.

His teeth, which can neither be said to be specially fitted for a particular diet nor extremely unsuited to any kind, possessed for these very reasons a limited and yet valuable degree of adaptability to an almost infinite variety of foods, perhaps more so than those of any other creature. That is to say, primitive man was probably better fitted than any other animal for what is termed omnivorousness. Nor can it be doubted that this came about by natural selection. For being, in the struggle for existence, physically at so enormous a disadvantage, if he had been limited to one or a few articles of food, his competitors, feeding on the same kinds, being so much better fitted, would so easily have gained the advantage over him as to drive him out of the field of competition, and thus lead to the extermination of the race.

Being able, however, to subsist on almost any kind of diet, though not nearly so well on any particular kind as the creatures which competed with him for it, it must soon have become natural for him to take a little of one description here, and a small quantity of another kind there, as opportunity favored or risks were minimized. Intelligence

would in various ways assist effort in this sort of conduct. Withal it is evident, however, from the many disadvantages under which he labored, that he had to satisfy his hunger usually in the midst of many dangers, and at the expense of much time, effort, and ingenuity. The greatest possible degree of adaptability to the utmost variety of foods, and a disposition to take only a comparatively small quantity of any particular kind at a time, would, therefore, be naturally selected.

In the last chapter it was ascertained that the pregnant human females could preserve their lives only by hiding and remaining in concealment during the whole period of their incapacity. The question therefore arises, how would they, during this time, obtain food and water? As to water, the query may be dismissed, for it has been seen above that creatures of intelligence *could* manage to obtain this at times when the act was not dangerous to them, and it is thinkable that the pregnant human females would ascertain such times and make use of them wisely and stealthily. But as to food, the question remains unanswered. With reference to time, it is evident that they must go in search of food during daylight. For their eyes were not nearly as well fitted for seeing in the dark as those of their enemies and competitors, nor had they an acute sense of smell to guide them, and their food was hard to find and scattered. Next, regarding the locations for finding food: these are easily classified

as situated within their places of concealment and without. If without, then the females would have to leave their asylums, and, during the long search for food and while consuming it, expose themselves to the assaults of their enemies and competitors; therefore, the benefits of concealment would be lost, the pregnant females would perish, and the race could not survive.

If within, then there are again but two contingencies. Either the food supplies must exist naturally within their retreats or they must be brought there artificially. Firstly, considering the possibility of hiding in localities where supplies of food existed naturally. Such places quickly become the most frequented haunts for creatures of various types, and therefore utterly unfit for concealment. For this very reason they also become the favorite hunting grounds of carnivora, therefore totally unsafe as abodes for the helpless and incapacitated. All other possibilities by which the pregnant human females might have obtained their food being exhausted, the only possible conclusion is that it must have been brought artificially within their hiding places. The alternative of food being carried within their asylums by the females themselves need not be considered, for this could obviously not be done unless they went in search of it outside their retreats, which has been disposed of above.

If it be said, the females may, in anticipation

of pregnancy, have stored food in places of concealment; then the reply is, that this either takes a perfected instinct for granted, which is contrary to the facts, or else assumes a degree of systematized knowledge and planning out of the question in brute-man or woman.

Having ascertained the utter futility of every other alternative, we are now face to face with this most remarkable conclusion, that the "genus homo," when still in its earlier brute condition, escaped extinction only because food was placed within the hiding places of the pregnant females by some artificial agency outside their own persons; that a race has survived, multiplied, and become supreme master of the earth, harnessing even the almighty forces of nature to the chariot of civilization, which is the offspring of a helpless brute that could not possibly have escaped extermination if its hiding females had not, during a portion of their period of pregnancy, lasting several days, weeks or months, been artificially provided with food within their retreats.

Miracles are by their nature excluded from any discussion which lays the least claim to being rational. The hypothesis that some non-human brutes had regularly, for many generations, gathered food fit to nourish human females, and brought it to them within their asylums, may, therefore, be unhesitatingly rejected. For it postulates a marvel without precedent, a miracle greater far than any the ingenuity of the theologians has ever invented. No

living creature, unless it be a human being, can reasonably be supposed to have acted in a way which calls for such accurate adjustments of means to ends, unless by a perfected instinct, which would have taken many thousands of generations to emerge by natural selection into efficiency. During the period of its inefficiency the human race would have perished, and if there had been such an instinct, some traces of its former existence would surely have been discovered before this. Since neither has happened, the hypothesis is too absurd for consideration. It is, therefore, certain that human beings must have provisioned the females in their retreats, and the questions arise, were they male or female, or sometimes of one and sometimes of the other kind? What was the relation between them and the females they fed?

When man had learned the use of clubs, missiles, and fire, in other words, when he had learned artificially to arm and warm himself, his survival was no longer in question, but abundantly secure. Higher intelligence applied to the use of these aids, and his wonderful adaptation to handle them skillfully, secured him advantages far outweighing the infirmities, disabilities, and perils brought upon him by his physical uprightness.

But the problems discussed in chapters I to VIII of these essays, be it distinctly remembered, refer to that long period which commences with the first appearance on earth of the two-footed man-brute,

and which ends when he began to arm himself artificially. It has been demonstrated that gregariousness would have operated against his survival during this period. The habitual collection in crowds or numbers of such helpless, vulnerable creatures, so easy to kill without risk to their assailants; so easy to discover from the distance; so easy to eat without the hindrances interposed by woolly, furry, and hairy hides; could only have led to wholesale slaughters by their enemies, and, therefore, taking the slow rate of reproduction into account, to the speedy extermination of the race. These reasons justify the conclusion that, during the epoch here discussed, creatures of the "genus homo" were found mostly wandering in search of food or hiding by ones and twos, and that so many as an adult male and female with two or three of their young was a rare and risky gathering.

Could the advantages have outweighed the risks of gregariousness? By no means. Unprovided with even the smallest means of offence and defence what resistance could such creatures offer? Though assembled in great numbers, what possible injury or pain could they inflict upon their powerful enemies, armed with fangs, tusks, teeth, horns, poison glands, claws, talons, etc., protected by thick hide, shaggy fur, scales, etc., etc. Evidently none worth mentioning. Even the goat, the deer and the sheep have horns and sharp incisors and prognathous jaws, shaggy fur, and thick hides. The little

peccary has vicious teeth in its protruding jaws. With these it can bite and tear and do this in places about the feet and legs, which a taller antagonist finds it hard to protect. The backs and heads of these little creatures, which are the only parts of their bodies exposed to an antagonist, are protected by the skull, vertebræ, and ribs, and by stiff, prickly bristles. What a contrast from the man-brutes' tall, bare-skinned body, fully exposing his vitals to his enemy.

The only possible use that such creatures could get out of gregariousness lay in this, that one might watch while the others rested or sought food. But, compared with the added risk of wholesale slaughter this was small gain to a creature unable to feed on grass or herbage. The greater safety was in remaining scattered, for the *enemies of man reproduced far more rapidly than he.*

The fact furthermore that the anthropoids are not gregarious is in itself a strong point against the *purely arbitrary assumption* of gregariousness among the early upright progenitors of man. Is not this argument weakened, however, by the fact that even the hungry lion or bengal tiger has been known but very rarely to dare attack a party or company of people? Does not this indicate that gregariousness would have been an advantage to the primitive brute ancestors of man?

By no means! For the above statement is strictly true *only* with reference to parties of *civilized*

*persons*, who travel with beasts of burden, baggage, servants, firearms, etc., whose bodies are covered with clothes, hats, boots, spurs, etc., and who usually make a clearing, where they camp, light fires. and set watches. Consider what an impressive commotion and show of strange power such a party must make in its passage through the haunts of wild beasts! The naked unarmed natives of such districts are by no means equally immune and yet for unnumbered generations they have known how to use artificial arms and fire. Even since the advent of the English in India, bengal tigers have sometimes entered native villages in broad daylight and carried off and eaten some of the inhabitants. Then consider during how many unnumbered generations the trait of wariness, not to say fear, of the artificially armed and clothed upright creatures, has been naturally selected among all wild brutes, and to what extent the severity of this natural selection has been intensified since firearms came into use! Try to imagine the human race had now suddenly lost the faculty of using artificial arms and tools, even such simple ones as sticks and stones — were afraid of fire, as other brutes are — were reduced for defence to their naked fists, without any professional boxers to teach them how to use these — how long would it take the more powerful and fierce carnivorae to learn the fact what an easy, delectable meal, par excellence, this unhairy kind of creature makes which carries his vitals right in

front, covered only by soft tissues? It is certain then, that: gregariousness did not begin to have survival value for man until he had learned to arm himself artificially.

Consideration of answers to the questions asked above may now be resumed. To perform the actions under discussion, a human being or human beings must feel some sympathetic interest in the dangers and sufferings of the females.[1] Now what sort of human beings would answer to these requirements, and in what relation would they stand to the pregnant females? Would adult females, standing in the relation of friendship answer? Friendship can only arise in the associated (social) state, among creatures having at least occasional brief periods of peace and leisure to give opportunities for the amenities and joys, the experiences of similarity or complementariness of tastes, activities, etc., in which the sentiment of friendship has its roots. It seems, therefore, self-evident that such a thing as a long-enduring, steadfast, self-sacrificing friendship, with-

[1] It is exceedingly improbable that the males had any notion of the reproductive results of cohabitation until long after permanent sex unions had become quite common. Nothing in the act of reproducing suggests its results to either sex. Even the female has no coherent chain of feelings to teach this mysterious connection; and from the consciousness of the male the knowledge is still more remote.

The reader must be warned against assuming that the connection between the gratification of the attraction between the sexes and the birth of offspring, as now generally understood by adult civilized human beings, was known or even suspected until long after permanent unions had become very common in human societies.

out an instinctive basis, was utterly impossible to the scattered few of the race under the conditions then prevailing, which required the utmost effort from even competent members, to barely maintain existence; and this reasoning discriminates with equal validity against either male or female friendships.

There remains, then, but one kind of human being, and but one relation which answers these requirements — a relation, among sexually reproducing creatures, as old as life itself, as strong as the intensest of all instincts, the deepest of all passions, abundantly capable of drawing and holding two human beings of opposite sex together — an instinct which unites them during that period of their lives when their bodies come nearest to physical perfection — which, although by nature only fitted to enforce compliance with racial need of reproduction, has yet in man acquired the power of elevating his intellectual faculties to their highest possibilities, of evoking and maintaining in him the heroic attitude of mind, of arousing sublime and beautiful emotions, of initiating bold æsthetic and artistic conceptions and the most beneficent and admirable aims.

When this powerful instinct in those primitive times had drawn a male and female together, there did not then, as now, exist legal, conventional, or educational influences to mitigate or modify the force of the natural attraction, nor was there any

dissimilarity in tastes, necessities, occupations, or modes of life to cause them to leave each other's company in the intervals between the periodic stimulations of the instinct. In other words, there was an active, powerful force continually drawing them together, and nothing to draw them apart.

Neither was it likely, when an attraction had been once established between two of opposite sex, that the affection of either would become alienated through the intervention of a more favored specimen of the other sex. For the number of living individuals of the race was very small, and for these few it had survival value to remain scattered by ones and twos, or at most in small family groups. It is, therefore, a safe conclusion that after two of opposite sex had been companions they would remain so unless the exigencies of pregnancy parted them. Until that time, that is, during many days, weeks, or months, they would hunt together, battle against common enemies, seek food, eat, drink, sleep, and rest together. In this way, and during this long time of companionship, they would become more and more accustomed to each other's natures and habits, until little by little, through progressing pregnancy, the first feeble symptoms of approaching incapacity would begin to show in the actions of the female. A little less efficiency and agility in taking her share in the contests with enemies, a little less ease in holding her own in flight from

enemies or in the pursuit of prey. This would gradually and almost imperceptibly force the male, without comprehending the mysterious cause which produced the changes in his consort's actions, to do a little more and a little harder fighting than before, and, for a little distance, to follow the prey alone when the female had fallen behind; to carry a little larger share of the food captured or collected to the common resting-place, etc.

Thus, as by slow degrees her share in life-sustaining actions diminished, his would increase, and yet her portion in the results would not be less. This process would continue until she would be unable to give assistance to her mate in any violent encounters. Even before this, however, efforts to keep up her part in the fight and in the chase would make her liable to suffer pain from over-exertion for hours or even days. These tendencies would culminate in her being finally forced to remain in concealment while he would go forth alone in search of food and prey, portions of which he would be likely to bring to the place of her concealment, because the habit had been established during the long months of companionship. See Appendix, Note III, "On Altruism."

So very gradually had his share in the efforts increased without diminishing her participation in the food, that after she remained behind in concealment the surrender to her of a portion sufficient for her support would hardly be perceived by him as

a change. In no other way is it natural, in no other would it be rationally thinkable, that food could have been provided for the pregnant females in concealment. It was brought to them by their male consorts. Since only in this manner it could come to pass, since the survival of the race depended on its occurrence, and since the race has survived, therefore the conclusion is warranted that it happened in this way.

Such conduct is not confined to the human race, but has been observed among baboons and anthropoid apes; and male birds have been known to bring food to their mates during the period of incubation. Nor need one search far for the cause of this habit. Evidently it had survival value, especially in the case of man. For, in the struggle for existence, the tendency would be to preserve and multiply families in which the males had a disposition favorable to this trait, and, on the contrary, to eliminate those in which they had not. Natural selection, therefore, accounts for the fact that this habit has now become wellnigh universal in the race.

To the argument contained in the five paragraphs immediately preceding, it might be objected that the description of the situation presented has not been derived from observation, but may on the contrary be characterized as an assumption created by the imagination; which, on account of the remoteness of the era in which it is laid, cannot be

corroborated by observations or experimental tests. Is it therefore untrustworthy? It may be, but is *by no means necessarily so!* For the mental process which connects known antecedents with known subsequents, by means of links obtained from the imagination, has supplied a *large number of the most reliable inferences and conclusions in science and in thought*, and, as explained in the third paragraph of the preface, the value and validity of such conclusions is not impaired by the impossibility of obtaining observations or experimental tests in support of them. For illustration, let it be supposed that on a desolate island which is hundreds of miles away from other lands, and whose surface consists of granite and the products of the decomposition of this mineral, some articles of pottery and clothing, and nothing else indicating human origin, are found. The granite and the products of its decomposition are the indisputable evidence that the island has existed before human beings had begun to make pottery and clothes. Yet even this *indisputable statement is derived from the imagination*, and cannot be corroborated by observation or experimental tests. The presence there of the articles named is the only fact evidenced by sense experience, and corroborative by observation and experimental tests. The conclusion is then reached, that a person or a number of persons were out in a large or small craft, or on a raft, and had with them there these articles; that from

the craft they landed, took these articles on shore, and left the island without taking these articles with them. What a complex and highly imaginative assumption this is to explain the observed situation! Yet there is not a sane person living who would doubt the absolute correspondence between the unknown facts as they occurred and the purely imaginative assumption! And why? Because, firstly, there exists only accord, and no discord, between the known and ascertainable facts in the case and the assumed imaginative situation; secondly, the conditions could not be rationally explained in any other way; thirdly, the conditions, as thus explained, are in accord with the totality of average, normal, human experience, and not in discord with any part of it. Of this kind is the strongest possible proof of verity, and this kind applies to the imaginative assumption made in the five paragraphs referred to. Furthermore, as demonstrated in Chapter IX, sympathy for fellow-creatures of the same race is one of the "true human race characteristics," and this would produce such a situation and such conduct as has been depicted in those paragraphs.

But some one may reply, the possibility of human beings bringing those articles to the island in the manner stated and leaving them there can be corroborated by experiment. Surely! Would any sane person require performance of the experiment before admitting the possibility? And it is possible,

though not as easily possible, to make experiments confirming the situation and conduct of the upright brute actors as depicted in the five paragraphs mentioned. And are the greater difficulties involved reasons from which to argue against the acceptance of this explanation, when only accord, and no discord, exists between the known and ascertainable facts and the assumed explanation? When this is the only possible rational explanation, and when the conditions thus explained are in accord with the totality of average, normal, human experience, and not in discord with any part of it?

# CHAPTER VI

## NATURAL SELECTION OF FAMILY RELATIONS

Parental wealth tends to lengthen the helpless infancy of offspring, and parental poverty to shorten it. For motion is always in the line of least resistance. When wealthy parents continue to provide for their offspring long after the natural necessity for it has ceased, the infancy of the children lengthens by relaxation of the efforts which otherwise would be made by the young creatures. Contrariwise, when savage or poor parents lack resources, and are therefore obliged, in the search for them, to abandon their children before they are able to take care of themselves, under the operation of the same law the helplessness of infancy is shortened by the putting forth of earlier efforts.

