AMERICAN JOURNAL OF INSANITY

AN ANTHROPOLOGICAL STUDY OF THE SMALL
BRAIN OF CIVILIZED MAN AND ITS
EVOLUTION.

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One of the most remarkable popular misconceptions, creeping also into scientific literature, is the belief that civilization has increased and is still increasing the size of the skull and the weight of the brain, and that education and thinking are equally efficient causes of brain growth. This paper is written to call attention to the fact that man's brain developed by the laws of natural selection during hundreds of thousands of years, the "fittest" variations in each generation being the most intelligent. This process must have ceased in central Europe about 20,000 to 40,000 years ago when the average skull was at its maximum. Since then civilization has made it more and more possible for brains smaller than the average to be as "fit" for survival as those larger, so that civilization gradually checks further evolution of brain growth and replaces it by greater and greater normal surviving variations. Hence, for the last 20,000 years the average size and weight of the brain have been diminishing, yet variations are getting normally further from the average, and the longer civilization lasts the more certain it is that we will find larger brains than have ever existed before, and an increasing number of specimens below the average of the present lowest and smallest skulled races. The change to mod-

ern conditions has been, of course, so slow that appreciable differences may have not occurred until the last 2000 years.

Everyone who has given any consideration to the subject, knows that the basis of civilization as well as all evolution is "division of labor," yet when this rule is applied to mental operations, we fail to see that this same law makes it possible for smaller specialized brains to be the fittest for survival in the new civilized environment where each man may know how to do but one little thing well.

It is an old story now to compare organized human society with the organized human body. Each is a compact colony of individuals, each of whom though a distinct creature, is wholly dependent upon the colony for existence. In each organism the individuals are so highly specialized that each has lost capabilities possessed by its ancestors and is able to do but one thing. Each community is protected by a police force or army, whose duties are to capture or destroy the enemies of the society. Both organisms have similar ways of getting supplies of food in bulk, disposing of wastes, distributing goods in certain channels, similar methods of exchange or barter, a central government, home-rule in local affairs, telegraphic, telephonic and telescopic exchanges each with its "central" or nerve centre, and all so inter-related, bound together and dependent, that if one system is injured they all suffer. We need not carry the analogies further. They are myriad for the simple reason that each system of cooperation was evolved as a result of the same method, division of labor.

In their evolution each took essentially the same course. At first the protozoon was a single independent bit of living matter, every part of which acted as muscle, stomach, brain or skin as occasion arose. It could do every thing and had to do every thing. In course of time the cells did not separate when each became half of the mother cell, but they lived in a colony. At first they were independent, but finally they helped each other, and they thus had increased chances of getting food and escaping enemies. Those colonies finally survived in larger numbers in whom the individuals became specialized, for that is economy—the guiding law of evolution. In a colony the individuals were bound together the more closely, the more they became

dependent upon each other, or the higher the organization the greater the specialization of the component cells. By natural selection, the division of labor has become so great that changes of structure have made cells of identical parentage so different that one does nothing but transmit light in the cornea, another contracts in a muscle in obedience to the signals of another, one can make pepsin while another can make some other chemical, and another, the leucocyte, is a policeman, soldier and mechanic. Indeed the leucocyte seems to be the only one of these numerous cousin cells which has preserved the ancestral jack-of-all-trades capacity.

Like the protozoon, man was at first a jack-of-all-trades, and a skillful one too. Instead of being gregarious he was probably a free lance like an amoeba, possibly living in pairs either temporarily like the birds or a more or less permanent union. After a long time those who were grouped into communities survived because they could live better than in independence. By union a community was better fitted for existence just as the protozoon colonies. A long time after living in a clan, man was almost as independent as when he was a free lance. He practiced all his functions just as before and the colony was nothing more than a group of individuals living independently but near together. It was precisely like the first multicellular organisms which were composed of identical cells each of which did exactly like all its neighbors. There was no division of labor.

This was probably the period of man's greatest average brain development. Long after his organization into tribes and even nations, at or even after the dawn of civilization, each man could do every thing well. He could hunt, fish, build houses, make arms, chip flints, be a soldier and fight, protect his home, tan hides, make clothes of skins and sandals of leather, look after a wife or so, and he knew much about the weather, woodcraft, zoology and botany too. Indeed he could do all these things before he had learned to talk except by a few cries and grunts. Dr. G. A. Reed (*Present Evolution of Man*) says he has seen Maoris of New Zealand equal in power of mind to average Europeans.

The Hon. G. Hilton Scribner (*Pop. Sci. Mo.*, Feb., 1895) elaborates this idea of the versatile intelligence needed for existence

in a savage life. We should think for a moment what a large amount of brain it requires to do all this successfully. The skill and intelligence needed in woodcraft alone would tax the mental powers of the average modern man. Then we must think of the result of not having enough intelligence to do all this,—inevitable death—for in those conditions men were too busy keeping themselves alive to have any spare time to preserve the weaklings.

During this time and for a very long time previous, survival of the fittest was the same thing as survival of the brainiest. It is certain that when by climatic changes, man's environment became unfriendly, he had to think, scheme and contrive or die. There must have been a rapid evolution of brain if we are to judge from embryological evidence as we will see later, and of course a great mortality among the unfit less intelligent. It is possible that a single thought may have been sufficient to save one man out of many, for if he had happened to think that he ought to hide some food, he may have had enough to tide him over a period of winter starvation which carried off most of the tribe. We know that just such period of stress, carrying off the less provident, actually occurred among our Pacific Coast Indians as late as the end of the first half of the present century.

This evolution of brain by natural selection must have taken an immense time, for it took advantage of only slight variations from the average, and in this condition, variations must have been very slight as all men were on a dead level of capacity. Everyone was the equal of his neighbors for they all had to do precisely the same things, know the same things and possess the same skill or die.