Thus far has the progress of civilization in large measure been characterized by progressively greater concentrations of wealth in the possession of certain classes. It is, therefore, reasonable to assume that among these classes, at least, the duration of helpless infancy has been lengthening ever since the beginning of civilization.

Here is not the place to discuss the question whether "the growth of human intelligence" has

also contributed to lengthening helpless infancy in the human species, as contended by John Fiske. Whether it has or not, this is certain, that from the very first appearance of brute-man on earth, *helpless infancy must have endured in this race longer than in any other*. This follows as an unavoidable conclusion from physical uprightness, which involves a very complex and delicate co-ordination and co-operation of many widely differentiated structures,—bones, tendons, muscles, nerves, etc. Therefore, it is possible only after all these various parts have been developed by exercise into a considerable degree of precision and efficiency in their adjustments.

The arrangements subserving locomotion in most other animals are comparatively simple. Very little strength and precision, and but a small degree of co-ordination of four very similar if not almost equivalent movements, is required to enable young quadrupeds to balance their bodies and move about. But in man, muscles about the back, chest, abdomen, neck, and head, and in the toes, feet, limbs, hips, and arms, must accurately co-operate in balancing the body for standing or moving about in the erect attitude. And because of this degree of complexity, this variety of co-operating organs and co-ordinated muscular contractions, a higher degree of precision in functioning is necessary in the human race, which can be attained *only* by allowing a longer period for development, that is to say, a longer infancy. And this reasoning and this con-

clusion applies to the "genus homo" from the time of its first appearance on earth, for the upright attitude has distinguished it since then.

During the lengthy period of their helpless infancy the human offspring had to be nourished, cared for, and protected by their parents, or perish. The survival of the race depended upon the disposition of the parents, or of at least one of them, to assume for a long period the burden of providing the little ones with nourishment and protection. Whether the burden was assumed by one or by the other, or by both, its assumption must have proved to be a very serious hindrance in the struggle for existence to whichever accepted it. The survival of the race makes it certain that on the average the parents of the race have not shirked their duty in this matter. Because of the naturally closer connection of the mother with the child, and of the feeding of it for a long period by a natural secretion from her body, it is safe to assume that this burden of feeding, caring for, and protecting the child after the flow of milk had ceased or become inadequate for the nourishment of the rapidly growing offspring, fell upon the mothers of the race. The former process would gradually, unavoidably, blend into the latter. But how could the mother provide for her own maintenance and that of her child, care for it, protect and carry it in arms, and yet enter into the struggle for existence with any chance of success? And on her success depended the survival of the race!

A female quadruped, a few days after delivery, may go in search of food unhindered by the offspring trotting at her heels. If enemies appear, the mother faces them, and the little ones keep at a safe distance or go into temporary hiding until the battle is over. Even if a young one is occasionally captured by an enemy or disappears, the loss is not important to the race, for large litters are frequently reproduced.

But in the human race, one child, once a year, during a few years, comes very near being the limit of reproductive capacity, and this one, during the long period of its helpless infancy, has to be carried in arms by the mother whenever she goes in search of aliment, or it must be left behind unprotected and unprovided. Evidently, then, the survival chances of mother and offspring are not much, if any, better after the birth of the latter than they would have been shortly before, had not the male consort then come to the relief of the sorely troubled female. And in this case now under discussion the same sort of relief must have come from the same source.

Such a proceeding had very decided survival value, and any families in which the male consorts showed a disposition to provide food and protection for their mates and offspring must have been selected for preservation, while those which were lacking in it were left to die out. Nor could natural selection neglect the extent or quality of this disposition. For if the males of certain families had a disposition

and capacity to provide well and liberally and for a longer period, then the females and offspring had a chance to grow stronger, healthier, and better fitted for the struggle for existence, and those families, therefore, had the best chance of survival.

Nor does the matter end even here. For it can hardly be doubted that, in that epoch, the unrestrained reproductive instinct and the necessities of the race admitted of but short intervals, for the competent among the females, between the end of the helpless infancy of one child and pregnancy with the next; so that natural selection would sift out only those families for preservation in which the males were naturally disposed to provide for their females and offspring, as long as the reproductive period of the female and the helplessness of any of the offspring lasted.

## CHAPTER VII

### THE FAMILY, MONOGAMIC MARRIAGE, ECONOMIC DEPENDENCE OF WOMAN, THE HOME

The existence of four institutions peculiar to the human race: the family, monogamic marriage, the economic dependence of woman, and the home, have been accounted for in the preceding chapters.

All four were traced to the earliest period in the existence of the two footed brute ancestry of man, and to physical uprightness, through the survival of the fittest, as a cause.

A vast amount of evidence, drawn from the reports of travelers who have lived for many years in barbarous or semi-savage communities, in order to study their customs, beliefs, and traditions, has been adduced by some writers in support of the contention that the horde, group, tribal community, or clan ante-date the family.

How can such a view be reconciled with the apparently conclusive evidence furnished in preceding chapters, that family relations closely resembling those of the present day prevailed during the very dawn of human existence on earth? Only on the hypothesis (and it is legitimate to answer one hypothesis with another) that the *modern type* of family is

a form of atavism, developed within the horde, group, tribe, or clan, *after* these social aggregates *had supplanted the primitive family*, by being of higher survival value. How could this come to pass?

When the use of clubs and missiles had developed the predatory type of men who preyed upon their own race (see Chapter IX) the existence of family groups, each consisting of a helpless woman and her children, from which the able-bodied male had to absent himself to go in search of food, became exceedingly precarious and they were liable to be wiped out suddenly or scattered.

The members of numerous family groups, which in time of peace had spread over considerable territory, in escaping from their predatory fellow men, by running away in many different directions, would tend to meet at places where topographical difficulties interfered with further flight, or forced them to make changes in the direction of it, or where the finding of water or food caused them to halt. Out of these accidental gatherings groups, hordes, tribes, and clans may have been formed.

The primary conditions of these primitive human communities must have been very unfavorable to the continuation of family relations. Privacy if not absolutely impossible within them was nearly so. And this applies equally to the daily presence of the father. Without these there can, however, be no continuous family relations.

The state of warfare which produced these primi-

tive communities and which they maintained must have widowed many of the adult females and orphaned even larger numbers of the young. The position of widows and orphans in such communities must have been pitifully desperate. Relief could only come from a disposition of the females to attach to themselves any available adult males, nolens volens, or from the sympathetic interest of the more fortunate in the community. Not much could be expected from the last named agency. The family could therefore not be the normal unit of such communities.

After tribes and clans, etc., had existed for many generations, and had gradually attained a high degree of organization and of internal security, then governmental, conventional, and ethical ideas may have resuscitated the family group, practically de novo. For even the memory of their primitive existence may have been obliterated.

The existence of a fundamental difference should be noted, however, between the attractions which hold the family united and the external coercive forces which bring and keep the members of tribes, clans, etc., together. These latter may be likened to compression.

Love, affection, and mutual interdependence are the intrinsic factors which, by attractions akin to those which draw the ultimate particles of a substance to each other, through desire voluntarily unite the members of a family group.

But as a driving wind in winter will gather the individually beautiful snow crystals in shapeless heaps or drifts, so was the coercive force of common danger required to induce primitive human beings to exchange the natural freedom of individual and family life for the restraints of the tribe or clan.

Can it be asserted that the existence of tribe or clan *absolutely* ante-dated the *earliest primitive* human families? Not without denying by inexorable implication the upright stature of the human race and its unavoidable consequences. For *human individuals* were the *only material* from which such aggregates could be formed. These individuals could not be anything else than the offspring of human parents of upright stature. During the long helpless infancy of such offspring, they and their mothers had to be supported by the father or perish. Support of mother and offspring by the father during a lengthy period constitutes genuine family relations. Therefore, can the absolute priority of the tribe, clan, or other aggregates not be asserted without implying a denial of the existence of physical uprightness in man, which is absurd and contrary to the hypothesis.

That beautiful relation between two people of opposite sex known as monogamic marriage has, heretofore, usually been looked upon as one of the latest results of governmental, religious, and conventional regulations, enforced only within the highest types of civilized societies. From the preceding

chapter, however, a very different view of the subject seems rational, namely, that this form of sex relation is the necessary result of permanent support by the male and scantiness of population, which prevailed during the earliest periods of brute-man's existence.

During subsequent eras of warfare, the level of the adult male population may sometimes have fallen so very low that polygamy was the only remedy which could save the race or the tribe from extinction. It is possible that such epochs occasionally lasted for so many generations that the former existence of monogamic marriage was only remembered, if at all, as a tradition, or a reminiscence from a former golden age. This ideal, in subsequent periods of peace, may then have been resuscitated and reinforced by governmental, religious, and conventional regulations, and this would account for its present existence.[1]

The *original* economic dependence of woman, mentioned in the two last chapters, began only when the infirmities of the final stages of pregnancy had made it impossible for her to obtain her own food supplies and defend herself against enemies. It, therefore, could not possibly influence her in her choice of a consort, which necessarily had to occur long before that time.

The kind of economic dependence which has

[1]It seems strange that the obvious fact that family relations and monogamic marriage have existed in the human race ever since its advent should be called in question, seeing that they are found among the anthropoid apes.

existed since historic times is of a very different nature. While *indirectly* traceable, like every other peculiarly human institution, to man's physical uprightness, marriage by capture, feudalism, and man-made laws must be assigned as directly responsible for its existence. By taking from woman her natural right of free choice in matters sexual, and conferring this power exclusively upon man, this sort of economic dependence has brought many evil consequences upon the race, detailed mention of which is inappropriate in essays of this kind. Yet can it not be doubted that, for a long time to come, many men and women will continue to join in marriage, mainly prompted by the desire of making a comfortable home and raising a family of children. And to accomplish this creditably requires ordinarily the *whole time and energy* of the mother during the greater portion of her mature life. The earning of the living for the family during this period naturally and equitably falls upon the father, becomes his special function. And division of labor has its advantages in this department of life, as well as in others. But, under such circumstances, love and community of interests are the basis of the arrangement, and evil consequences, if any exist, are obviously minimized. The father's knowledge of his economic power must give way to his sense of obligation, and the mother's sense of dependence can hardly be any greater than that existing between equal business partners under

normal arrangements. The force of economic conditions, however, seems to be already tending towards a readjustment of existing sexual relations. For the increasing complexity of socio-economic conditions, and more still the concentration of economic power in the hands of the few; the increasing demands of an ever more complex order of society; the increasing facilities for satisfying the demands of the reproductive instinct in an illegitimate way; the rapid decay of all reliance upon the supposed supernatural sanction for marital unions — all these causes co-operate to produce an ever-increasing number of bachelors and spinsters and to lessen the opportunities for attractive marital relations. As the number of unmarried women increases, more and more of them are forced into industrial, self-supporting occupations, and the demand for increased opportunities of this kind will rapidly become more urgent, and is bound to make itself heard.

Even animals of comparatively low organization and intelligence resort to nidification during the mating season. But the love of home in the human race is more deeply rooted. It springs from the very structure of man's organism. For this structure made the hiding habit of the females, and the support of mother and offspring by the male, absolute necessities on which the survival of the race depended. And these two habits made a permanent and secure abiding-place for the family as unavoidably necessary for the survival of the race as those habits themselves were.

# CHAPTER VIII

## DIFFERENTIATION OF SEXES IN CHARACTER AND THEIR MENTAL AND ÆSTHETIC COMPLEMENTARINESS

On comparing the males and females of any of the higher mammalian genera, except man, with each other, there is discovered a broad sameness in the somatic structures and functions *not related* to reproduction, and an equal fitness of both sexes for the various activities demanded by the average exigencies of race life. This fitness is but slightly impaired for the females, during a very brief period, just before and after giving birth to the young.

In the human race, however, physical uprightness has produced a very different state of affairs. By enforcing, during periods of varying length, a separation of the sexes, it has initiated in them a divergence of activities and habits in opposite directions, which through natural selection has resulted in a differentiation of characters along the sex line. For, seeking food to support themselves, their females, and young, the men could not remain in the security of the places where the former were concealed, but had to come forth into the open to meet the hardships and dangers of the struggle for existence, by fierce self-seeking activities, including the battling with power-

ful and ferocious competitors and enemies. This demanded agility, audacity, ferocity; the determination to possess and conquer, no matter at what cost of blood or pains to self or others, and heartless disregard for the sufferings of others, that is to say, *destructive, disruptive, cruel egoism.*

Since race conditions inexorably required males of such characteristics, therefore would nature rigorously select those endowed with them.

Upon the females in concealment devolved the propagation of the race. To succeed in this they had, firstly, to guard the secrecy of their places of concealment. A cautious, cunning disposition was suited to this. Secondly, to preserve the lives of their young. This required patience, tenderness, sympathy, conservative, *constructive self-surrender.*

Since the race conditions demanded women of such characteristics, therefore would females endowed with them be naturally selected.

It is obvious, from the above, that the set of qualities which was required by the race conditions for the females is the antithesis of that required by them for the males. One set can exist in an individual only by the exclusion of the other. The growth, increase, or development of one set in a person, therefore, implies the decrease or decay of the other. Since both sets of sex traits favor the survival of the race, therefore, was the ever greater development of these differences between the sexes in character fostered by natural selection. In other words, the

*ever farther differentiation* of the sexes in habits and character in opposite directions had a vast survival value.

It will be explained in the next chapter how this unique division of the complete human race character into two sections, which was indispensable in its early struggles with more powerful brute enemies and competitors, became afterwards, when it was no longer of any use whatever, perverted into a scourge for the masses of mankind. This chapter will further briefly deal with another phase of this differentiation, viz., with the "mental and æsthetic" complementariness of the sexes.

The complete race life requires the possession of considerable portions of both sets of sex traits, and since in these latter days this differentiation is almost universal in mankind, and the partial possession of sufficient portions of both sets of qualities by one individual is of very rare occurrence, therefore must many individuals of both sexes be necessarily but imperfectly fitted for the *full* joy and usefulness of the highest possible race life, if in this present age they are without the comradeship of a person of the other sex, and the consciousness of this imperfection seems unavoidable, though often evidenced only by general unrest and dissatisfaction.

This sensitiveness of each sex to its own deficiencies is necessarily associated with perception of the proficiency of the other in these wished-for qualities. That is to say, there exists in each sex a sense of its

own incompleteness, associated with a belief that the qualities which are lacking can be found in the other. Let it be remembered that this refers to mental and æsthetic faculties only.

Therefore, must an individual of one sex, on the average, become mentally and æsthetically attractive to the other, nearly in the same degree as he or she possesses the special sex qualities of his or her own sex. In other words, a man will be attractive to women proportionate to his manliness, and a woman attractive to men in proportion to her womanliness in matters mental and æsthetic. In this way has sexual selection aided natural selection to increase and accentuate mental and æsthetic sex traits in the human race, widening the difference between the sexes.

Now observe that these special sex qualities, although, in the unending chain of cause and effect, the remote results of reproductive activities, were yet, from the very beginning, separate and independent of the instinct and of the attraction originated by it. Note further, that from generation to generation, under the influence of natural selection and sexual selection, aided by the process which Herbert Spencer calls "Multiplication of Effects," this differentiation of the sexes has reached wider and wider fields of human interest, in the realms of actions, thoughts, and feelings, until in this age there seems to remain hardly a thing, the reactions of which on men do not more or less differ from its

reactions on women, and which is not by the reactions received from man differently affected than by those which reach it from woman.

To illustrate: Let a manly man and a womanly woman look at the same great work of art, or the same grand scene in nature; they will be attracted by different features of it, and will have aroused within them different thoughts and emotions, different motives for differing actions. Let them read the same poem or other literary production, and the results will differ similarly. Equally so, if both have the same problems in politics, economics, religion, ethics, business, or daily conduct presented for decision.

And in every such case the angle of divergence between the persons of different sex will be the same as that indicated by that first separation of the sexes, when the male confined himself to the struggle for existence, and the female to the propagation of the race. Mark now the truism: that the range of activities of the human body and mind, and the joys of doing, thinking, feeling, are deepened, pari passu, with increase in the perceptions of more details in the phenomena that affect us, and with multiplication of the subjective activities they provoke.

Since, by reason of the differentiation here under consideration, the female perceives, in nearly all phenomena presented, some details which the male does not, and, therefore, acts, thinks, feels, in some respects as the male does not, and vice versa, there-

fore, can each by itself act, think, feel, only incompletely with reference to the wonderful variety of things in this universe, which are more, if not doubly more, completely available to the dual human molecule — man and woman united in closely intimate comradeship. So that the single life can never be commensurate with the magnificent and beautiful possibilities of human action, thought, and feeling; can never rise to the full dignity of the human destiny; but must unavoidably fall short of it.

The complete mental and æsthetic race possibilities, the highest of which mankind is capable in usefulness, in beauty, and in joy, can only be reached in the joint life, close intimacy, and comradeship of two of opposite sex, and this is independent of the instinct which provides for the perpetuation of the race.

# CHAPTER IX

## HOW PERVERSION OF RACE CHARACTER ORIGINATED WARFARE, GROUPS, AND HORDES

Individual character may be defined as a group of intrinsic potentials[1] from which the uniformities in a creature's actions or conduct arise. See Chap. III, page 76. These potentials are determined by the intrinsic nature of the creature, but actions derive their specific qualities from the functional adaptation of the external organs. And the external organs are visible. Therefore can the character of an animal be ordinarily inferred from its external appearance.

Mimicry in nature, which misleads animals with reference to the character of creatures by external appearances, depends for its survival value on the validity of this rule. To illustrate: A certain harmless fly escapes from enemies by being changed through variation into looking in color and form like a dangerous, stinging wasp. The character of the fly remains harmless after this variation has occurred. The creatures in the habit of feeding on this species of flies, however, seem to be afraid of the wasp-like appearance and confine themselves

[1]The word "potential" was selected because it seems to include all inherent provocatives of conduct.

to eating the normal type. This makes great inroads upon the surviving numbers of the normal, but permits the wasp-like to multiply. After some generations, these conditions thin out the normal type and increase the wasp-like to such an extent that the creatures feeding on this species of flies are tempted to emigrate to regions where the normal type still predominates. This gives a new chance of survival and multiplication to the normal type in that locality from which these enemies have emigrated. Under the operation of the law that the older hereditary tendencies in an organism have far more power of resistance than the later variations, and that reversions to the older type increase whenever the conditions which have favored new varieties begin to diminish in force; the normal type in the last-named locality, then, tends to increase proportionally much more in numbers than the wasp-like. After some generations this causes the former again to predominate, which is likely to tempt its enemies to return to that locality, when the reverse of the process will commence again and soon. See footnote, page 39, and Appendix Note IV.

When one type begins to diminish, it becomes harder for both sexes of that kind to find mates of their own variety, and this difficulty increases the rapidity with which the other type tends to predominate.

Would not careful consideration of the process

above described justify distinguishing the harmless looking flies as "the ordinary hereditary," or "true" race type? And the wasp-like as the "exceptional false" type, which owes its existence to natural selection when the race is crowded by its enemies and which will tend to disappear whenever these enemies of the race are overcome?

If of these harmless flies a variation could have been reported, which had endowed them with the poisonous stings and aggressive dispositions of wasps without changing their appearance, that would have illustrated the various bearings of the difference between a true hereditary and false exceptional race type much better, although it would not have been a case of mimicry. If such a variety had arisen and had used its destructive proclivities against its gentler race fellows, that would have been almost the greatest possible hindrance to normal race progress.

The production of such a variety from the harmless type is, however, so easily within the powers of variation and natural selection, which have achieved the far greater contrast between amœba and man, that its non-existence is a mere accident which can make no difference in the bearing which these considerations will have on future arguments.

A few illustrations of the principle developed thus far, viz., that traits of character may be recognized by outward appearances, will make the progress of the argument clearer.

The long, sharp claws, great protruding jaws, long dirk-like incisors of the lion, his powerful muscles and frame, the shaggy mane protecting his front — these appearances indicate what kind of conduct may be expected from such a creature. The long, slender legs, graceful body, and large eyes do the same for the character of the deer. The long and mobile ears, low body, muscular haunches, show the character of the rabbit or hare; and so on, almost through the whole range of animal life.

It could not be otherwise, for if those outward organs on which creatures depend for their reactions with the external world did not correspond with their character, which determines the *nature of these reactions*, then such animals could not adapt themselves to their environment long enough to live to maturity. Such types would die out in remarkably short time.

Nor can the visible organs be without considerable influence *on the formation* of character. For the possession of physical adaptations, such as the visible organs are, undoubtedly leads brutes to make use of them. Use causes the formation of corresponding habits of conduct. Habits of conduct are the essential constituents of character. See Chap. III, page 76. To this extent, *at least*, do the visible organs contribute to the formation of character.

To apply the above mentioned principle safely to

man requires great care in distinguishing between his artificial and natural appearance. For civilized people have become so thoroughly used to the extreme artificialities of the conventional kinds of toilets and dress [1] that they are involuntarily more impressed by alternations or deficiencies in these than by slight physiological variations. Just think how the absence of a necktie from a gentleman's attire, or of shoes and stockings from a lady's feet, would startle the average conventional person!

The bodies of civilized persons are usually concealed by artificial coverings, and the head and face are transformed by the toilet and the labors of the barber and hair-dresser. These trifles, contributed by tailor, barber, and their like, can, however, not indicate the manly characteristics in the nature of a person — rather would excessive, punctilious care bestowed on them be significant of absence of these.

Artificiality in externals is not confined, however, to contemporaneous civilized people. It has been practiced ever since history began by nearly all those who could afford it, and even savages and barbarians disfigure the natural beauty and dignity of the human body by various familiar devices.

Greek statuary and the comparatively naked bodies of the natives of Africa, and of the coolies of

[1] The word "toilet" is used here to signify artificial changes in the appearance of hair, head, face, etc., to distinguish these from dress, which appertains to coverings for the body.

India, come nearest to showing the natural appearance of man.

And what sort of race character does this appearance imply, and what kind would the physical attributes from which this appearance arises tend to produce? viz., the utter absence of means of offence, defence, protection, and escape; the extreme vulnerability, made obvious by the shining skin and the absence of hair, fur, hide, etc.; the upright attitude, from which visible peculiarities arise as follows: firstly, exposure right in front of the reproductive organs and the contents of the pelvic cavity and chest, where, covered merely by soft and easily broken or ripped tissues, all the vital organs and blood-vessels are located; secondly, the exceptionally high elevation and mobility of the head, where the senses of sight, hearing, smell, and taste are situated, which location, as explained heretofore, greatly increases the extent of the areas surveyed by the three first-named senses, and which brings all four of them into the most favorable juxtaposition for co-operating with, aiding, and guiding the operations of the exquisitely developed human sense of touch; which sense, thirdly, this same upright attitude has caused to be specialized in the anterior extremities; fourthly, the excellent adaptation of the posterior extremities to the firm, well-balanced support of a tall upright body, whether the same be at rest or engaged in locomotion; fifthly, the exceptional freedom of the anterior

extremities [1] for an infinite variety of movements, which *exists in no other creature*, and in which the whole of the upper body above the posterior extremities somewhat participates.

The visible attributes mentioned up to secondly in the last paragraph suggest extreme inoffensiveness; a peaceful, kindly disposition; aversion to violent, arbitrarily selfish acts. Those cited from secondly to fourthly indicate docility, intellectual power, energy, and acuteness, therefore the ability to plan for complex purposes. Those explained under fourthly and fifthly imply the physiological capacity to execute an infinite variety of complex concerted movements with ease. Such movements can, by the exercise of the intellectual faculties implied between secondly and fourthly in the last paragraph, be co-ordinated into conduct favorable to complex and remote results. Considered in their entirety, these attributes are suggestive of a nature easily impressed, quickly aroused, ready to compare, reflect, and decide, therefore inclined to fellow-feeling, sympathy.

Such are the characteristics implied by the visible appearances of the natural human body. And such are the traits of character which the physical attri-

[1] Although the parts called anterior and posterior in other creatures are in man, in reality, superior and inferior, yet have the former terms been retained in these essays; because, firstly, they apply to all brutes universally, with this one exception, and, secondly, because it keeps this fact more forcibly before the mind, that the change from the firmer, safer horizontal to the more mobile vertical attitude produced wonderful differences.

butes, from which the appearance arises, would tend to produce.

Based on observation of the external physical fitness of creatures, this deductive method for obtaining knowledge of true hereditary race characteristics cannot fail to lead to correct conclusions. A chance of error only arises when the crowding of a race causes a *false exceptional type* of character to be selected in the manner illustrated in the paragraphs on mimicry occurring earlier in this chapter.

It has been shown in Chapter VIII that such a case occurred in the human race, viz., that the true hereditary human race character during the long era before men had learned to arm themselves artificially, while they were still crowded by their powerful brute enemies, could survive only among the females. During this period natural selection in each generation eliminated those males which were too largely endowed with these beneficent characteristics, and permitted only the fiercely combative imbued with destructive egoism to survive.

But since offspring inherit from both parents, a few male infants continued to be born in all subsequent generations, which combined in their dispositions just enough of the characters of their fierce masculine progenitors to make them formidable, and sufficient of their gentle feminine ancestors to make them sympathetic. This was the prehistoric, heroic type of men.[1]

[1] It follows from the mathematical rules of probabilities and from the premise above stated, that "offspring inherit from

Possessed of immense muscular power, great agility, cunning, courage, combativeness, reckless disregard of wounds and of the danger of meeting death, and equal indifference for the blandishments of self-indulgence, glory, or reward; endowed with deep sympathy for the feeble and helpless of its own race — this type was pre-eminently fitted for the severest tests of bravery, skill, and endurance.

In this form of heroism the destructive powers are controlled and directed by the beneficent tendencies of the true race character, and therefore only available against the inanimate environment and the brute enemies of mankind. Aggressive warfare directed against the useful and inoffensive of our own race, instigated by the motives which, no matter how disguised, have originated nearly all modern wars, viz., greed or lust of power or riches was obviously impossible with such men. Such characters would prove a help, and could never be a hindrance, to the attainment of humanity's highest ideals.

both parents," that the chances for the births of female infants, inheriting in proper proportions the dispositions of both their fierce male and gentle female ancestors, are *equal* to those of the births of male infants combining in due proportion the characteristics of their gentle female with those of their fierce male progenitors. Both belong to the heroic type. No partiality was intended in the text above by mentioning only one side of the proposition. The other side, being irrelevant to the argument, was left out.

When, by sexual reproduction, a ferociously, cruelly egoistic disposition is mixed with a just, patient, self-abnegating one, then it is obvious that, irrespective of sex, the proportions in which each of these two dispositions may occur in the character of new individuals, are of infinitely great variability.

Since this description includes the true race characteristics, which are a hindrance rather than a help where ferocious, determined, merciless, bitter fighting against great odds is required, and since nature had selected *men* for many generations exclusively with reference to qualifications for such a struggle, therefore it follows that men without nobler tendencies must have been the rule, those with them the exception. *Not until men had learned to arm themselves artificially could a more general return of the stronger sex to the true hereditary race characteristics be looked for.*

It must have produced a wonderful transformation when this took place, when men began to arm themselves with sticks and stones. What a contrast between the miserably helpless upright brute and the hero with the club and missiles!

Such a type of men supplied with these artificial weapons, for which their organism had such wonderful natural adaptation, was easily a match for the fiercest and most powerful among their brute enemies and competitors.

With the acquisition of ever better skill in the use of clubs and missiles, and with improvements made from time to time in their form and quality, there, therefore, came an end to the perils and disabilities which had kept the race close to the verge of extermination. Security had come at last, and with it increase in numbers. Matriarchal and patriarchal groups were probably in process of formation. Nat-

ural selection, in so far as it arises from struggles with brute enemies and competitors — and that is the whole of it in the ordinary acceptation of the phrase — no longer eliminated those of the true race character, viz., the patient, the gentle, the thoughtful among men. Some of this latter class about this time probably began to engage in industry, by the shaping of crude tools, arrows, stone axes, etc.

The domestication of animals,[1] the beginnings of efforts at the cultivation of the soil and of the accumulation of small stores of fruits, nuts, and other necessaries of existence beyond immediate wants, are usually placed by anthropologists in this period. The decisive battles with brute enemies had been fought and won. That chapter in the history of the race was closed. Man was supreme master on earth. Henceforth, if anything, except some great convulsion of nature, was to threaten the existence of the race or hinder it from reaching the happy, peaceful conditions for which the true race character prepared it, then it could not come from without, but had to arise within the race.

The fearful devastations produced by the life-destroying ability and ingenuity of artificially armed men were briefly illustrated in an earlier chapter.

[1] Kindliness and sympathy easily explain the domestication of animals. After man had killed some powerful parent brutes, the piteously helpless condition of the young orphan brood must have appealed to him. What more natural than to carry them to the hiding-place of his family. There the women would care for them and thus domesticate them.

When, by the activity of these traits the complete subjugation of man's brute enemies and competitors had been accomplished, then by the same means the opportunities for the exercise of these traits had been greatly reduced. These faculties, however, remained potentially in full force. And in accordance with a well-established psychological law, they *craved* action *all the more* because of their recent strenuous activity.

If in denial of this it is assumed that fiercely combative primitive men might have employed themselves in peaceful, life-sustaining activities, then let it be remembered that the labors by which nature is subdued to the uses and welfare of man demand thoughtfulness, patience, self-abnegation, perseverance, etc., the traits of the true race character, and not those naturally selected and engendered by fierce fighting, and by a mode of existence which alternates periods of idleness and indulgence with brief terms of great hardships and desperate combative efforts.

No! the false type of human character, unless alloyed by the true, never has taken and probably never will take, voluntarily to those patient, peaceful, thoughtful ways which the true race type displays in those beneficent activities which make the earth habitable and beautiful for moral beings. The craving above mentioned of persons of the false type for fierce and destructive activities therefore in that early period could only be gratified by exercise within their own race.

Given opportunity or temptation and they would surely satisfy it that way.

Both opportunity and temptation came quickly enough. For action is always in the line of least resistance or greatest attraction. It has been mentioned in an earlier paragraph of this chapter, that about this time some of the "hominidæ" had begun to store small accumulations of the necessaries of existence, in or near their family retreats, for future use. These little supplies furnished temptation and opportunity. Nothing is more attractive or tempting to animals or brute men, than ready-made supplies of the necessaries of existence or objects of desire. The *possible* supplies, out of sight and hard to find, and to be gathered only as the result of laborious, persistent, risky efforts, cannot in these respects compare with those already accumulated. Here, then, was opportunity, temptation, and the line of greatest attraction.

Nor was it in the least difficult or dangerous for artificially armed, fiercely combative, rude, savage men to overcome the resistance of the helpless females and young, who were sometimes and in some places left during all the day as sole defenders of these accumulations. So this was also the line of least resistance.

At first such attacks were probably few and rare. For the very fact of the existence of small accumulations relieved some of the men from the necessity of going daily in search of food, and by the premises

in this argument, man's powerful brute enemies were sufficiently subdued at that period so that there was no need of going daily in pursuit of them.

The males inclined to these depredations, however, would probably not venture on them on days when the other men were with their families. Only isolated cases would occur, when roving males, finding that the protecting men had gone away from retreats in which accumulations existed, would dare to make raids on them. This is the line of greatest temptation, attraction, and least resistance. They would make attempts to enter the retreats to possess themselves of the supplies.

In that early period, the natural emotions and passions of the females and young in these retreats thus trespassed upon had obviously not existed long enough to become modified by either prudence and policy, which are the products of experience of natural consequences (and the experiences of these attacks, by the hypothesis, were absolutely new) or by social and conventional feelings or sentiments, which are the results of very refined and therefore much later experiences. It is therefore beyond doubt that they followed the natural impulse to resist aggression without considering consequences; and the conflicts following could hardly be supposed to end without loss of life. *Success in sordid, selfish, cruel acts* makes these *exceedingly infectious*, and a few occasional robber raids could not satisfy

the craving for cruel, fierce activity which the men of the false type felt.

Furthermore, numbers of fierce, combative males craving action for their unemployed faculties may have occurred at that time in fairly constant and considerable proportions throughout the whole race. For their existence and activity had been absolutely essential to survival until then. And wherever they were found the reasons which caused them as above stated to prey upon the gentle and defenceless of their own fellows remained in full force.

It can therefore be safely taken for granted that the example and success of the first few of these robber raids above mentioned led to the rapid extension and multiplication of such enterprises, until they became wellnigh universal and continuous within the area inhabited by man.

When intro-racial predatoriness had by these means become general, the whole race, except the predatory men, suffered from the prevailing state of insecurity. Probably only the few matriarchal and patriarchal groups, which may have existed in that period, were able to offer successful resistance to these raids. But, as has been shown in earlier chapters, mankind at that time lived mostly in isolated families. The females and young of these, if they escaped slaughter and captivity, were driven from their retreats and dispersed.

Terror-struck and running away from their enemies, without knowing whither, these fugitives

coming from many different directions would tend to meet at places where topographical difficulties hindered further flight or forced them to make changes in its direction, or where hunger, thirst, and the occurrence of supplies of food or water caused them to halt.