Primitive men discovered that one of their number could chip flints or hunt a trifle better than the others, and the mechanic or specialist arose by normal variation, but we need not go through the tiresome details known to everyone. In course of time the professions arose from that of priest. As knowledge increased, one man could not learn it all, so that from lack of capacity and time, one had to confine himself to law, theology or medicine. At the present time, the increase of knowledge is so enormous that one cannot become expert except in one little branch. We have progressed so far that many call it an

age of specialists, but in principle it is not one particle more an age of specialists than when the first savage devoted himself to chipping flints in return for meat because he found that he could thus get more meat for less work. What has attracted our attention is the extremely minute subdivision of the modern division of labor, as for instance, among the toy makers in Germany, where a laborer may for years make but one part of one little toy.

An old teacher in one of our schools was very fond of saying that our skulls only held a quart and that we could not make them hold more. If we filled the measure with one thing, some of that would run out when we poured in a half pint of something else. He merely meant that modern science was of such extent that if we were to be successful we should devote ourselves to one thing. If, for instance, we tried to know the botanical details of the drugs we use, we might forget our surgery and be pushed to the wall by some young fellow who had a quart of surgery in his skull but not one grain of botany and who could cure his patients though he had never learned where opium came from. Instances are known of successful specialists grossly ignorant of even the rudiments of the grammar of their mother tongue.

The corollary following from the above is the important fact to remember. A man possessed of a single useful faculty may succeed in civilized life, though his general intelligence may be so limited that he would have perished in a savage life. He is adjusted to a civilized environment and fit for survival, but in a savage environment he would be so out of adjustment as to perish in the struggle for existence. Quite recently it was necessary in a western army post, to discharge from the army a man who was so stupid that after six months' careful instruction he was unable to learn any of his duties and could not be trusted on guard or in any capacity requiring intelligence. He had such a small head that it is quite certain that his brain was much smaller than the average. He was perfectly healthy in all respects and for years had made a fair living as a railroad laborer, as his father had done before him. Psychologists have frequently called attention to the fact that in civilized life among laborers there are many imbeciles whose defects are hidden

because they are never called upon to do anything requiring intelligence. All of these men are fitted for survival now, whereas in prehistoric times they would have perished before maturity if not killed by their parents.

If small specialized brains were the only ones fitted for survival then it would follow that as civilization advanced there would be a progressive diminution of all brain weights—a conclusion not supported by any evidence. On the contrary, every degree of intelligence can find a sphere of activity in which to struggle successfully for existence as a specialized unit in organized society. They are all fitted for survival and they all leave offspring.

How far specialism can go, that is, which specialists are the best fitted and will eventually leave the greatest number of healthy offspring to carry on or change the species, does not concern us here at all. We need only note that the same law applies to man as to all other species, as a rule those individuals who vary the furthest from the average are the least adjusted to the environment and either perish or leave fewer and fewer offspring; while those who vary the least from the average are apt to be better adjusted to the environment, are better fitted for survival and as a rule leave the greatest number of healthy children. Both the classes of greatest and least intelligence generally die out soon, and in all civilized countries both the upper and the lower classes of society are constantly being recruited from the great middle class—the real people. Great men rarely trace lineage back far before it is lost in mediocrity, unless the family enjoys a parasitic existence as in the old world. Classes of men can be likened to a tree in which all the branches too far from the trunk break off and the central ones carry on the growth, which may not be perfectly vertical but in the direction best fitted to the environment. It is the same law to which Ernst Haeckel calls attention—the extinction of aberrant types and the persistence of those which hug close to the main evolutionary stem.

The fact to be repeated and enlarged upon for our present purpose, is not which degree is the best fitted for survival but the more important one that they are all far better fitted for survival than in a savage life, and do survive and leave offspring,

whereas in savage environment even slight variations from the average might perish. In other words, variations, upon which evolution depends, are very slight in savage life but become greater and greater as civilization advances. The dead level among the savage does not permit of sufficient variation to produce the specialist needed in modern civilization, and no savage nation having civilization thrust upon it ever carries on that culture except in the slow and tedious method of natural selection during thousands of years of the evolution of variations from the average.

We have already mentioned that there is no single body-cell which can accomplish anything like the varied amount of work done by its amoebic ancestor. Nevertheless all the body-cells working together as a "team" can do infinitely more than an equal number of amoebae. It is the result of the cooperation of specialized units. Likewise there are few, if any, civilized men who can accomplish anything like the varied amount of work done by their prehistoric ancestor. Yet all the men of a modern civilized nation can accomplish infinitely more than an equal number of savages, for civilization is "the harmonious orchestration of specialists." This dependence of specialized men makes independent existence impossible and it will be forever, for nations are real live organisms wholly composed of dependent specialized units. Consequently the further advance there is in civilization the greater are the normal variations among the men of that nation. We now find extreme normal healthy variations in every character—physical and mental. In skull capacity there are greater variations than ever before and these variations must increase in time. The more savage a tribe or the more remote in time, the greater is the similarity of the skulls in any one locality. When we go back to prehistoric skulls, as those of the Russian plains, they are said to be so nearly alike as to appear to have been made from the same mould. This is shown more graphically in the curves in the chart, Fig. 1. This great variation of the civilized brain is in accordance with that law of organic evolution that, "A part developed in any species in an extraordinary degree or manner in comparison with the same part in allied species tends to be highly variable." Man's brain cannot be an exception and it must have begun to

be highly variable within a short period after it made that abyss between itself and the ape brain. Like other changes it was very slow at first, the most marked results probably being within the Christian era.

We must constantly keep in mind that men do not drift into specialties by chance any more than a color-blind man takes to making oil paintings. He cannot take up any employment like a savage, for he is limited by hereditary variations going back many generations. He limits himself to that which he can do best, not because knowledge is of such enormous extent and he

CHART I.

Diagram showing how civilization reduces percentage of average skulls and increases percentage of variations from the average. Numbers given are purely hypothetical.

has not time to do more than one thing, but because he is unable to do many things. His success may be trifling if he does not discover what he can do. This limitation of the modern man is remarkably like the limitation of the modern specialized high-bred dog. There is precisely the same difference between the intelligence of the wolf and the domesticated dog that there is between that of the savage and civilized man. The wolf's brain is about the average size of the dog's and the wolf shows more cunning and intelligence than any one dog no matter what that dog can do. Yet the wolf's intelligence is of a more general type, as in savage man, while the dog shows special

intelligence in one direction and the different breeds vary enormously. This variety of abilities makes the sum total of the dog's intelligence much greater than that of all the wolves. A high-bred dog may be an idiot in everything except his specialty, just like the narrow specialist among civilized men, and the mixed breed or cur is apt to be quite intelligent, is easily taught tricks, and, to a certain extent reverts to the more generalized intelligence of the wolf.