Although these meetings, as above outlined, were merely incidental, several circumstances make it very probable that more or less coherent permanent aggregates, such as groups or hordes, would result from them. For when the fugitives met, they must have been thoroughly exhausted, panicky, and in consequence of their late fearful experiences, inclined for slight cause to great extremes of apprehension and timidity. Then upon meeting fellow-sufferers with outward indications of being in similar mental and physical plight, their fears must have been assuaged and their sympathy aroused. While they were not free from terror of the ferocious men that might come upon them from a distance, yet must they have felt a sense of security and power of resistance for defence in the presence of these large assemblies of comrades in misfortune. Thus there obviously arose a strong inclination to remain together. Successful efforts must have been made frequently by the men whose absence from their retreats had been the cause of these disasters to find the whereabouts of their fugitive families, and thus the meeting places of the latter would easily become temporary points of concentration.

Although the individuals in these crowds could not avoid, in the pursuit of the daily necessities of life, leaving these places, yet would a sufficient number for a nucleus and protecting guard naturally remain behind, and those who had scattered to various distances in the neighborhood would upon the occurrence of any unusual noise, sight, commotion, etc., feel strongly inclined to hasten back to these meeting places. This is one way of accounting for the origin of primitive groups and hordes.

But suppose introracial warfare had commenced before clubs and missiles were used? Quarrels and contests undoubtedly occurred, as they do among other brutes, but not on so large a scale as to justify naming them "introracial warfare." Conditions were *entirely against such assumption.* No widespread distribution of small accumulations to furnish the incentive could have existed *before* the use of clubs and missiles. The struggle with more powerful and better adapted brute enemies and competitors was *too severe* to admit of it. This struggle also furnished more than enough employment in the defence of individual and family safety for all the combative ability in the race. Besides, introracial warfare would have been such an excessive addition to the other disabilities of the race, before clubs and missiles, as must inevitably have led to its speedy extermination. Finally, even if the supposition was rational or based on fact, it could not have produced a different trend of events from that above deduced.

If to this account of the origin of introracial warfare and of hordes and groups, however, it is objected that substantiation by observations and experimental tests is impossible, then the reader must be reminded that, as stated in the preface, this cannot impair the value or validity of the conclusions reached. "For rational minds do not for such reason reject conclusions based on sound premises explaining facts otherwise not rationally explicable. If they did, then 'the theory of the infinity of space,' of 'the eternity of time,' of 'the indestructibility of matter and force,' the belief that 'two parallel lines never meet, no matter how far extended,' 'the nebular hypothesis,' 'the universality of the laws of nature,' and many other equally essential parts of science and thought, would have to be rejected along with the conclusion just reached in these essays, for none of them can be verified by observations or experimental tests." And what are the premises from which the above manner of accounting for the origin of introracial warfare and the formation of hordes and groups follow as conclusions?

There is, firstly, the existence of the true and the false human race characters. Of these two, the true is by far the older type and the false a later variety. Secondly, the natural selection of the false type during the earliest period of brute-man's existence. Thirdly, the law that the older hereditary tendencies are always by far the more persistent, and that reversions to the older type begin to increase when-

ever external conditions, which have favored new varieties, begin to diminish in force. Fourthly, there is the indubitable fact that more than half the human race, viz., a large majority of the females and a considerable proportion of the males, *always have been in every generation*, even up to this present age, of the true race characteristics. See note, page 39, and Appendix, Note IV.

The law quoted establishes beyond doubt that the true race character has an enormous advantage in the matter of new births over the false type. Add to this the fact established by the fourth premise, that taking both sexes into consideration the true type has always had the advantage of being represented by a larger number of adult individuals in each generation, and that new births must, cæteris paribus, always increase and decrease in proportion with the number of adult individuals capable of reproduction, and it is demonstrated beyond reasonable doubt that, throughout all past ages and up to this present time, new births have always contributed more profusely to the true race type and less to the false.

Therefore, unless the natural course of events had been interfered with, there should exist in this present age, thousands of generations after the cause of the natural selection of the false type has *ceased to operate* (see third premise above), an overwhelming predominance of persons of the true type, irrespective of sex, in all avenues of human activity,

leaving the occurrence of specimens of the false type a rare sporadic phenomenon. Since almost the opposite is the fact, *therefore it is certain beyond doubt* that the natural course of events has been interfered with.

The nature of this interference, consisting of the turning of the destructive egoistic proclivities of the false type against the harmless and useful members of our own race, has been sufficiently illustrated in earlier paragraphs, and is corroborated by the existence of many familiar archeological and historical evidences. This conclusion is therefore established beyond reasonable doubt.

Can any one be so blinded by prejudice as to contradict the statement that this mode of interference continues in this present age? That such a state of affairs increases the survival chances of persons of the false and decreases those of people of the true type of human character, and that it hinders and retards the attainment of those peaceful, happy conditions for which the true race characteristics prepared humanity, is self-evident.

Here is a mass of indisputable facts constituting an adequate cause for the astounding discrepancy between real and rationally inferred conditions. This way of accounting for it conforms to the rule of parsimony, to the true nature of all the factors in the problems, and is not in conflict with any fact or established principle of either ordinary experience, rational thought, or science.

# CHAPTER X

## A NEW FACTOR INITIATING A NEW ERA

The modification in the entocuneiform bone and in the position of the foramen were "the cloud no bigger than a hand," "the coming event casting its shadow before," whereby a new potential factor entered among the innumerable interacting forces and materials, which in the remote past were the cause of the present as well as of the far-off future conditions in the universe. This new factor has the power of changing the blind drift[1] of these forces and materials into a definite tendency towards a new ideal goal. Until this new factor appeared all things in the universe were helplessly given over to these same blind interactions. Feelings, thoughts,

[1] Is "blind drift" an appropriate phrase for interactions which conform to an unalterable order, determined by the nature of the constituent physical factors among which time and space must be included? Surely it is! The phrase only becomes inappropriate, when forms of mental force, such for instance as purpose, desire, aversion, fear, hope, *are known* to be factors in determining the outcome; or in changing the nature of the interactions; e. g., when a stream of lava rushes down upon human homes and orchards, with nothing to interpose, that is "blind drift"; when crowds of villagers arrive with shovels, picks, plows drawn by horses, and energetically devote themselves to the opening of wide and deep trenches to divert the flow, then the new direction has not been given by "blind drift." Then the "blind drift" of nature has been superseded by the purpose and effort of man.

desires, hopes, aspirations, ideals, had no power whatsoever to sway them. Life and consciousness were mere incidents in their currents. The nature and duration of the former, and the terrible or pleasing character of the latter, were inexorably determined by the same blind interactions.

But the appearance of the new factor above alluded to marks the beginning of a new era. Life, consciousness, and human ideals will not be without influence hereafter. On the contrary, they will by the power of this new factor in future acquire an ever-increasing importance in determining the destiny of the universe and the goal toward which it will be progressing. This new factor is the true hereditary character of the human race, which followed as a natural consequence from the bodily formation, which was made inevitable by the two anatomical modifications referred to in the title, as "The Physical Basis of Civilization."

Of this character the wonderful human intelligence is the most conspicuous primary constituent. Through this, operating in connection with patience and heroic love of truth, came knowledge of the more complex relations between causes and effects; therefore science and scientific foresight. Peaceful docility, adaptation to an infinite variety of productive industries, as well as the capacity to comprehend and retain in mind great purposes during lengthy periods, and the will-power, under the inspiration which such purposes yield, to direct and

maintain efforts in the line of their attainment — these are the essential parts of it. It further includes sympathy with the infirmities, frailties, and sufferings that fall to the human lot, and with the noble aspirations that come to the mind from the grand prospects attainable by our race through co-operation.

Such characters and such prospects inevitably tend to an *ultimate mental attitude*, in which a wrong to one becomes to some extent a wrong to each and all; in which the suffering of one becomes to a degree the pain of each and all; in which no one could do a wrong to another, because it would be felt by him the same as a wrong to himself; in which the benefit to one would be felt as a boon by each and all; and so forth. In other words, the average state of mind would imperatively demand conformity to the three principles designated by Herbert Spencer, in his original "Social Statics," as "Justice tempered by Positive and Negative Beneficence."

When such motives initiate and when scientific foresight guides the grand co-operative industrial enterprises of the nations toward *the attainment of ideal conditions, for the highest uses of life*, then this new factor in the formula of the higher development of the universe, this true hereditary character of the human race will begin to assert its wonderfully beneficent capacity.

Its influence thus far has barely been potential.

Slowly humanity is passing through the preliminary steps in preparation for its dynamic activity. It possesses the power, and has already begun to exert it, ultimately to change the character of the struggle for existence, the tendency of natural selection, the nature of the traits which determine the survival of the fittest, and the goal toward which the progress of the universe is tending.

The phrases: struggle for existence, natural selection, the survival of the fittest, describe three varying aspects of the same group of phenomena which, taken as a unit, constitute a change-producing agency in nature. The first phrase refers to the mode of proceeding, the second to the two sides of its general effect, and the third to the net result. As explained in Chapter IV, the struggle for existence naturally divides into two sections, viz., first, the struggle against inanimate environment; and secondly, that between living antagonists. In the first part the struggle is between the powers and resources inherent in life and the tendencies antagonistic to life inherent in its environment. The first is the earlier and during its predominance the more severe part. But by virtue of the powers and resources inherent in life, and more particularly by a capacity for wonderfully copious and rapid multiplication of individuals, which prevails mainly in its lowest forms, and a tendency to infinite multiplication of varying *forms*, which is found increasing as specialization advances — by virtue of these two principally, a

stage was reached about the end of the tertiary period at which so many genera, species, and varieties had practically overcome in the struggle against the inanimate environment, and had multiplied to such an enormous extent that thereafter and for these reasons the second part of the struggle, in which success depends on individual ability and conduct, became the predominant form of it.

Only by natural adaptations, as illustrated in Chapter IV, could life be maintained while the first part of the struggle prevailed. In the second part, that is, in the contest with fierce, powerful, greedy, living competitors for the largest attainable individual share in the supplies and opportunities provided by *unaided nature*, strength, cunning, ferocity, selfishness, utterly ruthless of the fates of others, are the traits that most favor survival.

From that time, and seemingly thereafter for all eternity, these and similar traits, and it is significant that they are the same as those which distinguish the false human race character, were required by the struggle for existence, and their possessors were naturally selected as the fittest to survive.

For although there are a few exceptional cases of instinctive co-operation among creatures below man, i. e., bees, ants, beavers, etc., and an occasional instance of a co-operative habit, such as when, among herbivoræ, one individual keeps a look-out for enemies while the others are feeding or resting, yet, do these few departures from it *not militate against the*

*validity and generality* of the rule that the higher brutes below man depend for the preservation of life and the satisfaction of desires, and therefore for individual and type survival, on their natural adaptations, firstly, to their inanimate environment; and secondly, to the struggle with living competitors.

It is significant that this rule applies also to persons dominated by the false human race characteristics. Ruthless egoism cannot produce the supplies and opportunities upon which the life and happiness of civilized human beings depend. It can only appropriate them after persons of the true type have produced them. Persons of the false type are not above sub-human brutes in character, only in intellectual power. Intellectual power, like other modes of force or energy, can be used for high ideals and for low self-gratifications. It marks a difference in degree, not in kind.

To return to the main argument: Since instincts come into existence very slowly through coincidences in variation, and are then still more slowly selected, only if the conditions under which they favor survival continue during many generations, therefore could they *never be the equivalents of* the infinitely greater potentialities of *purposeful industry and voluntary co-operation*, even though these had forever remained at those lowest terms which prevailed before moral aims began to supply the motive power and scientific foresight the guiding principle.

Nor can the low types of mentality possessed by the most intelligent brutes below man supply these equivalents, for they are inadequate to anything higher than to aid the traits mentioned in the fifth paragraph above, in securing the largest attainable share of the supplies and opportunities *provided by unaided nature;* and while the intelligence of persons of the false type is equal to higher things, their character is not. Forceful, cunning egoism is well fitted for the appropriation of the increased supplies and opportunities added to those of unaided nature by the activities of the true race type, but it cannot produce them.

General welfare, moral obligation, are notions far too abstract for brutes, but comprehensible to the lowliest normal human adult intelligence of this day. To expend efforts in the present for something to be achieved in the far future, which for the present can only exist in the imagination, when these matters are not covered by a developed instinct, is obviously beyond the power of sub-human brutes, and while easily in the power of persons of the false human race character, it is not their disposition. Considerations of general welfare or moral obligation do not appeal to them and cannot control them.

Nor is there the least reason to believe that the intelligence of sub-human mammalia in any far distant future could ever grow up to these higher things. They have never had primitive man's urgent need for higher intelligence, for they are

physically well adjusted to their natural environment. They have never had the constant incentive for using their intelligence, nor the three causes which forced its growth in the case of man (Chapter III). Their intelligence since life began, when it has progressed at all, has done this at so exceedingly slow a snail's pace that species and even genera have slowly evolved, flourished, and disappeared, being displaced by some fitter type, without there being any perceptible increase in intellectual power, so that evidence of improvement in this can only be obtained by a perspective glance across several geologic ages.

Therefore can the existence of these exceptional co-operative instincts and habits not militate in the least against the rule stated in the sixth paragraph above: that the higher brutes below man depend for the preservation of life and satisfaction of desire, therefore for individual and type survival, on their natural adaptations to the inanimate environment and to the struggle with living antagonists.

And the same applies to persons of the false race characteristics, so long as their higher intelligence fails to overrule their low, brutal promptings. To them, therefore, the phrases "struggle for existence," "natural selection," "the survival of the fittest," apply in the sense heretofore used in scientific literature; but except in so far as the pernicious predominance of the false type forces it *temporarily* upon the race, *not to man!*

*For how vast is the contrast between the highest brute conditions and those presented by humanity!*

During an enormously long primal era occurred the slow but unparalleled phenomenal growth of human intelligence. Chap. III. This fitted our brute ancestors at an early period for modes of conduct which enabled the race to escape extermination. Later, when higher intelligence was applied to the use of clubs, missiles, and fire, man easily became the supreme master on earth.

Thereafter possessed of an intelligence so high that it led to the comprehension of some of the principles that govern the interactions between forces and materials in the universe, our race no longer depended on adapting conduct to environment, but knew how its environment might in various ways be altered to conform to its own needs and desires. Possessing this knowledge, specialized industry, co-operation and genius supplied the power to produce these changes.

A brief survey of the success thus far attained along this line, and of the obstacles which had to be overcome, will tend to throw the situation as a whole into clearer light.

Enormous areas formerly covered by the ocean, by lakes, swamps, rivers, etc., have been converted into rich agricultural lands. Arid regions have been made to produce abundant harvests. Deserts have been made accessible and beautiful. The rigors of cold climates have been mitigated by artificial

heat, clothing, and shelter, and the terrors of the torrid zone by artificial refrigeration. Regions haunted by death-dealing micro-organisms have been made wholesome, productive, and beautiful. Devastating epidemics have been checked and robbed of their terrors. Tremendous obstacles to intercommunication have been overcome. Night has been robbed of its darkness. Distance of its power of interfering with hearing and seeing. Most of the eternal infinite forces of nature can now be diverted by human efforts from their natural courses so as to serve the purposes, desires, and ideals of mankind. The supplies and opportunities provided by unaided nature have by the labor and genius of the true race type been tremendously increased in quantity, vastly improved in quality, and multiplied in variety. Fauna and flora have been utterly changed so as to make them conform to the necessities, desires, and æsthetic requirements of humanity.

These are only a few illustrations of the many wonderful improvements which the latest factor in the progress of the universe, viz., the true human race character, has thus far made possible with the aid of the first feeble beginnings of guidance by scientific foresight.

And all such enterprises had to force their way against and through the obstacles which a system dominated by the traits of the false race character interposed. Is it not obvious that undertakings depending for success on the expenditure of efforts

by many individuals, employed in diversified, specialized, productive labors, must be if not absolutely thwarted at least fearfully hindered, if their administration is dominated by the unscrupulously selfish purpose of a few to convert the opportunities which such occasions invariably create, into means for their own aggrandizement, undisturbed by the injury, injustice, and suffering which this inflicts directly on those honestly engaged in the work and indirectly on the welfare and progress of all mankind?