It was said above that primitive man, or his mannish ancestor, must have been put to such an intense struggle for existence that when he began to replace brute force by his wits, there must have been a tremendously rapid increase of intelligence in a geologically short time, as shown by the fact that as the environment became unfriendly the *only* survivors were the most intelligent in each generation. Now we know, as Dr. Joseph Simms has shown (*Pop. Sci. Mo.*, Dec., '98) that the colder and more forbidding and unfriendly the country, the larger are the brains of the natives—Lapps 102 cu. ins., Swedes 100, Anglo-Saxons 96, Finns 95, Anglo-Americans 94, Germans 92, Celts 88, Malays (?) 86, Chinese 85, Tombs of Gizeh 84, Embalmed Semitic 82, Egyptians 80, Fella 79, Bengalese 78. Hot-tentots are said to average 75, Negroes 61 to 69, and Malays may be as low as 57 to 62, according to other writers.

About half way between the lowest man and the highest ape with its 34½ cu. ins., we find the pithecanthropus, 45 cu. ins. (?) or perhaps more.

The explanation of the above differences in brain weights is quite simple, for we all know that as we go from hot to cold countries, the struggle for existence becomes more and more severe and that the survival of those slightly larger and more intelligent than the average would account for the evolution of larger brains and bodies the further north we go in Europe, the Scotch, for instance, being about the tallest people on earth. In America it is the same way, the tall people being the northern Indians and the Patagonians, and the general trend of increase of brain is away from the tropics. A more complete explanation of this difference will be deferred until we have touched upon the place of man's origin.

The circumstances and the time of man's brain evolution are

then certainly interesting and important speculations if we are to comprehend in their fullest value the above differences in brain weight. Our pre-glacial ancestor, in that tropical climate which extended nearly to the pole, may have had so little trouble in getting food that it was the active and agile intelligent ones best fitted to escape the enemies of the times, who were the best adjusted to the environment and who survived in greater numbers. Now what a change occurred in the very slow and gradual approach of the long cold! What a struggle began with a wiping out of species which could not find fit variations adjusted to the change, and what a mortality there must have been among our most stupid ancestors, and therefore what a rapid evolution of brain when the most intelligent survived, and no others, in each generation. Is it not possible then that brain developed during this cold and as a result of it? When that era began man's ancestor was a highly intelligent animal and as it receded he became a brainy man. As the cold lessened and eased the struggle, the evolution of brain stopped, but the longer it continued in the case of the men imprisoned so to speak, in the north, the bigger grew their bodies and their brains, recognizing of course, that a cold too intense and scarcity of food may so alter the conditions as to check brain and body growth as with the Eskimos. Will there ever be found undoubted evidence of pre-glacial man or only of a pre-glacial intelligent animal too brutal to be called man? What a vast difference there must have been between the defensive intelligence of the pre-glacial ancestor and the offensive intelligence of the glacial descendant. The one had foods in plenty and had to have brain to defend while the other had little food and had to have greater and greater brain to contrive, look ahead, invent and think.

Man cannot do mental work until he gets the tools and the necessary leisure time. It can therefore be accepted as an axiom that brain makes civilization and that civilization never makes brain. The biological law that "function precedes structure" does not mean that animals ran before they had legs, but that they got along some way and that those which had rudimentary organs survived in larger numbers and evolved the structure; nor does it mean that man talked before he had vocal

organs nor was civilized before he acquired brain, but that there was an attempt at these things necessitating a natural selection of those in whom the organs were the best adapted by variation. The need existed first, the attempt to fill the need or function followed and natural selection secured the best tools. This law merely states how natural selection obeys the law that "necessity is the mother of invention."

Now when did man first use his brain for this purpose? Surely not until the struggle was less intense and he was not occupied all the time in "making his living" like the Lapps and Finns. Perhaps as the glacial time receded or as he migrated south in the early glacial, man found himself, if we may so speak, with more brain than he actually needed for his lessened struggle and leisure to think of other things and slowly and painfully began the division of labor. It took less time to secure necessities and he proceeded at once to devise means of making it easier still. The price of a day's labor, that is the amount of finished product a man can turn out, has been increasing ever since.

It is perfectly natural then that civilization should arise in countries which being warm, first attracted northern man and which are now terribly hot. It is evident that there was no further need for increase of brain by the destruction of all except the most intelligent, so that its evolution in that direction stopped in the Egyptians and Akkadians while it was still going on rapidly to the north of them. Evolution took the direction of dependent specialization in the south. It is also perfectly clear why it was that when these belated bigger and brainier men of the north did get the leisure they too evolved their own civilization, but when they received some hints from the south they carried civilization to its present position. They had better tools to work with.

As soon as when from environmental changes, man had more brain than was needed for the purpose for which it had been evolved, its growth instantly stopped and specialization began. "The Teutonic races, in their barbarous state, two thousand years ago, possessed brains as large as now, and so with other races" (J. C. Nott). The earlier a nation began its civilization then the smaller must be its average brain. No wonder then

that the North American Indian had 100 cu. centimetres more of skull capacity than the Peruvians. While the modern average European skull is 93 cu. ins. in capacity, that of barbarous tribes is 82, the Toltecs 77, and the Peruvians 73. The latter began to learn too soon. For their environment they had more brain than was needed to prevent extinction while the European went on acquiring 20 cu. ins. more before his environment changed. It is also evident why it is that those people who escaped from the struggle soonest are unable to carry their civilization beyond a certain point,—they did not begin with enough brain. It is also evident why other small-brained peoples in the tropics have evolved no civilization at all, for they entered the environment of their pithecoïd ancestors where specialization is impossible from the extreme ease with which food can be obtained. These matters will be again referred to.

EVIDENCE FROM ARCHAEOLOGY.

In whatever direction we seek, we are sure to find remarkably clear evidence that man's brain developed to its maximum size long before the dawn of civilization by the process of natural selection in an environment which eliminated the least intelligent in each generation, and that civilization always checks the process. The evidence from paleontology and archaeology is very much to the point. As the first anthropoid apes occur in the miocene rocks throughout the world, we are sure that the common ancestor of apes and man existed at least early in the miocene, but most probably in the eocene and possibly earlier. It is generally accepted as a fact that during the long hot miocene he had advanced far in his physical evolution and was here and there probably intelligent enough to chip flints, though the latter "finds" are not entirely accepted as "worked" implements. Though decidedly ape-like he was already in advance of the apes, for the latter do not even yet use implements, but advance in intelligence in such a hot climate where food was plenty could not have gone far in bridging that abyss between the highest ape and the lowest or earliest man.

In pliocene times the critical change began and the cold increased until it culminated in the ice age. In the middle of

the pliocene the difference between the ape and the man-ape was sufficiently marked to account for the total extinction of the former and survival of the latter. The ancestor of man could adjust himself by the survival of the fittest variations in intelligence and structure, but there were no fit variations among the apes. So that the change to cold which wiped out the latter caused the rapid evolution of the former. It is during this time of increasing cold, that all authorities agree that a creature we can call man actually appeared. So that when the cold had come so great as to be called a glacial period 240,000 years ago, intelligent man must have existed, for from this time on we have evidence of his handiwork all over the earth.¹ This early rapid and wide spreading of primitive man or his immediate ancestor must have been a direct result of intelligent overcoming of enemies and adverse conditions as it certainly was not due to an amelioration of the environment. His birth-rate was formerly just large enough to prevent extinction, but now through lessened death-rate it permitted him to spread over the earth. Overpopulation began fully 250,000 years ago and ever since then men have been fighting each other for more room and are at it yet. Where the first steps took place does not concern us here, we are only to note that at the beginning of the glacial cold a man existed, a most brutal, horrid, ape-like man to be sure, but able to struggle against extinction and to spread. He may be described "as a little less than a man" or "a little more than ape" for the *pithecanthropus* is placed not far from this time either a little sooner or a little later.²

Now began the glacial cold with which we are mostly to deal. For the next 160,000 to 200,000 years there must have been a survival of the most intelligent, because during this time we find undoubted evidence of man's increasing intelligence. The first finds are crude in the extreme and remained so for at least

¹ Sir Jno. Evans (address at Toronto meeting of the Brit. Assn. for the Advancement of Science, 1897) states that paleolithic implements identical with those found in the drift deposits of the Seine, Thames, etc., are found in S. Africa, N. Africa, India, and in Spain, Portugal, etc.

² It is interesting to note that scientists are divided into three classes as to their opinions of this fossil; some consider it a low man, others a high ape, but the most consider it a link or man-ape.

160,000 years, as such evolution must have been slow though tremendously rapid as compared with the previous epoch. Though there is a slight improvement in these early weapons, it is not until the glacial or "drift man" has advanced to the "cave man," that we find a marked improvement, and the caves themselves did not begin their formation until after the mid-pleistocene, probably 160,000 years ago. It is indeed not until we reach the upper or very late cave layers that we find a needle with an eye, a drawing of a mammoth and other evidences of a brain of large size. So it was not until the end of the glacial time that brainy man appeared, and though the man of Spy may still have had ape-like physical characters, the Engis skull was so good that Huxley said it might have belonged to a philosopher. No doubt the periods of rest in the interglacial periods gave occasions for culture and spreading. In such times success was not so rigidly to the most intelligent, for food was more plentiful.

Haeckel mentions the very sudden blossoming out of varieties under certain conditions, leading to a most rapid evolution and Prof. Le Conte calls attention to the "Critical Periods in the History of the Earth" when there are rapid changes in environment from oscillations of the crust, changes in physical geography, climate, etc., causing a very rapid evolution of living forms in that place. These periods separate "eras," when changes are slower. The last period was the glacial when changes were tremendous and the resulting era he calls the "Psychozoic."

The possibility of man living in Northern Europe in glacial times should not be doubted even if his intelligence for much of that time was less than that of the lowest living man, for the essential difference between that time and the present was only one of the relative length and severity of the summer and winter. Omitting the changes in the elevation of the crust—for they are of minor effect, one degree of latitude being said to be equivalent to 250 feet elevation,—the essential feature of the glacial times was the increase in the eccentricity of the earth's orbit and the position of the earth in perihelion in summer instead of at winter as at present. So that whereas we now have long mild

summers and short mild winters we then had long severe winters and very short terribly hot summers,—not long enough to melt all the snow except along the southern lowlands, but hot enough to cause severe floods each summer.

We now come to an abrupt change in the next finds—the post-glacial or neolithic, on or near the surface, in cave floors, camps, middings, pile dwellings, and sepulchres. The change is so abrupt that it was once interpreted to mean an immense lapse of time, and it is often considered an enigma because the time is positively known to be very much shorter than the paleolithic. The last glacial finds are not older than 80,000 years at the greatest and some of them are much more recent, and the first neolithic finds cannot be put further back than 20,000 years. The connecting link or the mesolithic between the two, then certainly had at the very greatest 60,000 years to work improvements which we will subsequently show must have culminated rapidly when once started. We know that the rigorous climate softened slowly and that the ice age may be said to be still in existence for some of its glaciers have not yet melted. When the Cro-Magnon race was alive, Europe was 8° colder than now. Hence the same condition causing the survival of the most intelligent and yet a severity of climate not permitting of leisure may have gone on 20,000 years, or even 60,000 in a milder form, after the supposed end of the glacial 80,000 years back. It is perfectly safe then to conclude that 20,000 to 40,000 years ago mesolithic man reached his highest brain weight, and that not until that time did his environment soften sufficiently to give leisure to begin the neolithic stage.