In almost all past times the "wolf in sheep's clothes," "the mailed fist in the velvet glove," have prevailed over simple honesty, gentleness, patiently productive industry, genius, and altruistic heroism. To resume the argument: Since humanity can control the inanimate forces and resources of nature, since it exercises an easy and unchallenged supremacy over all its former brute enemies and competitors and has done this ever since the beginning of the neolithic age, therefore there is not now, nor has there been in the human race since the neolithic age, any *such natural* struggle for existence as exists among brutes below man. *Our race has risen superior to it.*

But the predominance of the false type in the race, its unjust appropriation by trick or force of the products of others, its readiness to inflict suffering and death, and its inexhaustible resources of deception, have forced an unnatural, artificial, intro-

racial struggle for existence upon humanity, which is *far more severe and cruel* than that natural form to which our race has risen superior, but from which the brutes below man, except those which have been domesticated, can not escape.

Only during the primal era, when our helpless brute ancestry, not yet familiar with the use of sticks and missiles, was pitted against species and genera vastly better fitted for the struggle for existence, when the struggle against living antagonists was exclusively extroracial, only in that era, and never since, has the false type or its methods been anything besides a hindrance and a curse to the race.

Fourteen hundred millions of naturally peaceful, intellectual, industrious human beings, when left free by the false type to follow their higher motives, will by voluntary co-operation be able to create happier and more beautiful conditions on earth for every one, far more favorable to the survival of the wiser and nobler among them, than by greedy, fierce contentions for economic advantages for individuals, classes, or nationalities.

This, then, is the way in which this new factor has power to change the nature of the struggle for existence:

Until humanity appeared, organic progress could only be attained when each individual, variety, race, and species fiercely and ruthlessly contended against others for the largest share in the supplies

and opportunities provided by unaided nature. For the inexorable conflict between the narrowly limited conditions on which life depends and the blind drift of the interactions between the materials and forces of the universe could, *until then, only be met* by the powers and resources inherent in life, through changes in organization arising by variation. (See Chapter I, paragraphs on variation, and Appendix, Note IV.) But through co-operative industry our race has power to alter this blind drift, and by science it can anticipate with such a close approach to accuracy the results of the changes it has the power to produce, that by these means our race would be able, if it was but united and willing, to multiply and improve the supplies and opportunities provided by unaided nature, to such a stupendous extent that the greatest possible advantages that can now be won by the most highly favored individuals, classes, and nationalities, through conflicts with others, appear insignificant by comparison with the grand results attainable for *each and all* through peaceful, voluntary, sympathetic co-operation under the guidance of scientific foresight.

The struggle for existence, if that phrase is applicable to the society of the future at all, can therefore not permanently continue to be dominated by personal, class, or national interests, but must be directed towards the attainment of universal welfare, of higher conditions for all mankind. Fierce, brutish,

or selfish and cunning conflicts for procuring individual, class, or national advantages are therefore excluded, and must necessarily be superseded by the earnest efforts of each to be of utmost service in producing conditions which shall be most favorable to the highest and happiest lives of all the race.

Instead of "every one for himself, no matter what befalls others," which is the spirit of the old style struggle for existence, the new struggle will be to excel in promoting the general welfare of all.

And this is the way in which the tendency of natural selection and of the traits which are fittest and which therefore determine individual and type survival will be altered: personalities in which passion or selfishness overbalance the sense of justice, such as are animated by sordid, ambitious aims, although prepossessing in speech, manner and appearance, although forceful, tactful, and cunning to a high degree, although surrounded by artificial glamor of sanctity or benevolence, although controlling power, wealth and influence, will not as they are now, be naturally selected in the society of the future by the sexual, social, conventional and governmental environment. On the contrary, such persons will be sifted out, eliminated, for they can only hinder and retard the higher progress of humanity. But characters suited to universal, consciously sympathetic co-operation will be preserved and multiplied, for they are needed for the general welfare.

And this is the new goal toward which the progress of the universe is tending: life and consciousness will not remain mere haphazard incidents in the blind drift of the interactions of its forces and materials; but the force inherent in life's highest type, viz., in our moral and intellectual race, will by loyal industry, genius, co-operation, and science so regulate and direct these interactions that they must bring life in general nearer to a realization of the purest and highest ideals of truth, justice, happiness, beauty, etc.

Wider recognition of these fundamental truths will not be without some influence in bringing about the change in conditions which they suggest. Primarily will it in time produce so widespread and deep an aversion to and condemnation of the immoral aims and methods of the false type, and such devoted support of those of the true, as to influence social and sexual selection favorably to the true and against the false.

Thus the true will tend to increase in numbers and influence and the false to diminish.

Nor are other agencies lacking which favor this change. It is furthered by every factor which tempers the harsh contrast in opportunities for desirable lives which now exists between the masses of humanity generally employed in arts, trades, and occupations which make the earth habitable and beautiful, and that small minority which possess and amass wealth, power, and privilege without

rendering equivalent beneficent service to the general welfare. Prominent among the agencies here referred to are heroism and genius.

While the word "genius" is not specially subject to misinterpretation, the expressions "hero" and "heroism" have been so indiscriminately used in literature and common parlance that the sense in which they are intended above must be explained. They refer exclusively to unostentatious acts and persons which are remarkable for courage, patience, etc., in self-abnegating devotion to truth, justice, liberty, to the relief of suffering, the reform of wrongs, or to some other pure and noble ideal.

Practical illustrations of this would undoubtedly prove enlightening. But their selection must be left to the discrimination of the reader. For it is hard to find accounts of truly heroic acts and lives that have not been distorted by prejudice, sycophancy, and incompetence.

But how *genius* may affect the currents of history can be comprehensively illustrated by reference.

During the period of more than a thousand years which is frequently distinguished as "the dark ages," the system of control, which is symbolized, so far as physical force is concerned, by the armored knight, and in matters relating to intelligence and morality by the infallible Church, ruled over the souls and bodies of miserable humanity with inexpressible severity. Then human genius invented gunpowder, printing, and the compass. Before these

inventions four armored knights had been more than a match for as many hundreds of the common people. After that they were not. Before then, thinkers, scientists, moral enthusiasts, reformers, etc., had hardly the least chance of influencing the masses of humanity, as against the overwhelming, insidious, highly organized power and authority of ecclesiasticism and feudalism. The art of printing gave them that chance. Before this, the oceans, to the mariners, had been trackless, terrible labyrinths; thereafter they were wide open roadways, leading directly from and to every point on the continents adjoining them. And how wonderful are the results of these three triumphs of human genius!

Within less than two centuries they produced an enormous expansion in humanity's knowledge and ideas of the surface of our earth, also in commerce, industry, art, literature, etc. Then came the discovery of America and the reformation of Luther, the revival of learning, and simultaneously *in a few decades* an amount of improvement in the physical, mental, and moral conditions of mankind far greater than that accomplished in the more than 1,000 years preceding. Then within the last 130 years the American and French revolutions have occurred, also the independence of the Spanish American colonies; the introduction of constitutional instead of autocratic government in most of the European nationalities; and in nearly all civilized countries a larger degree of freedom of religion,

press, and speech; also, the nearly universal abolition of chattel slavery; further, the nationalization of Greece, Italy, Germany, and such a general uplifting, such striving for justice, human rights, human dignity, brotherhood, and higher ideals, that by the side of it the noble achievements of even primitive Christianity, before Constantine and the Church transformed it into a tool of despotism, seem less important.

This, however, warrants no sanguine expectations of great improvements within a few brief generations. It is merely an indication of a tendency to *ultimate* results, deduced from the facts and principles of science brought out in these essays and *supported by an historic reference*, but the author is not aware of the existence of any considerable collection of reliable data whereon an estimate of the time within which this change from forcible rule by the false to beneficent guidance by the true could be based. With reference to the present and near future, it is plainly in evidence that at all important centers of population the false type is highly organized and firmly entrenched in the control of military and civil government and of financial and economic resources, and through these of the conditions under which persons not born to wealth, power, or influence are forced to earn their living.

With the battle-ship, the heavy rifled cannon, the machine gun, etc., the disparity between the few

in power and the masses has been increased; and the means for molding the intellectual and moral faculties, viz., school, church, press, platform, literature, etc., are rapidly passing under the control of those who although they possess great political, economic or ecclesiastic, etc., resources, can not be held responsible for the evil or good use they choose to make of them.

Judging, furthermore, the future by the past, it may be taken for granted that whenever such a course promises success in terrorizing the masses of humanity into continued submission to the rule of the false type, the latter will not hesitate to employ all the vast powers it controls in the destruction of life, genius, heroism, and property.

## SUMMARY

The tremendous structural defects from which the earliest upright brute ancestors of man suffered in the struggle for existence, and the fact that these were all produced by the change from the horizontal to the upright attitude, were discussed in the first chapter. Incidentally, some fundamental principles of biology were briefly explained, to remove the risk of error which might otherwise arise from their popular interpretations.

How the two anatomical variations referred to in the title as "The Physical Basis of Civilization" inexorably produced the upright attitude was told in the second chapter. Also the bearing of panmixia upon the gradual but steady improvement of all distinctly human traits, and it was demonstrated that nothing besides conduct guided by intelligence could have saved the race from extermination. The reasons were next given why an enormously long period was required to account for the growth of the brute sense of our earliest upright ancestry into that superior intelligence which the first artificially armed men must have possessed.

Two objections, heretofore current in literature, against this last conclusion were then discussed with such thoroughness and impartiality as the

author was able to bring to these subjects, and were found to be without foundation in fact or sound reason. It was explained why conduct in general is the *all-important factor* in the survival of man, and yet of such *very slight significance* to brutes below him.

In the third chapter, three causal agencies and several remarkable combinations of circumstances were cited, which have, in co-operation with variation and natural selection, produced an inexorable tendency towards the steady improvement of human intelligence.

The fourth chapter was devoted to a demonstration of the proposition that even intelligence could not have saved the upright ancestry of man from extermination unless its pregnant females had resorted to self-concealment.

The origin of family relations, of the economic dependence of woman, and of the home were the subjects of the fifth and sixth chapters. It was here explained how even concealment of the pregnant females would have been insufficient to save the race from extermination if the support and protection of females and young during the reproductive period of the former had not been undertaken by the adult males.

In the seventh the conclusions reached in the earlier chapters were briefly summarized, and it was found that family relations, monogamic marriage, economic dependence of woman, and the

institution of the home, all had their roots in the physical defects alluded to in the first chapter.

In the eighth chapter it was made clear how the conditions mentioned in earlier chapters inevitably produced a radical differentiation in habits and character along the sex line.

In all these eight chapters the argument was limited to conditions existing before man had learned to arm and warm himself artificially. In the ninth chapter it was pointed out that the two different types of race character mentioned in the eighth are properly distinguished as the "true hereditary" and "false exceptional"; that an era of new conditions must have begun when man armed himself artificially. In the antecedent period only the rigorous natural selection of men of the false type could have saved the race from extermination; in the subsequent era man's supremacy on earth was so absolutely secure that the false type found little opportunity for employing its special destructive faculties, except in activities highly injurious to the peace, welfare, and progress of the race. It was shown that this circumstance led to introracial warfare, to the first formation of groups and hordes.

In the tenth chapter attention was then called to the true hereditary character of the human race as a new factor in the universe and to its wonderful achievements. It was pointed out how this new factor ultimately has the power of turning the blind

drift of the forces and materials of the universe into a definite direction towards the attainment of the purest and highest ideals of truth, justice, beauty, and happiness, although up to this present age this tendency has been desperately hindered by the predominance of the false type in nearly all human affairs.

To this extent have the expectations held out by the title been fulfilled: mental, moral, social, economic, and rudimentarily political conditions, which are among the constituents of civilization, have been traced to two anatomical modifications. Possible doubts whether the more complex modern phenomena, belonging to these same categories, are likewise indirectly traceable to these same anatomical modifications should be removed from rational minds on remembering that these complex modern conditions could not possibly be just as they are to-day unless the conditions preceding them, which have in these pages been traced to these anatomical modifications, had been just as herein traced.

To show this in detail for these modern conditions belongs to works on the recent phases in the development of civilization, and not to an essay on its physical basis.

Here, then, excepting only the important supplemental matter contained in Appendix Notes, this work comes properly to an end.

Feelings, emotions, sentiments which naturally in

ordinary life play so large a part in the vital problems with which this book is occupied, for the sake of accuracy have been rigorously excluded from its pages.

Since the discussion has come to an end and since the conclusions and inferences reached can not possibly be affected by these closing words, therefore is it surely excusable, if just before the reader and the writer finally part company, one last thought is indulged between them, which ramifies into the region of emotion and sentiment:

While the devotees of the physical sciences patiently labor through the centuries to unravel from the dense tangle of experiences a truth or a fundamental principle here and there, the poets of the true race character, who were formerly called inspired prophets, discover them by the aid of their deep and tender sympathy, through intuition: as in the following four stanzas from Longfellow's "Arsenal at Springfield."

Were half the power that fills the world with terror,
  Were half the wealth bestowed on camps and courts,
Given to redeem the human mind from error,
  There were no need of arsenals or forts:

The warrior's name would be a name abhorred!
  And every nation that would lift again
Its hand against a brother, on its forehead
  Would wear forevermore the curse of Cain!

Down the dark future, through long generations,
  The echoing sounds grow fainter and then cease;
And like a bell, with solemn, sweet vibrations,
  I hear once more the voice of Christ say, "Peace!"

Peace! and no longer from its brazen portals
  The blast of war's great organ shakes the skies!
But beautiful as songs of the immortals,
  The holy melodies of love arise.

# APPENDIX

# APPENDIX

## NOTE I

### ON ARTICULATE SPEECH AS A CAUSE OF THE ORIGINAL SUPERIORITY OF HUMAN INTELLIGENCE

Mental states, such as fear, caution, anger, pleasure, love, desire, etc., cause brutes to utter sounds which imply the conditions of mind that provoke them and tend to reproduce them in those who hear these sounds. But broadly speaking, there exist only habitual and conventional relations between the sounds of *articulate speech* and whatsoever they symbolize. A speaker's manner, intonation, pitch of voice, may indicate his mental state. These, however, are merely incidental concomitants partaking of the nature of brute language, and *not parts of articulate speech.*

The latter is a conventional combination of purely arbitrary sounds which by agreement and habit have come to signify similar manifestations in the consciousness of many human beings. Before such speech can make a beginning agreement, therefore, must have been established between a considerable number of persons as to matters present in the con-

sciousness of a speaker whenever certain combinations of these sounds are uttered. The agreement must extend over a considerable range of experiences. These must have gone through the process of being segregated, compared, distinguished, correlated, and remembered. The faculty to select and interpret the *appropriate* arbitrary terms from the ill-assorted supply available when they are uttered must exist in a number of persons. This is obviously *not possible until after higher intelligence exists.*

Besides, knowledge is the material with which intelligence is occupied, and can only be originated by direct intercourse with the environment, *never by language.* Language can *transmit* the experience of one mind to another, *if* that other has had similar experience. A large variety of fairly specialized knowledge, therefore, must exist before articulate language can be of any use. From which it follows that higher intelligence must antedate articulate speech, and that the latter could not have been its cause.

Yet can there be no doubt that articulate speech is an admirable agency for distributing knowledge, for exciting, stimulating, and directing the activities of the mind. It is almost the only means for comparing the knowledge possessed by different individuals, and for eliminating errors arising from personal idiosyncrasies.

The facility with which the arbitrary terms of articulate language can be separated, combined,

and transposed has probably aided the development of imagination, inventiveness, and of mobility and plasticity of mind. The habitual association of parts of knowledge with arbitrary fixed language symbols has no doubt strengthened memory and made conceptions more definite and less transitory.

But this wonderful human language has not been without evil consequences. The confusion of mind, the disuse of the human faculty for independent thought, the consequent deterioration of this faculty in many persons, may be charged to some extent to *a language out of relation* with the parts of knowledge it symbolizes. Such mental conditions leave *wide openings for the admission of error* in the passage from knowledge to expression, and in the transit from impression to representation in consciousness. They tend to a habit by which language *heard or seen* lodges in memory *without producing a realization* in consciousness of the experiences to which it alludes.

Thence arises the tendency to vapid repetitions void of earnestness or vitality of phrases and *without a realizing sense of their meaning.* This explains the existence of persons whose sensibilities are tickled by the mere sounds of words, but whose minds are callous to truth, sincerity, and accurate meanings. Persons so constituted easily become dangerous tools of ambitious, bold and unscrupulous schemers.

## NOTE II

### ON MEMORY

One becomes aware of memory when fainter repetitions of former experiences arise in the mind, seemingly disconnected from the causes which primarily produced them. For instance, suppose the sounds of a church bell are heard ringing on a summer evening in a meadow surrounded by hills. The sensations of sounds heard, of sights seen, of soft breezes fanning the checks, of fragrance in the nostrils, are directly connected with the causes which then and there produce them. After some days suppose a witness of this scene wishes to describe it to an evening party of friends. Faintly the sensations arise again in his mind, seemingly disconnected from the causes which originally produced them some days before. No church bells are ringing, yet faintly in his mind he is aware of their sound. No landscape of meadow and hills glowing in the sunset greets his eyes in the artificially lighted room where he is speaking, but within his mind arises again a faint likeness of the scene he wishes to describe. No flowers are in the room, yet as he describes he seems to experience a faint semblance of their fragrance, and a feeling of well-being and con-

tent, similar to that felt on the evening when he witnessed the scene, again comes over him. This we call memory — our recollection or remembrance of those experiences.