To recapitulate, at the beginning of glacial times, 240,000 years ago, man was still very ape-like,—in 160,000 years more towards the end of that period he had a large brain but was still brutish, and in 60,000 years more he was a much brainier savage. These lengths of time are positively necessary for the evolution of brain by natural selection, even in the relative severity of such a severe struggle, and after the conditions became softer it still required an immense time to produce the slight difference we are presuming to have existed between the earliest mesolithic man of 80,000 years ago and the earliest neolithic of 20,000

CHART II.

for the most rapid and greatest advance was in the 160,000 of the severest glacial times.¹ (See Chart II.)

This conclusion is also in strict accordance with the well-known fact that after the brain had reached its largest average, the development of culture was still a painfully slow process, and that abstract ideas were not reached for an immense time, being still absent from the lowest men. Men are mostly copyists and the great mass of mankind does nothing towards the advance of culture, which is the sum of the tiny new increments added in each generation. If European mesolithic men were as intelligent as North American Indians we can be assured that several generations could go by without one single invention improving their lot.

An apparently sudden appearance of neolithic culture also depends upon the fact that civilization increases in a geometrical rate, because each new invention adds something to all previous ones, or acts as a multiplier, not a mere addition. Great inventions also are often a mere assembling of many previous minor ones. The steam engine for instance was built up of thousands of inventions, dating back even to the discovery of metals, and it is but one factor in all subsequent advance. It is also

¹ The rapid evolution of brain in the post-pliocene explains the paucity of fossil remains of the connecting links or transition forms. Only an infinitesimal fraction of land forms leave any trace anyhow, and we can never expect to find remains of these missing links in this short glacial period. Nor can we ever expect to find them in the southern hemisphere to which they may have migrated, for the change in climate would cause great changes in form. The present lower races are vastly modified descendants of later emigrants, who may have exterminated the earlier brutish emigrants, only to be themselves forced on by later arrivals. The most simian men on earth are said to be the groups of Bosjesmens, Hottentots, etc., forced into south Africa by brainier later arrivals. Perhaps they are descended from earlier types of European men than even the Negrittos, who are regarded by Prof. W. Flower as the type from which all the negroes sprang, in the same way the Veddahs of Ceylon are considered by some scientists the lowest men in the world, and are the descendants of earliest immigrants.

There are numerous animals whose ancestral forms are wholly unknown, because of their rapid evolution in critical periods; the elephants, for instance, appear very suddenly and, excepting a single dwarf fossil, none of its immediate ancestors are known.

a matter of comment that great revolutionizing inventions are really very simple affairs, so simple indeed that we remark as Huxley did of Darwin's idea, "Why did we not think of such a simple thing before?" The advance in culture is so tremendously rapid now, not because the multiplier is any greater than with the mesolithic savage but because the multiplicand is tremendous. It is quite likely that a colony of modern farmers suddenly made ignorant of metals and transported to our iron fields, would take just as long, if not longer, to discover metals on their farms than did neolithic man, for they invent and discover just as slowly as ever. Marsh's estimate of 12,000 years for a savage to civilize himself must be entirely too short. It must have taken 160,000 years for paleolithic inventions to accumulate sufficiently to amount to a mesolithic stage, remembering of course that in the early part of that time he had less brain to work with than the lowest living races.

It was not until 60,000 years more had passed that the sum of mesolithic inventions reached a neolithic age and the more rapid increase towards the end of course made it appear like a sudden jump in culture. In no other way than by assuming a geometrical increase of culture can we explain that remarkable jump to the neolithic. The mesolithic had but rude tools and pottery, no grain and the only domestic animal was the dog. The new age had pottery, artificial caves for houses, then lake dwellings, and such a sudden appearance of cows, pigs and goats that they were once thought to have been brought into Europe from the east, though a much later invasion really did occur. Yet we know from recent experiments that new varieties of domestic animals can arise in a much shorter time by artificial selection than we once thought—the estimates of biologists are undergoing constant reduction. So that the domestication of the above animals, though perhaps started by the mesolithic man, may have been accomplished by the neolithic in a short time, for we know that these bones were fairly numerous in the late neolithic. W. H. Ballou (*Pop. Sci. Mo.*, Aug., 1897) states that "paleontology can throw no light whatever on the domestication of animals,"—possibly because the process began too late,—and "zoology has so far rendered no material assistance,"—possibly because the process was so rapid.

Indeed the pig and the horse were unknown to the early Egyptians and also to the Akkadians before the Semitic invasion. The wonderful resemblance between many breeds of domestic animals for a long time after birth so that experts may be deceived as to the breed until near maturity, is strong evidence of the very late specialization of these varieties by artificial selection.

These suddenly appearing domestic animals are almost exclusively gregarious, and had undergone a natural selection for millions of years, fitting them for a semi-dependent existence in herds, and the transference of that dependence to man was an easy matter and need not have taken long. Indeed such wild animals as monkeys, parrots and jackdaws, deer, etc., are quite easily tamed. When once started artificial selection is rapid, and their sudden appearance instead of indicating long time is really indication of man's increased leisure and intelligence. Domestication of gregarious animals was like enslaving the lower races of men, it took very little time to make them good dependent slaves by killing off the independent ones.

The only non-gregarious domestic animal is the cat, and though it has been subjected to enormous artificial selection it is half wild even yet, rather defying any toning down and it can lead an independent wild existence better than any other farm animal, though they all revert to a wild life in one generation it is said. Its origin also has never been explained, though it seems to be the survivor of a recent prowling intruder after man built houses and was tolerated by neolithic man because it helped to rid him of other prowling thieves, a case of commensalism. It is still more attached to the place than to the man, occupying a place midway between the domestic animals and the scavengers like rats, which are undoubted instances of commensalism.

The modern rapid evolution of new varieties of plants shows how rapid their evolution from wild species can be, and fully accounts for their sudden appearance in neolithic times. Goodale does not seem to anticipate much trouble if all our fruits were utterly exterminated as he could produce them again from wild pomes and berries.

The geometrical progression of neolithic civilization took

about 13,000 years to enable man to abandon a nomad pastoral life and begin to build houses and take up agriculture, for the oldest of such evidences in Europe date about 5000 B. C. By this time the sum of human knowledge was so great that it took but 3500 years to learn the use of copper and bronze; and in the finds of this period the bones of the ox, sheep, hog and dog predominate over those of the stag, goat, wild boar and fox, showing that hunting was now only an incident of life. It now took but 1000 years to learn the use of iron. After writing was invented of course the progress was more rapid still as it was not so easy to forget, and the periods separating the later time into epochs get nearer and nearer together until we reach the present, which dates from the commercial use of electricity less than a generation ago. It is interesting to note that the number of years usually given to these periods of civilization can be arranged in a fair geometrical proportion, each about $\frac{2}{7}$ of the preceding,

600,000.....protolithic,
 170,000.....paleolithic,
 50,000.....mesolithic,
 13,000.....neolithic nomads,
 3,500.....neolithic agriculturists,
 1,000.....copper and bronze.

This brings us to 500 B. C., since when the advance is too rapid to be thus figured out as will also be seen from Chart III.

After the variations of brain were well advanced, there were more inventors and better ones, so that the multiplier itself increased, and the increase of civilization was then even greater than a simple geometric progression.

If we introduce Prof. McGee's protolithic stage of a creature using stones but too stupid to fashion them, and give this a value of 600,000 years, it fits into the above geometric progression, being about $\frac{2}{7}$ of the paleolithic. It also makes the time estimates translatable into Prof. W. H. Holmes' estimates of 60,000 post-glacial 600,000 of glacial times, 1,000,000 pliocene and 3,000,000 miocene. It also takes us into the uncertain borderland between the pliocene and glacial when we have the pithecanthropus, surely a protolithic creature and one whose

geologic horizon is so hard to place because of the gradual change from pliocene climate to glacial. Indeed all time estimates of man's origin are curiously susceptible of agreement if we would only consider the uncertainties of dividing geologic times, and the impossibility of determining when the advancing creature should be called man, because everyone goes back to a time when increasing cold destroyed all but the brainiest and caused evolution of brain by survival or selection of the brainiest—the only possible method of evolution of man.

Such estimates agree also with the estimated ages of mesolithic finds in bogs which are all the way from 4000 to 16,000 years old in places where this age was delayed as we will shortly explain, and that the middings of the earlier mesolithic people must have taken 10,000 to 12,000 years to collect and that from slow oscillations or the earth's crust such remains are now on raised beaches 40 or 50 feet above the present shore line and in other places are miles inland. From all the data M. de Mortillet estimates that though the paleolithic age began in Europe 238,000 years ago, the neolithic could not have begun until 20,000 or perhaps 10,000 years ago. It is to be remembered that as these ages have gradually developed one into the other it is impossible to say when one ends and the next begins. He divides human life into 222,000 years of quaternary, 6000 of prehistory and 6000 of history.

By migration into milder climates some tribes of paleolithic man of course were placed in the ameliorated conditions permitting of culture thousands of years before climate changes permitted the like for the stay-at-homes in Europe. Indeed some races must have migrated so soon that they never could civilize themselves and never have passed beyond the paleolithic stage for they did not stay long enough to develop the necessary brain. Others who migrated later had more brain but never could develop a culture beyond the barbarous stage and never will. Only those who remained behind are now the highest and brainiest. For this reason—lack of brain—it is an invariable rule that early tropical civilizations stop soon never to advance. We inherit the benefit of the long and brutal destruction by natural selection of all our ancestral relatives except the brainiest. Early cessation of the process in Southern Asia

has been the eternal damnation of the people; they are fixed forever.

EVIDENCE FROM HISTORY.

Historical evidences are very strong on all the above points. The first civilizations to develop were in the fertile tropical valleys, the Nile, Mesopotamia, and in India. We can be assured that as paleolithic man was contemporaneous in Europe, Asia and Africa he must have migrated into Southern Asia and Africa where the conditions were not so murderous for the less intelligent, and therefore, where his maximum brain development was earlier and less. Though he began the slow mesolithic stage very early, say 100,000 years ago, he had less brain to work with and took a far longer time to go through the mesolithic stage than did the European; perhaps he took fully 80,000 years or more, for the earliest civilization of the Akkadians is not placed further back than 6000 B. C., or those of Nippur 7000 or 8000 B. C., so that its beginnings could not possibly be much earlier than those of Europe which we know was quite well advanced in 5000 B. C. These Akkadians were known to be mountaineers from the north and the early immigrants they found in Mesopotamia were checked in development so soon that they probably could not get beyond a paleolithic culture. North of Persia are tremendous deserts where there are indications of innumerable cities in the time when the climate was different, water was plenty and an Asiatic Mediterranean extended to the Arctic. This area could have accommodated a mass of humanity and the Akkadians may have been merely a western mountainous offshoot. Perhaps they were able to advance this civilization further than their relatives for it certainly was remarkably advanced 2000 years after we get our first evidence of it. When the delayed and more barbarous Semites crept in about 4000 B. C., they advanced the civilization further still and formed the Chaldean and Assyrian cultures. Hebrew means "from beyond" Mesopotamia. They, themselves were overcome by the delayed and more intelligent Aryan Persian, coming originally from the colder north, and these in their turn submitted to the further delayed Macedonians. The Persians by the way were conquerors of a Mongolian population which they found upon their arrival—a possible Akkadian outpost.

Egyptian beginnings, totally unlike Asiatic civilization, were probably contemporaneous with Akkadian, not antedating those of Europe many thousands of years, for they did not have iron until about 1200 B. C., only 700 years before it entered Europe, and our first evidence of them is not earlier than 6000 or 7000 B. C. Yet it was a wonderfully high civilization with domesticated animals, temples and astronomy, building pyramids and using copper at 5000 B. C., and bronze 3000 or 2000 B. C. We can presume that they ended their slow mesolithic stage some thousands of years earlier, but at the most it was not so remotely anterior to that of Europe. It is said to have been reported that borings have brought up a copper knife at 24 feet depth, indicating 8000 B. C., and pottery at 60 feet or 6000 B. C. in the early neolithic. Flints have been found in early quaternary soil. Being smaller brained from early migration they must have taken a longer time to get a start, for they used bronze three thousands years longer than the Europeans, and we can presume at least 80,000 years to the mesolithic and perhaps longer. The geometric rate of increase during their long neolithic could well have developed astronomy to the flourishing state it was in at 4000 B. C. Their traditions say that all this civilization arose in Egypt and was not imported.