Whence and how, apparently disconnected from the causes which produced the primary impressions, do these manifestations *arise again* in the mind? To find an answer to this question, consideration must first be given to the problem of how the real causes produced the primary impressions.

The sound waves from the vibrations of the bells affected the auditory nerves. The vibrations of light transferred by meadow, hill, sky, landscape, to the invisible ether were by this transmitted to the nerves of sight. The infinitesimally small particles of odorous matter exhaled by flowers, etc., into the atmosphere affected the olfactory nerves. The motions of the breeze reacted upon the nerves of touch located under the skin of the face, neck, and hands, and all these reactions affecting the nervous system as a whole caused the general feeling of well-being and content. It is obvious, then, that original experiences were produced by external causes acting on nerves.

But this does not explain how the subsequent fainter repetitions arose in the mind of the speaker, after the external causes had for many days ceased to act on his nerves. This mystery cannot be explained except by one hypothesis: that when the external causes were producing the original experi-

ences, they simultaneously effected *alterations* of a more or less *permanent* nature in the organism of the witness, and that, so long as these alterations remain, whenever a current force moves through these altered parts then it is modified because of *the existence of these alterations* in such ways as to reproduce in consciousness a more or less vivid repetition of the original experiences.

An analogy may prove helpful. Suppose two people conduct a conversation in presence of a phonograph. This instrument has a cylinder with a covering sensitive to sound waves. By some mechanism the cylinder is made to revolve while the conversation is in progress, so as to present, from moment to moment, a succession of different parts of its surface to the sound waves. The sound waves produce *permanent* marks on the surface of the cylinder, and when *thereafter* it is made to revolve, these marks cause sound waves to arise which reproduce the words and the peculiarities of the voices as they were in the original conversation, only modified by the imperfections of the instrument. The repetition of the conversation by the instrument would be *impossible unless the sound waves from the original conversation had left permanent alterations (markings) on the cylinder.* If the marked cylinder is taken out of the machine and one which has not yet been used is substituted, would it not be preposterous, as well as impossible, to imagine that any sound of the conversation before mentioned could become audi-

ble thereby, even though the cylinder was revolved forever and ever?

Leaving analogy and applying the same line of reasoning to our problem, it follows that memory depends on the peculiarity of the nervous system referred to in the first paragraph on page 75, Chapter III, without which it would be inconceivable, if not impossible.

Two other hypotheses to account for memory have been current. The first differs from the one above detailed, in that it supposes the alterations or markings to occur in the tissues surrounding the nervous system. This can hardly be maintained in the absence of evidence to sustain it.

For it is an obvious fact that the external causes act *directly* on the nerves. If they act at all on the tissues surrounding them (and this is so far not known), they can only do it indirectly. This can, therefore, not claim to be more than a mere guess.

The other may be described as follows: From each *kind* of external causes the impulses are transmitted to special nerves located in special parts of the body, and these nerves are specialized to receive impressions of that kind only. *By this hypothesis*, do these impulses produce no permanent alterations or markings on these nerve-cells. But because these cells are specialized to this class of phenomena only, therefore whenever a current of energy passes through them then the sensations which distinguish that

special kind of external cause are revived, and this is supposed to account for memory.

If this is true, if the external causes do not alter or mark the nerves which are specialized to their service according to this conjecture, then why could not these nerves cause the experiences which distinguish the external causes to which they are devoted, *before* they have been acted on by them? By the hypothesis they are the same before as after. What need, then, for experience, education, study? Let a current of force flow at birth through the infant's nerve-cells and it will at once possess all the wisdom and general ability that a lifetime could possibly give. What strange, absurd hypotheses may pass current while they remain unchallenged!

## NOTE III

### ON ALTRUISM

The support of brute-woman by brute-man, which was discussed in Chapters V and VI, seems to constitute the first instance of *conscious human altruism.*

The love of the mother for her child has frequently been upheld as the original and highest form of altruism in nature. But is it? Altruism has been defined as "devotion to others." Surely the mother is devoted to her child, and the child being another, this is a true form of altruism. But with reference to time, is it the first? Evidently not. For in sexually reproducing creatures before a mother can have a child, the child must have a father. As shown in Chapters V and VI, the human father made efforts to provide for the mother before the child was in existence, and the mother with reference to the father being *another*; this constitutes a form of altruism antedating the mother's devotion to her child.

So far as it is possible to know, this must have been the first form of *conscious human altruism.* Which of the two is the higher form? By which criterion can conscious altruism be graded as higher or lower? Obviously by motive. What is the motive

of the mother's devotion to her child? Can it be called motive at all? May it not be described as purely instinctive? Up to the time of birth, the child is within the mother's body. Her devotion to it during that period can hardly be distinguished from self-devotion. Then, when the child's internality changes to externality, the devotion to it is a continuation of the former feelings, therefore hard to distinguish from instinct. It must necessarily grade very low by the criterion of motive. How was it with the devotion of brute-man when he provided for the necessities of his female mate? It cannot be denied that originally male and female were attracted to each other by reproductive instinct. But, as has been illustrated in the foregoing chapters, there grew up, during the long months of comradeship, from intimate acquaintance, laboring, rejoicing, and suffering together, a fellow feeling unavoidable under such conditions between natures susceptible to it and closely akin. The high development of this trait in later times is evidence that the susceptibility to it existed from the first. Then when he brought food to the woman in concealment who can say that fellow feeling *was not the most powerful* among the complex motives of brute-man?

If it be asserted that the desire to indulge the reproductive instinct was the sole motive, the answer is, that this *could not be so*, because, at that period, females will not submit to it. Man's ancestors, during the era here referred to, were nothing

more than intelligent brutes, and no female brute will permit the male to indulge at such a time (last stages of pregnancy). This is a rule almost without exception among wild brutes. That it is different with some men now living in civilized communities is no reason for believing that anything like it occurred with brute-man. Indeed, that which now sometimes does take place between men and women is obviously the result of civilization. For, during many generations, civilized women have abjectly depended on the men who supported them for a mere chance to live. Many such men have sexually selected their consorts with sole reference to abject submission in this matter of intercourse. How could the well-attested greater rarity of this kind of abuse among savage people be otherwise accounted for?

It appears, then, that fellow feeling and sympathy were present, if not predominant, among the complex motives which induced the devotion which the human male-brute displayed when he provided for the needs of his female consort in concealment. This constitutes a true case of conscious altruism, and ranks higher, by the criterion of motive, than the mother's devotion to her child. As to priority in time, and superiority in motive, does the devotion of the lover to his bride outrank the mother's love for her child?

This conclusion, however, would not justify an inference that the complex, refined, and evolved

altruism of the women of to-day is inferior to the average altruism of men of the present age, but it would support the opinion that in its original undifferentiated form the altruism of the human male-brute would be more readily transformable into the intellectually initiated higher forms of this tendency, such as devotion to high principle, to justice, to truth, to classes, foreign nations, humanity, to life, in general to

> That thread of the all-sustaining beauty,
> Which runs through all and does all unite.

And it seems that the consensus of historic and contemporary experience supports this view.

## NOTE IV

### A SEARCH FOR THE ORIGIN OF LIFE, SEX, SPECIES, ETC.

Because it is inconceivable, the idea still found in text-books that matter attracts matter has been abandoned by many modern physicists. They explain motion as the result of propulsion. Though the cart is behind the horse, yet is the latter not said to pull, but to propel it by pushing against the straps of the harness. The hand when stretched out to pull a thing towards the body, as it is now expressed, really pushes it or a part of it, and the rest of it, by its cohesion with that part, is made to follow in the direction of the push.

To illustrate how attraction seems inconceivable, let "A" be one mass of matter and "B" another. Then as commonly understood "A" attracts "B," and vice versa. In the effort of realizing this notion in mind, and complete mental realizability is the test of conceivability, one is limited to imagining the extension of some part of "A," intangible and invisible though this be, towards the far side of "B," or vice versa, and then the foreshortening or contracting of the extended part causes "B" to approach or meet "A," or vice versa. The cause of this effect is called attraction. Such a proceeding,

however, with reference to atoms, molecules, or masses, is too absurdly anthropomorphic to be entertained in a rational mind. The idea of propulsion which implies contact somewhere, and the transmission of energy thence through an unbroken line of matter to the point of meeting, has the advantage of being rationally conceivable. Attraction, then, being inconceivable and propulsion the only possible other cause that can be assigned in explanation of motion, it would seem that it must be accepted as the universal cause of motion or change. Thus the query arises, Where and what is the source of the ubiquitous propulsion?

The general evidence of all things leaves a deep impression on the mind that the matter in the universe is in continuous commotion. The very nature of all our consciousness proves the truthfulness of this impression. An absolutely unchanging consciousness is impossible. We are unconscious when no changes occur in consciousness. We only become conscious when consciousness changes. And since the world to us exists only in consciousness, and since consciousness, as above pointed out, is invariably consciousness of change, and since all change, in the last analysis, is some mode of motion, and since matter is that which moves, therefore it follows that it is an implied universal dictum of all experience and a part of each and every manifestation in consciousness that the matter in the universe is in continuous commotion. From this

it follows as a corollary that the motion of each particle[1] and mass is directly conditioned by its collisions with surrounding particles and masses, and indirectly by the collisions of these with others surrounding them, and, next in order, of the collisions of these others with still others, and so on, ad infinitum, until in an unending series all particles and masses in existence are included. Since this is an inevitable inference from the universal dictum of all experience and of a part of every experience, and since the reliability of any fact or dictum of consciousness is in direct proportion to its universality and ubiquity, therefore does this proposition possess the highest possible degree of reliability.

From the facts of crystallization, it seems an inexorable inference that the ultimate particles of every substance have a certain shape peculiarly their own, which, or a compound of which is shown in the form of the crystal. The ultimate particles must also occupy a fixed amount of space each and possess a positive amount of mass, or else specific gravity would be inexplicable, if not impossible.

These considerations involuntarily almost produce a leaning of the mind towards the belief of the ancient alchemists, viz., that all the various kinds of elementary substances are merely differently

[1] In this essay the word "particle" is used to signify atoms, molecules, and small individualized concentrations of matter, such as are often referred to as specks, grains, corpuscles, electrons, etc.

conditioned manifestations or states of one original unconditioned universal material. Since science has established a parallelism in the equivalence and transmutability of all the different kinds of force and energy in the universe, this view commends itself the more, and this equivalence and transmutability points obviously to a common origin in that universal reservoir of all force and energy: *the general commotion of all things.*

From these facts and arguments it follows, firstly, that every kind of particle must be endowed by the universal commotion with a kind of kinetic and potential energy peculiar to it, *its own* — the result of its peculiar shape, size, and mass when acted on by the universal commotion. For convenience, this peculiar motion of each element will hereafter be designated as its *proper motion.* Secondly, that the proper motion of every kind of particles or masses must differ from the proper motions of every other kind, and that this difference must be homologous to the difference in form, bulk, and mass existing between the particles and masses. Thirdly, that, provided these particles do not change their form, bulk, or mass,[1] these differences must remain

[1] If future observations and experiments should confirm the lately reported transformations of the so-called element uranium into helium, lithium, radium, etc., then on the hypothesis that the so-called chemical elements are variously conditioned manifestations of a universal, originally uniform matter, these changes might be interpreted as arising from modifications in the form, bulk, or mass of the ultimate particles of uranium. These atomic modifications again might be explained as arising from the unbalancing and consequent rearrangement of the

the same in kind throughout eternity. Fourthly, that the actual amount of motions existing in each particle or mass are subject to alterations from moment to moment from the incident force of the universal commotion, and from changes this produces in the relative locations, including distance and angular bearing, of the most minute as well as the larger integers of matter, both those closely and those remotely surrounding each particle or mass.

These proper motions of each kind of particles must in infinite time, among dissimilar motions of dissimilar particles and masses of infinite variety, tend to a progressive concentration of like particles with like and to their dissociation from unlike. It is worth while noting, as a preliminary to further explanation, that this inevitable inference from the most universal and ubiquitous dictum of all experience, viz., from the universal commotion of all things, is identical with the definition of the law of evolution as expressed by Herbert Spencer, in that it predicates a concentration of matter, with con-

interatomic forces within the portions of this co-called element, which have been under laboratory observation. This unbalancing might be accounted for by the environmental alterations, purposely provided by the experimenters. These alterations would obviously be competent to change the incident force of the inherent attractions and repulsions existing, firstly, between the particles of the so-called element; and secondly, between these and the particles of other substances in the environment. The existence of uranium in nature, in its turn, could be accounted for by the equilibration in times immemorial of its interatomic forces, with the atomic forces in its environment, which had remained undisturbed until the experimenters disturbed it by their experiments.

comitant dissipation of motion, by which all matter and force tend to progress from an indefinite and incoherent homogeneity to a more definite and more coherent heterogeneity.

A seeming exception, which however is not real, from the tendency of like particles to concentrate with like, and dissociate from unlike, must now be noted. If the sizes and shapes of several kinds of particles so differ that the form and size of each kind is complementary to the forms and sizes of the others, in either the proportion of one to one or any other proportion, then, cæteris paribus, will the tendency to concentration of each kind by itself be overbalanced by the tendency of each to concentrate with the kinds complementary to it. To illustrate: Let the particles of a substance "A" be globular. They would then tend to concentrate in masses of scalloped exterior. Then let the particles of another elementary substance "B" have the form and size of the interstices left between the particles of "A" when concentrated by themselves. And it is obvious that, in the general commotion of all things, the tendency to concentrate "A" particles with "B" particles would prevail over the tendency of the "A"s to concentrate exclusively with "A"s and "B"s to concentrate exclusively with "B"s. For both "A" particles and "B" particles in accidentally meeting would only be following the lines of least resistance and greatest traction by sliding into the interlocked positions towards each other,

which complementariness of their shapes and sizes suggest. In this interlocked position, they would offer a much more effective resistance to disturbance or separation by external influences than when each kind is concentrated by itself. Various kinds of so-called chemical affinities might be explained on this principle, and it is immaterial whether for the purpose of such explanation it is assumed that the forms of particles are derived from the forces inherent in them, or vice versa.

Each fresh impulse imparted from moment to moment by the general commotion must disturb, and therefore delay, the concentration in orderly masses which the proper motions of the particles of each substance tend to produce, as above explained. Since the actual motions of any particle are the results of both the tendency to concentrate and of the hindrance which this undergoes, as above explained, therefore can the proper motions not impart a direct but only an indirect impulse towards concentration of like with like and separation from unlike.

Since masses composed of like particles are called pure, and those which are otherwise are called impure, therefore it follows that the occurrence in the natural course of events of perfectly pure substances must be exceedingly rare, and therefore that most masses of matter possess a degree of impurity which leaves a large margin for improvement in purity, and that the degree of this purity

depends, cæteris paribus, on the lengths of the period during which the particles of a mass have exercised their proper motions, and on how much during this period these motions have been free from the hindrance or disturbance above pointed out which arises from the continuous reactions with the universal commotion. Let the reader note in the above the remarkable parallelisms between proper motions and heredity, between the disturbance of the tendency to concentration by the universal commotion and variation; also how the relation of each particle and mass to the universal commotion recalls those relations between organisms and their environments which are the basis of natural selection.

It must now be impressed upon the mind of the reader how the inevitable outcome of the universal commotion, which, as pointed out above, is the broadest possible dictum of all experience, and which, therefore, possesses the highest possible degree of reliability, is exactly identical with the process of evolution as interpreted by Herbert Spencer and other profound leaders of thought. For this outcome is: "A concentration of matter" (like particles concentrating with like) "with concomitant dissipation of motion" (the motion necessarily dissipated in the process of concentration by the like particles is not lost, but imparted by them to the unlike particles, from which they have been dissociated and which carry it off, dissipate it),

"during which the matter progresses from an indefinite, incoherent homogeneity" (in plain language, an intimate, intricate, undistinguishable mixedness of like with unlike through the mass), "towards a more definite, more coherent heterogeneity" (in plain language like particles concentrated by themselves and therefore en masse distinctly different from the other masses formed by similar concentrations of other kinds of particles by themselves).