Prof. Flinders Petrie places the earliest Egyptian neolithic civilization at 10,000 B. C., and though he does not attempt to explain where this race went through its previous stages, he suggests a Libyan origin, as the earliest prehistoric skulls from both Egypt and the dolmens of Algeria are identical with modern Algerian skulls, and modern Kabyles in the Algerian highlands still make the same pottery that was made in Egypt at 6000 B. C. Yet there is nothing to disprove that the earliest culture may have been the culmination of a long stage indigenous to the whole of north Africa and that successive brainier invaders came in from time to time to carry it further than the paleolithic races, for he shows that there were at least four different types of men figured in the earliest times, their prisoners of war being still different; and yet the type was unified by 2000 B. C. and has not changed since in spite of ceaseless invasion and conquest, for the intruders die out. Egypt has always been a death trap and the present fellahin may represent a type

which migrated into the country by slow stages from Europe beginning 200,000 years ago, and perhaps taking half that time to develop by natural selection a race that can withstand the climate. Dr. Petrie mentions the invasion of 5000 B. C., probably from the Red Sea, and the high civilization which followed 4500 to 3500 B. C., decaying about 3000 B. C., blossoming out about 2600 B. C., again at 1500 B. C. after the invasions of the Hyksos.

The recently discovered Hittites were Mongolians of Asia Minor and Syria, no doubt of the same stock as the Akkadians. Being in a colder country than the Egyptians they were delayed but more intelligent so that they were not formidable until 2000 B. C., when they overran Egypt. Their civilization was taken up by the savage brainier Greek and carried further in the abstract ideas, and this was taken up by the more barbarous and later Italians, and this in its turn by the savage, big-skulled northern races in the Christian era. It is now generally accepted that the Greeks at the time of Homer were very recent arrivals, probably from the north, and found lower races already in possession.

In Scandinavia the ice continued the longest and prevented human existence until a late period except as Eskimos or else the evidence has been washed away, for the first evidence of his presence shows him to be already in the neolithic stage—a recent immigrant from the south where he had passed through his evolution. The cold was even then so intense as to keep him back, for bronze did not reach him until the 8th century B. C., about 700 years after it had reached central Europe. Iron did not come for another thousand years and yet these people have survived as our brainiest and have done much to advance modern civilization. The Scotch in the highlands were in a barbarous state until even a hundred years ago. The most delayed of all to take up civilization is the Russian Slav, and the present advance of that empire is in strict relation to the long time they have been under natural selection in the evolution of brain. Denmark also having been under the ice cap, has no paleolithic men.

Thus for 8000 years and probably 10,000, we have clear-cut historical records proving that the earth has always been over-

populated and that streams of men are constantly flowing to seek more room, forcing out older settlers wherever they are found; and that as a rule, until mediaeval times, the intruders or conquerors are less cultured, but more active, brainier and larger men from more severe climates, generally the north.* From prehistoric times and at the present there is a human "drift" to the south in Europe and Asia, the immigrants being checked in development or actually degenerating as soon as the severity of the environment is lessened. Evidence could scarcely be clearer that brain grows in the cold until the owners migrate to the south.

EVIDENCE FROM PALEONTOLOGY.

	Thousands of Years.	Man's Ancestors.	Puber- ty (?).	Number of Generations.
Recent Pleistocene.....	270	Adam and Eve. Man, contemporary with Reindeer in France.		250 3,500
Pliocene	600	Pithecanthropus erectus.	16	17,000
Miocene	2,100	{ Anthropoid Apes. Lemures.	10	60,000
Eocene			5	420,000
Cretaceous	3,600			
Jurassic	1,800			
Rhaetic.....	1,800	Prototheria (first mammalia).	3	1,800,000
Keuper				
Muschelkalk				
New Red Sandstone....	4,000	Theromorpha. Proreptilia. Eotetrapoda.	4	425,000
Magnesian Limestone..				
Lower Red Sandstone..			4	250,000
Coal Measures.....			4	500,000
Mountain Limestone...	4,000	Dipnoi and Crossopterygii.	5	1,000,000
Devonian			3	900,000
Silurian	2,700	First Fish-like creatures ..		
Ordovician.....	2,700			
Cambrian.....	4,000			
Total.....	27,700			5,375,000

The above table is taken from "The Last Link," by Ernst Haeckel, being in great part calculated by Hans Gadow (Cam-

* Dumont (Civiliza. et Dèpopulation) mentions the constant direction of ethnic currents along certain well-marked tracks—now the same as ever.

bridge). The time periods are minimum estimates—the most recent estimates for the mesozoic instead of 7 millions is 1000 million years, showing that the number of generations required to evolve man from fish-like creatures—5½ millions—is well within the probable limits. We must note that it took 60,000 generations to develop the pithecanthropus of the early pleistocene from the miocene anthropoid ancestor, 17,000 more to develop the lowest man of the stage of the Ceylonese Vedda, and 3500 more to develop the man of 5000 B. C. in the dawn of history. This table illustrates very forcibly that in the evolution of brain by natural selection a thousand years are as nothing, and that the change in brain since the 5000 B. C. neolithic man, only 250 generations back, cannot be expected to be much and we have seen that they are not much. Secondly, that the brain must have developed in the 17,000 generations to lowest man and in the latter part of the 60,000 to pithecanthropus, for the tremendous gap between the ape and man must have taken all this time by the survival of the most intelligent. The selection being less rigid since the beginning of the neolithic, this table then is strongly indicative that the maximum brain development was reached at least 20,000 years ago in Europe and perhaps 40,000, and that the greater part of this growth must have occurred very much earlier; and we have seen that early glacial man must have had that brain if he was to survive conditions which wiped out all his larger animal companions. As this table places the pithecanthropus in the mid-pleistocene instead of the pliocene, the number of generations from it to neolithic man can be so enormously increased that the subsequent 2000 generations, from 40,000 years ago to the present, are a mere nothing in comparison. Now that the plunge has been taken and biologists and geologists have become accustomed to thinking of vast periods of time, the paleontologists are constantly lengthening their estimates of the time necessary for the transmutation of species by natural selection, but even if they do lengthen out these generations still further it will not alter the general trend of the diagrammatic curve we have drawn of the development of brain (Chart II) nor change that wonderful shoot upwards in the glacial times.