### ORIGIN OF LIFE

According to the order of sequences in this process of evolution, and according to the axiomatic truth that the originally undifferentiated must be the antecedent of the differentiated; the formation of masses of any particular kind of matter must always precede the orderly arrangement of its particles in any kind of concentrations, such as crystals, granules, clusters, cells, histoblasts, nuclei, etc. The difference in time may, however, be very small, as, for instance, between the formation of a saturated solution and the beginning of crystallization. Applying this rule to the materials and phenomena of life, it follows that the formation of protoplasmic masses must have preceded the formation of the most primitive living units, such as histoblasts, not to mention the more complex and therefore later concentration, such as cells and their varying component parts, nuclei, nucleoli, etc.

Before these wonderfully complex protoplasmic

combinations could be formed, the conditions existing in that part of the earth where the periphery of the denser interior globe adjoins the lower surface of the atmospheric envelope must have included all the prerequisites for the original formation of these compounds out of their elementary constituents. Science, so far, has not ascertained what these prerequisites were.

This is not at all surprising, for ever since humanity has existed, and long æons before science was born, living organisms have always been present as active factors in the process of the formation of protoplasmic compounds. Although, therefore, these prerequisites cannot be exactly stated, it is yet well known that temperature, atmospheric pressure, and the influence which these two exercise over the kinetic activity of so-called chemical affinities, were among the most essential.

Since even in its higher forms, which are enabled by their organization to resist environing influences, life cannot continue at temperatures or atmospheric pressures either much higher or much lower than those ordinarily prevailing in the present era between the equator and the polar circles — since the cooling of the earth, which is still going on, must have been continuous ever since our planet ceased to be a fiery liquid globe with a vaporous envelope; therefore it may be stated with entire confidence, that before the formation of any protoplasmic compounds whatsoever, the crust of the earth had cooled to

solidity and had been in this condition long enough to permit oxygen and hydrogen to combine, and some of the vapor of water to liquefy. It seems also very probable, from their atomic weights and from the temperatures at which they liquefy, that some of the compounds of the class of substances now to be mentioned, viz., calcium, phosphorus, potassium, sodium, sulphur, etc., which will hereafter be referred to as secondary elements of life were, at that time, in the gaseous form, present in combination with either one or several of the elements next to be named, viz., oxygen, hydrogen, nitrogen, carbon, which will hereafter be distinguished as primary elements of life; while others of these compounds, as oxides, acids, and salts, were held in solution by the portions of water which had liquefied from its previous vaporous mist or steam condition.

In the form of living organisms (plant and brute), and of the remains and products of these, a vast quantity of material is now present on the surface of the earth, and in the water which covers it. By far the largest part of this in weight and bulk consists of the primary elements of life in various combinations. All this just before life began must have been a part of the atmosphere; so must also have been the water of crystallization contained in many minerals; also of the water now existing as ice and snow near the polar regions and elsewhere on high mountain ranges and plateaus: also of most of the water now in the oceans, lakes, rivers,

etc. The depth and pressure tension of the atmosphere must therefore have been incomparably much greater at that time than it is found now. Beyond this it is hardly worth while to speculate until present knowledge has been largely expanded along this line.

The earth's atmosphere must obviously have passed through all intermediate grades of temperature, pressure, and kinetic energy of chemical affinities during the period in which it was gradually falling from the greater intensities which existed before life, to those which have prevailed since then. Within this series of intermediate degrees there must obviously have occurred one, at least, which was the very one in which temperature, pressure, and kinetic activity of chemical affinities provided the *exact equivalents of the presence of living organisms* in the formation of protoplasmic compounds, and by which the same results could therefore be accomplished. Otherwise there could not now be, or ever have been, any life on earth. This is about as near as knowledge can at present come to the place, time, and conditions where and when non-living matter first passed into living.

While the above leaves much uncertainty with reference to many important factors in the problems of the beginning of life, it settles one point, viz., that the quantity of protoplasmic compounds (life substance) formed in the earliest period depended entirely on the amount of suitable material

on hand within the area where the conditions prevailed, which were crudely outlined in the foregoing paragraph.

Before considering the origin of cells and of the differentiation of these into somatic and reproductive, it will aid comprehension to give some attention to the nature of the elementary substances which contribute the greater part of the material and energy exhibited by life and its products. Oxygen, hydrogen, and nitrogen are chiefly distinguished by the enormous excess of kinetic and potential energy which they retain at the lowest temperatures which have occurred since life began on earth. This enormous reserve power contained in each ultimate particle of these substances is highly suggestive in connection with the nature and processes of life.

It is clearly the competent cause of those multifarious movements and changes which distinguish living organisms in their simplest and smallest parts, and even more in those larger complex organs and tissues produced by the combinations and recombinations of cells in an apparently infinitely progressive ascending scale. It is also a sufficient reason, in connection with assimilation, secretion, and excretion, of all those changes which occur in any living individual, beginning with its birth and ending after death with complete dissolution. Included in this series are the phenomena of consciousness, thought, feeling, emotion, and conduct.

The element carbon plays an important part in the composition of living substance. In atomic weight it stands close to the three elements just mentioned. It differs from them in being a solid at very high and very low temperatures. Its combinations when they are parts of living organisms are then also the more or less metamorphosed products of such, and found in either solid, liquid, or gaseous form. Thus the pre-eminent adaptation of this element to serve as a means of giving some degree of temporary stability to the combinations formed with it by the other three above mentioned is made evident.

The whole group of secondary life elements are adapted to serving a similar purpose. The mere addition, however, of this group is very important, for it greatly increases the possible number of variations in new combinations. The vast extent of the increase thus effected can only be appreciated when it is considered in how many ways the properties and affinities of these elements of the secondary group differ from those of the primary.

How suggestive of the infinite protean variety of forms of life is this infinite mobility of three elements, joined to the possibility of temporary stability added by the fourth and by the secondary group.

The atoms, molecules, and compounds of such extremely mobile substances must be exceedingly sensitive to the slightest alterations in the incident

force and direction of chemical affinities, whether these originate within or without the masses of which they are parts.

From instant to instant the movements within each aggregate produce innumerable differences in the distribution, locality, and distances between the atoms, molecules, etc., within them, and therefore in the force and direction of the affinities and repulsions exercised between them. The universal commotion does the same for the environing atoms, molecules, masses, etc.; and since these two, the separate and the universal, motions continuously interact with each other, therefore must the infinitely great tendency to enter into new combinations and to break away from the old, experience infinite multiplication from moment to moment. This tendency is limited, however, by the power which originates it, viz., the sum total of all internal and external affinities and repulsions which act on any separate unit.

So long as these new and old combinations retain within certain limitations of quantitative variability the essential properties of living substance, so long may they be classified as such.

When, as for instance in ivory or mother of pearl, through the quantitative predominance of carbon and of the secondary elements of life, the mobility for purposes of chemical changes or interior motions is almost nil, or when, as for instance in swamp gas or ammonia, sulphureted hydrogen, etc., the exces-

sive internal energy in the preceding stage has caused some atoms and molecules of both the primary and secondary group of elements above named to fly apart beyond the reach of the sum total of all the affinities within the mass of which they were a part, then they may be said to belong to a class of substances intermediate between living and non-living.

Between these two outer limits living substances may be said to be continuously changing their chemical and structural compositions, and simultaneously their state of aggregation. Thus the gaseous portions tend unceasingly to condense into liquids. The liquids, while continuously passing into the gaseous state, are likewise constantly solidifying. The solids are unceasingly being resolved into liquids, etc. These changes are accomplished by the before-mentioned continuity of the process of balancing and unbalancing of attractions and repulsions.

Could the most extravagant imagination of the author of the Arabian Nights have invented conditions so wonderfully favorable to the production of an infinitely protean variety of forms which simultaneously serves as a means for successfully defending life against the danger, to which it is continuously exposed, of being destroyed by the tendencies antagonistic to its processes residing in the environment? This defense is obviously accomplished by the power of producing an infinite variety

of new forms which is inherent in life. For in an infinite number of varying forms the probability is infinitely great that some will be found better adapted than others. Therefore as quickly as a form of life meets with destruction on account of its non-adaptation to environing conditions, so quickly other types of life are born into its place which are likely to be better adapted. The links in the continuous chain of life are thus replaced by new ones as quickly as they are broken or worn out.

Bearing these facts and arguments in mind, the inference becomes inexorable that from the very instant when the first mass of protoplasm was formed the struggle for existence and natural selection began. At first protoplasmic *compounds* were naturally selected. Next, the simplest kinds of protoplasmic *segregates* and *concentrates*. Then the simplest kinds of *organized* protoplasmic concentrations, such as histoblasts and cells. Thereafter began that phase of the process of variation and natural selection through which every form of organized life, from amoeba to man, has come into existence. By this, ultimately the organs subserving intelligence and morality have been born, and the future possibilities of this unended process no human mind can foresee or portray.

That the differences in composition, structure, and potential energy between various protoplasmic compositions though infinite in number must be

confined within comparatively narrow limits as to proportions and qualities follows, because, whenever the fixity goes beyond a certain limit, then that process of unbalancing and balancing from instant to instant, on which the maintenance of the moving equilibrium of life depends, must come to an end. But when at the opposite extreme, the pent-up and actual motions, exceed the force of the sum total of attractive affinities operating on the atoms, molecules, and concentrations of a mass or portion of living substance, then it breaks up and the freed atoms and molecules form less complex and more stable compounds, which are then not suitable for life.

The nature of assimilation next claims attention. By this process the suitable portions of any materials coming into contact with living substances are first transformed by them into compounds similar to the transforming ones, and then annexed to them. This process evidently is only possible when the balance of energy resides in the transforming substances.

Returning to the main line of argument: the last thing mentioned was the mode of formation of the very first protoplasmic masses on earth. Immediately after their formation the particles within these masses must have been in exceptionally energetic motion; for the violent rushing toward each other of the elementary atoms and compound molecules, entering into these combinations, was

suddenly arrested when the particles, etc., met and combined. But though arrested, this energy had not been lost, only changed into violent vibrations of the particles themselves, and into translatory strains, or actual translatory motions of the smaller concentrations formed within the masses. These motions facilitated the concentration of like with like and dissociation from unlike.

Concentration can only take place when like impulses act on numerous like particles diffused throughout a section of space or within a mass.

Since the internal agitation within these masses facilitated concentration and segregation, and since histoblasts, the forerunners of cells, are formed by the segregation and concentration of particular protoplasmic compounds, which before this concentration are diffused throughout the masses in which this occurs, therefore it follows that all the materials and conditions prerequisite to the formation of histoblasts existed within these masses, and therefore that it was only a question of time when the formation of histoblasts would begin.

After their formation these histoblasts or prospective cells, although microscopically small, having extension, possessed an outside surface and a center. They were therefore mathematically divisible into an infinitely numerous series of infinitely thin strata or layers intermediate between the extreme outside and the center. The extreme outside stratum on one side is always in contact with the sub-

stances and forces of the environment, and on the other with the substances and forces of the stratum immediately inside of it. Since the substances and forces of the environment differ from those of the outer stratum, therefore would the interactions, necessarily following contact, tend to modify its composition and molecular arrangement. Because it is very probable, therefore let it be assumed that the first modification produced in the outer stratum made a cell wall of it. This transforms the histoblast into a cell. Since the efficiency of every force diminishes in the square of the distance from its source, since the cell wall, no matter how infinitesimally thin, is mathematically divisible into an outer and an inner half, therefore, taking the thickness of one of these halves as the unit, it follows that where the cell wall is in contact with the interior cell substance, the forces originating in the environment can possess one-fourth of their original efficiency only; and applying the same line of reasoning to the whole substance of the cell with its infinite series of infinitesimally thin mathematical strata, the inference is reached that the changes producible by external influences are infinitely small at the center of a cell, and infinitely great by comparison at its surface.

External influences in their transit to the center pass through all intermediate strata. In their passage they must, by interactions with the substances through which they pass, lose a portion of

their original energy at every step. When they reach the center, they must therefore be in a very much enfeebled condition. This is a further reason why the outer substance of a cell is in a very high degree subject to changes from external influences, while the central substance, on the contrary, if at all, is but slightly so.

From this it follows that with the birth of a cell a process begins which tends to differentiation in its external parts, and which leaves the central substance almost unaffected. The longer the life of a cell, the greater the opportunity for concentration of like with like within it. The greater the mass of the cell, the greater the freedom of the central substance from disturbance by environmental movements and influences. The more purely alike the particles of an organic mass, the more correctly does it represent the nature and character and potentialities of its own kind of protoplasmic compounds. Thus it follows that in unicellular organisms the instant when they come into existence the central substance begins to be ever more specialized to perpetuate the original characteristics arising from the nature and composition of the compounds from which their particular form of life originally descended. It becomes the carrier of the hereditary traits of the special class of life to which it belongs. The external substance, on the contrary, by the same process acquires an extreme liability to variation by external influences. The circulatory motions of the

protoplasm within the cell, from moment to moment, expose different portions of it to external influences. Thus are the opportunities of the externality to react on the internal cell substance increased, and the conclusion reached in the last paragraph, therefore, *must not be applied too rigorously*.

By substituting the word "organism" in the above argument wherever the word "cell" is used, and the word "cell" or "cells" where "particles," "atoms," or molecules are mentioned, it will appear that this line of reasoning applies with equal force to metaphita and metazoa; for the external cells of these are subject to modifications from external influences, which, if they reach the central cells at all, do so to an unappreciable extent only. This explains the existence of somatic cells, in multicellular organisms.

These are cells originally external which have been modified by environmental influences during so many generations that they have lost the general characteristics of the organisms from which they spring, and which they are therefore unable to reproduce as a whole. They do, however, reproduce their own peculiar kind of cells and tissues by fission, etc. Out of these somatic cells the various specialized organs of a more or less complex body arise.

Variation, then, in the asexual metaphita and metazoa is practically confined to the production of organs out of somatic cells, while the central cells, which are the reproductive cells, are the reproducers and preservers of hereditary traits.

As specialization advances, the occasion for locating reproductive cells and organs near the center of the organism is, however, subordinated to other requirements; for the organs of specialized types of life must obviously be naturally selected, mainly with reference to their fitness to furnish the organism protection against deleterious influences arising in the environment, and provide it with opportunities for sustaining and propagating life. Furthermore, in specialized organisms life depends on harmonious co-operation of all the organs. The form of organs and of the whole organism must, therefore, be naturally selected with reference to these two requirements: fitness for protection, and opportunities for harmonious co-operation; and these limitations are incompatible with centrality for the reproductive cells and organs.

## Origin of Sex

The simplest kind of reproduction is hard to distinguish from mere overgrowth. When a unicellular organism has, by assimilation, grown so large that the motions of the extremities can no longer be controlled by the forces at the center, then these remote portions organize a cell of their own by caryokinesis, fission, etc. The internal circulation and the brief time between birth and reproduction in these simplest forms of life effectually prevent the differentiation between central and external substance reaching a degree, which would justify the

distinction between preservers of heredity and media of modification.

The next higher step in reproduction is by gemmation. In this process a portion of the cell of a unicellular organism is extruded, or a cell or some cells of a multicellular organism are extruded, and this extruded part then begins the independent growth of a new individual.

At this stage the differentiation between the external and central substance has evidently gone far enough to justify calling the central substance reproductive material. Some of this carrier of heredity is then extruded to build the new individual. The central substance in this stage must have been less subject to disturbance by the environment than in the one previously mentioned. The purifying process, the segregation of like from unlike, alluded to heretofore, has had more time to achieve its tendencies.

To give proper emphasis to this line of reasoning, it should be borne in mind that a part of the reproductive substance passes on from generation to generation, practically forever. The whole organism except this reproductive substance is composed of somatic cells, which die out completely in each generation, leaving nothing from which the bodies of the next generation could be grown. These latter have to be and are built by that portion of the reproductive material which is passed over by each generation to the next. If some reader

unfamiliar with the present status of the sciences of biology and histology should inquire: How is it possible that this substance can be expended in each generation in building up the body of that generation, and yet enough remain over to pass on to the next, and then build up the body of that, and so on in an unending series? Then it must be explained that not all of the reproductive material which is passed over in the form of the fertilized ovarian cell to the new organism in making is consumed in this making, but a small portion of it is segregated and reserved by *one of the earliest segmentations* which occur in the pre-embryonic development of the new individual. That the segregated portion grows in the body of the new individual by assimilation, and multiplies by caryokinesis fission, etc., seems to be established almost beyond doubt, by the experiments of prominent biologists. Such a process repeated in each generation, is competent to maintain a sufficiency of this important material ad infinitum. There can be no doubt that the fertilized ovarian cell, minus the segregated portion, is responsible for the general nature of the new individual, but it is probable that the segregated part determines sex. See note at end of book.

From the fact that a part of the reproductive substance passes from generation to generation unchanged, practically forever, and from the further fact that the portion assimilated in each generation

by this process of assimilation becomes exactly equal in quality to the part which assimilates it, it follows that the process by which like concentrates with like and dissociates from unlike has practically been *continuously at work upon the reproductive substance of the universe as a unit ever since life first began on earth.* This leads to the conclusion that the reproductive substance contained in any form of life *to-day* represents for that form *the total result* of *this process of concentration and dissociation ever since life first began on earth.*

In the next higher form of reproduction the freedom from disturbance must have been still greater, and the time applicable to purification still longer, for there appears now a tendency of the reproductive substance to fall apart into two different materials, viz., the male and the female reproductive matter. The latter, according to the undemonstrated opinions of leading biologists, contains the materials necessary to the beginning of the process, the former the fertilizing, formative principles. These two different substances, representing different functions and potencies, occur at this stage, however, in the same individual.

In a step still higher the male reproductive material has acquired separate existence. It lives apart from the body of the individual containing the bulk of the female substance. But in this primary form of the sexes, the male has hardly any other functions or organs besides those appertaining

exclusively to reproduction. It has been reported by microscopists that in this, the lowest form of sexual life, the male is sometimes absorbed into the female organism by serving as food for it. Evidently the segregation of the two substances has made considerable progress, but has by no means reached completion.

For it is reported that in organisms of this type the females sometimes reproduce without the assistance of the males, and at other rarer occasions that the males reproduce without aid from the females, which would indicate, if correct, that each sex retains enough of the powers of the other to go on without it in case of necessity. Segregation at this stage has not reached completion. Time between birth and reproduction has been too short, or the protection against external influence has been inadequate for perfect dissociation.

In the highest type of sexual reproduction, both the male substance and female are each contained in a separate organ, and each of these is specialized to its own part of the reproductive process exclusively. Each of these organs is, then, a part of a well-developed individual of the race type. The individuals of such races are distinguished as being of male or female sex, and while each resembles the other in being of the average race characteristics, in those visible, bodily organs, which are composed of somatic cells, they differ from each other in the parts directly related to reproduction. In this kind of organisms,

reproduction, except by the co-operation of both sexes, is unheard of, if not absolutely impossible.

From this brief survey it appears, then, that the process by which time and freedom from disturbance have caused like to separate from unlike has been acting on reproductive substance of all life as a whole ever since life began; reproductive substance originally being distributed homogeneously throughout the mass of protoplasmic compounds. In the next stage, reproductive substance is found distributed throughout the single-celled or multicelled organism, when reproduction by fission took place. In the next step, the reproductive substance begins to become somewhat more concentrated in certain portions of the individual, a part of such portion is then extruded and begins building up a new individual. This is gemmation. Next in order, reproductive matter begins to segregate into two different substances, each with separate qualities and functions, both of which are located in separate parts of the same individual, but have to unite to reproduce.

Next in order, neither the whole of the male or female reproductive substances is contained in the same individual; but although the male part of it and its organ have separate existence, they are almost all there is of the male individual, while the female individual comes nearest being a representative of the species, race, or variety. While at this stage there has been progress in dissociation,

obviously much remains to be done, if, as reported, the females and the males are under certain conditions capable of reproducing without the assistance of the other sex.

In the highest order of sexual development, each substance is contained in a separate well-developed organ of reproduction, and this is, then, part of the organism of a separate individual, distinguished as being of either male or female sex, and neither sex at this stage can reproduce without the other. Evidently the process of concentration with like, and dissociation from unlike, has nearly reached perfection in this kind of reproductive materials.

## Origin of Species

In sexual forms of life, as explained in Chapter I, the preparation for reproduction begins with the conjugation of two substances derived from two organisms of opposite sex. If the two organisms resemble each other, then the fertilized ovum, which is the result of the conjugation mentioned, is usually competent to initiate primary cell division and segmentation. If they resemble each other closely enough to be classified as belonging to the same species, then, cæteris paribus, a highly complex series of cell divisions tending to the evolution of a new organism continues during days, months, or even years, through the embryonic, infant, and adolescent periods, until an adult resembling its parents has been evolved out of each fertilized ovum.

The above, however, does not justify the inference that the bodies of the parents, which are composed of somatic cells, stand in causal relations toward the nature and growth of the new organisms. The reproductive cells, which before they were conjugated were situated within these bodies of the parents, are the real causes. Since these cells must in nature and composition be almost exactly like those which built up the bodies of the parents, therefore are these bodies *true indications of the kind of bodies which the reproductive cells within them are competent to build up.* It is in this sense that the bodies of the parents have been mentioned in the last paragraph. Why can it be asserted that the reproductive cells within the bodies of the parents are exactly like the reproductive cells which built up these bodies? Because the primary material for the cells within was derived by one of the earliest segmentations from the fertilized ovum which built up the body of the parent and the secondary material for these cells within was obtained by assimilation; and by the process of assimilation the material added obviously must be qualitatively equal to the material it is added to.

When by the process above explained the adult form has been attained, then thereafter the material added by cell division is mainly instrumental in replacing portions of structures that have been broken down by functional activity. This part of the process continues with varying energy during

the lifetime of the organism. The reproduction of fertile offspring has until lately been regarded as the test by which it is evidenced that both of the organisms which entered into the act by which the fertilized ovum is produced belong to the same species. The fertilized ovum must contain all the potencies out of which the essential properties of the subsequent organism arise. For although the environment undergoes ever so many changes, it cannot make "grapes to grow on thorns," or "figs on thistles," without resort to grafting or budding, and the artificial changes worked by man's ingenuity are not discussed in this place.

While, then, as above stated, the nature of the new organism is entirely determined by the mixture of reproductive cells which initiates it, the material for it must be drawn from the environment by absorption and assimilation.

When the mind attempts to follow the process of absorption and assimilation, the assumption of an excess of energy in the living, absorbing, assimilating entity becomes inevitable. If the energy within this latter were equal only to that in the environing materials, then no balance of force would remain to start the changes involved in absorption or assimilation. If the excess of energies resided in the environing materials, then these would tend to absorb, transform, or assimilate the living entity. There remains, then, only the alternative first stated.

For motion is always in the direction of greatest

attraction and least resistance. Therefore does the excess of force in the fertilized ovum transform and absorb the comparatively inert materials in the environment. Later, when the organism has replaced the fertilized ovum, then it will, so long as it retains an excess of energy, absorb and assimilate environing materials. But as soon as the conditions are reversed the movements and changes begin to tend to the absorption and assimilation of the organism by the environment.

To any one familiar with the present state of biologic and histologic science, it is obvious that the two substances which by their mixing form the fertilized ovum must be complementary for co-operation with each other in innumerable ways. If either of them falls short in any of the details essential in this multiform complementariness, then there must either result a failure to reproduce or an imperfect reproduct.

Even if the two substances are fully equal to the requirements of co-operation, yet if the structures, viz., the reproductive organs through and into which they have to pass to become conjugated, are not perfectly adapted in every detail to their transmission, retention, and accommodation during the preliminary and embryonic stage, then this may easily result in complete or partial failure of reproduction, or in a defective reproduct. The failure to reproduce, or the fact of reproducing sterile offspring, may therefore be explained as the *result of*

*comparatively small variations* in either the material or force constituents of the two substances which form the fertilized ovum, or in the structural properties of the organs into and through which they have to pass, or in which they are lodged after the coitus.

Since innumerable additions of small modifications arising by variation from generation to generation are competent to account for enormous differences in somatic structures, how can a rational person doubt that they are able to produce *small* differences sufficient to prevent perfect co-operation in either one or both of the substances which form the fertilized ovum? Or why should such small differences not result in modifications of the reproductive organs sufficient to interfere with perfect accommodation of one of the component substances or of the fertilized ovum? In either case, failure to reproduce or a defective reproduct, such as sterile offspring, might be the result.

The occasional occurrence of barrenness evidences that variations sufficient to make reproduction impossible between those of the same species happen not infrequently. Scientific literature seems a blank with reference to these questions: Could an individual barren with reference to the normal type successfully reproduce if mated with a specimen similarly barren, but whose barrenness is caused by modifications in reproductive cells or organs which make these cells or organs complementary to reproductive cells or organs modified in the same man-

ner in his or her barren mate? In the mating of individuals of closely related species, such as horses and asses, is a failure to produce fertile offspring owing to deficiency in the complementariness of the reproductive substances or of the reproductive organs? All such questions bear on the problem of the origin of species, the details of which remain almost as much terra incognita as in the days before Darwin. Speculation rationally conducted and based on the known nature of things is therefore legitimate, and may prove helpful in giving direction to research, experiment, and discussion.

As above indicated, there is good reason for the opinion that it will some day be discovered that the sporadic occurrence of barrenness in a species is the forerunner of the birth of a new species; viz., when variation through sexual reproduction has produced deviations in reproductive cells or organs or both of such a nature, that the individual affected *cannot reproduce with the normal type*, then the deviations occurring in one sex may sometimes become *complementary to those occurring in the other*, so that the individuals of one sex which are barren with reference to the specific type may successfully reproduce with those of the other sex which are also barren with reference to the specific type.

The explanation above given is supplementary to the Darwinian theory of the origin of species. This starts out with the proposition stated in paragraph 3d of Chapter I of this book, "that all higher

forms of life have been derived from lower," etc. It accounts for the derivation by the gradual accumulation through heredity and natural selection of small differences, which arise in sexual organisms from generation to generation through variation. Between organisms outwardly resembling each other, it recognizes difference of species by the fact that by interbreeding they can either not reproduce at all, or else only reproduce sterile offspring. It implies that a new species is not very different outwardly from the species immediately preceding it. It must be observed that in this explanation the emphasis is laid on visible differences in organs and structures composed of somatic cells. It leaves unexplained the more mysterious fact that variety after variety may arise, interbreed and reproduce fertile, until there occurs a new variety which resembles its immediate predecessors and other varieties within the species, but *cannot* interbreed with them and reproduce fertile offspring. In the preceding paragraphs it has been attempted to explain this fact, and thereby supplement the Darwinian theory of the origin of species at a place where its insufficiency is otherwise apparent. When among organisms which closely resemble each other in appearance, and which are derived from the same species, new species is distinguished by the test of incompetence to reproduce fertile offspring by interbreeding with the normal species from which they are descended, then this inevitably implies fertile

reproduction between members of the new species, and either absolute barrenness or that partial barrenness which results in the reproduction of sterile offspring from the interbreeding of the new species with other varieties of the parent species.

This mystery Darwin's theory leaves unexplained, but if research should hereafter confirm the opinion expressed in the third paragraph above, then would the said theory be thereby demonstrated beyond reasonable doubt.

## NOTE V

(To page 44)

### ON THE RELATION OF BRAIN WEIGHT TO INTELLIGENCE

Observations and comparisons, beginning with animals possessing barely rudimentary brains, continued through a gradually ascending series until the brain of primitive man is reached, have frequently been made, and leave no doubt that, *cæteris paribus*, intelligence increases with brain weight.

Exceptions to this rule are traceable to three causes, viz: Firstly, to differences in the sizes of the organisms from which the brains compared were taken. Secondly, to differences in the complexity of these organisms. Thirdly, to differences in the energy and activity of the forms of life from which the brains were taken.

With reference to the first kind of exceptions, it must necessarily require greater amounts of nerve energy to move the larger members of larger bodies; therefore are larger masses of nerve and brain required for the movements of larger brutes. Therefore do larger brutes, *cæteris paribus*, require larger brains for survival.

With reference to the second kind of exceptions: more complex organisms, performing wider ranges

of movements, require greater varieties and greater numbers of cortical centres to initiate movements, and a greater number of white nerves to transmit the impulses; therefore, larger masses of brains.

With reference to the third kind of exceptions, when certain types display greater energy, then the brain tissues have more to attend to and must, therefore, be more massive, or there must be more of them. Such creatures must, therefore, *cæteris paribus*, have larger brains.

Since exceptions to the rule are thus traceable to these three causes, therefore do they confirm and corroborate the rule.

Professor John Marshall has, however, reported that post-mortem examinations on the brain weights of distinguished scientists, statesmen, historians, authors, etc., show variations from 45.4 to 64.7 ounces. The last weight is about $\frac{1}{8}$ above, the first about $\frac{1}{10}$ below, the reported average brain weight of adult civilized Europeans. Professor Karl Pierson and Dr. Raymond Pearl have reported the result of post mortem examinations on the brains of 2100 men and 1034 women, taken from different European nationalities, and from these the conclusion is drawn, that "there is no evidence that brain weight is sensibly correlated with intellectual ability." Although these observations were not made on either primitive man, nor on the creatures below him — although the phrase "intellectual ability" seems inapplicable to either of these, yet since some

authors have construed both as if they applied, therefore should it be shown, if possible, that they do not apply.

The great bulk of the brain mass is white matter. The gray cortex is a smaller proportion of it. It is the principal function of white matter to *transmit* the impulses issuing from the external world to the cortex, and thence to muscular tissues, thereby producing motions.

Obviously, the more complex the outward organs are, the greater must be the variety of possible movements. If creatures possessing such bodies, then, find their best chances of survival in adjustments of their movements to the multiform changes in their environment, then brains with exceptionally great masses of white matter must be naturally selected in such forms of life. It is shown, in the paragraphs on the complexity of the human body, in the third chapter, that this applies to primitive man.

In civilized persons, and more especially in such as are engaged in purely intellectual activities, certain small portions of the white matter of the brain are occupied with somewhat different functions, viz: with mediating between various areas of cortex specialized to the highest purely intellectual processes. Among these processes are: cognition and recognition, by likeness and difference, classification, comparison, generalization, abstraction, etc.

These highest purely intellectual processes, ob-

viously, have almost nothing to do with the movements of the body. Their habitual occurrence is mostly confined to the lives and labors of scientists, philosophers, statesmen, professional persons, etc. Since these processes are specialized in certain limited areas of the cortex; since the cortex, by weight, is the smaller part of the brain; therefore is high intellectuality along the line of these processes *perfectly compatible with the occurrence in the same persons of comparatively small mass and light weight of the white matter of the brain*, which is the larger part of the latter, and therefore determines, far more than the gray cortical tissues, specialized to purely intellectual processes, do, the rank of the brain as a whole *by weight*.

The variations observed in the brain weights of civilized persons, and those of persons engaged in purely intellectual occupations, can therefore *in no possible way militate against the validity or reliability of the rule derived from observations on the brains of creatures below man*, up to and including primitive man, that among them, under normal average conditions, intelligence varies directly with brain weight.

## NOTE VI

(To page 223)

The earliest segmentations of the fertilized ovarian cell occur within a very small space. The organic tissue within which the fertilized ovarian cell is placed by the act of conjugation may surely be regarded as being a uniform medium within this small space. If the reactions of a uniform medium on the things in it differ in results, then the differences can only be owing to *differences in the things.*

On page 223 it has been mentioned that a small portion of the fertilized ovarian cell is segregated from the rest of it by one of the earliest segmentations. This segregation, being a difference in the results of the reactions between the medium and the fertilized ovarian cell within it, therefore is evidence of differences existing between the fertilized ovarian cell and the portion segregated from it. Reflection may yield a clue to the nature of this difference.

In the formation of the fertilized ovarian cell, by the intermingling of the two different reproductive materials, it is obviously excessively improbable that the quantities of these two different materials, coming from two different organisms, so to speak

accidentally brought together, should each occur in quantities exactly adjusted to the requirements for co-operation with the other. In other words, the probability is infinitely great that the quantity of one of the two materials must always be either greater or smaller than the exact amount required by the other for co-operation; that is to say, there must always be present, in the small space wherein the earliest segmentations preceding embryonic development occur, an *unused, unneutralized surplus* of either the male or female reproductive material.

This surplus, being of one of these two materials only, cannot be qualitatively like the co-operative mixture formed by the exact quantitative adjustment of each of the two substances to the requirements of the other for co-operation. On account of this qualitative difference, the reactions of the segregated portion with the uniform medium must differ from the reactions with it of the portion from which it has been segregated. These different reactions must naturally tend to a separation of these two substances; that is to say, there must be a tendency to remove the smaller portion away from the larger.

Such reflections impress the mind with the probability that the smaller portion which is segregated is a surplus of the kind above referred to, of either *unused, unneutralized male or female reproductive material.* The portion from which it has

segregated, on the contrary, must be the co-operative mixture formed by the combination in exactly co-operative quantities of the male and female reproductive materials. This mixture must obviously determine the general nature of the new organism; while the surplus may perhaps determine sex, and the traits appertaining to that sex. Future research and experiment may convert this probability into a certainty.

Heineman,

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