EVIDENCE FROM ASTRONOMY.

All estimates of the human eras we have given also agree quite well with the latest estimates of the glacial period from calculations of the eccentricity of the earth's orbit as given below in the table.

Years ago.	Eccentricity.
260,000.....	Less than now.
250,000.....	Same as now.
200,000.....	3 times the present.
150,000.....	1½ times the present.
100,000.....	2½ times the present.
80,000.....	2 times the present.
60,000.....	Period began to end.
30,000.....	Considered as the end.

The cold of course lasted long after the greatest eccentricity just as winter lasts long after the solstice, and the glacial is still said to exist in the north and in the highlands. The table also shows that the period "came on with extreme slowness and departed with comparative suddenness" (P. F. Kendall, p. 141, Wright's *Man and Glacial Period*), the very conditions necessary for brain evolution and then a sudden flaring up of civilization. If the glacial age had come rapidly it would have caused extinction of man's ancestor, not an evolution requiring very slow changes of environment.

EVIDENCE FROM CRANIOLOGY.

From a craniological study of primitive European man, as far back as we can reach, we obtain evidence of the culmination of brain growth during the late glacial. The general trend of opinion is to the effect that all the European long heads of pre-history are autochthonous and are not different immigrant races as once thought, and there is now but little doubt that successive higher and higher types followed each other in evolutionary series from the lowest to the highest—Cannstadt, Neanderthal, man of Spy, etc., to the Neolithic Cro-Magnon. The latter type is still in existence and some of the other earlier forms are better than some of those of modern Europeans,

showing a very early brain development. The Cro-Magnon is even larger than present skulls (Dumont). In Great Britain in particular, the earliest men were among the most dolichocephalic in the world, like negroes and Eskimos, and living in the late glacial so far north they may have existed as Eskimos. They are now believed to be the ancestors of the much higher, long-headed, long barrow race. The latest types are among the Furfooz race. It contains a few broad heads, probable forerunners of that broad-headed Asiatic invasion of larger and fiercer men, traced so well by Ripley and others. This invasion began in neolithic times, antedating bronze but very little; and though it may have entered Europe before 5000 B. C., it did not spread to England until about 1000 B. C., constituting the round barrow race. Though it spread almost as widely as its short, frail predecessor it did not enter Ireland nor leave much of a trace in Spain. It surely divided the aborigines into two masses north and south. Its home in Asia may thus have been for a while at least, a far better environment than Europe for human evolution. Perhaps it was a western expansion of the same races which at the same time overran Mesopotamia from the teeming area north of Persia, all of the same stock as the Akkads, Chinese, Hittites and native Persians.

The two primitive related long-headed stocks—Teutonic and Mediterranean—being autochthonous and better adjusted to the environment than the intruders, have therefore survived in greater numbers than the intruders, who have been gradually forced into the highlands and infertile regions where we find them to-day. In addition to this, the northern half were thus forced to keep in a severe environment undergoing natural selection in brain development, longer than any other race on earth, and are now the type of the rulers of the world. They furnish the blood of most of the noble and royal families of Europe even in southern places where they are undoubted conquerors and where their soldiers have all died out and they are totally different from their subjects.⁵ Even the possession of

⁵ Dumont (*Civilization et Dépopulation*) mentions the fact that as early as Cæsar's times the blondes had become the aristocrats. Vercingetorix was blonde and his soldiers short broad heads. Even in more

bronze did not preserve the broad heads, for they were forced into unoccupied places, where they founded lake dwellings just as the long heads had done in other places millenniums before them. The later broad head invaders, except such irruptions as those of the Huns under Attila, never got beyond eastern Europe where they are the main part of the people, merging into the pure Mongolian type. As we recede from the central ridge of Europe the less and less do we find of this late intruder.⁹

EVIDENCE FROM EARLY CULTURE.

A study of early European culture is also confirmatory of the origin of a large brain in Europe at a very early time. Ripley

remote times still, there are evidences that the blondes were rulers from the Peloponnesus to Ireland. Tradition states they conquered short brunettes in Ireland, in Scandinavia the nobles were blonde, the serfs brunette. In Greece and Thrace the Pelasgians were brunettes conquered by blondes, and the same may be said of Gaul.

*The craniological evidence that early skulls were once uniform, and later became varied, is universal. Dumont mentions it. Topinard says that "in a pure race all the individuals resemble each other as regards their main features." "M. Broca has in his laboratory five skulls of Patagonians which are identical." "We are told that the Andomans and Todas are all alike." He also says, of 22 photographs of Andomans, "the heads appear as if cast in the same mould," and that Eskimo skulls are almost exactly alike. Mr. Owen remarks upon the wonderful resemblance among 96 negro skulls of the Gaboon.

Topinard shows the enormous variations of modern brains as follows:

Causes.	Variations in per cent of total weight.
Sex	10.
Age	4.
Height	4.
Mental Disease	4-5.
Idiocy	18.
Last Illness	10.
Intelligence	20.

Morton's tables do not help us, as they contain mixed types of savage and civilized, but the following is significant of the variations due to civilization.

Races.	mean.	Skull Capacity.		diff.
		max.	min.	
Savage, Australians	.75	83	68	15
Civilized, Peruvians	.75	101	58	47
Savage, Polynesians	.83	84	82	2
Civilized, Chinese	.82	91	70	21

calls attention (*The Origin of European Culture*) to the undoubted fact that a neolithic culture sprang up in western and southern Europe and from the Alps to Scandinavia steadily and uninterruptedly from a lower state and totally independent of Asian and African aid, even inventing a system of writing. There was no hiatus between it and the paleolithic. It was not much later than Akkadian culture, only a delay due to the cold and the severity of the struggle for life. Asian culture went further at first because the people had leisure and could crowd together more in their fertile valleys. European bronze and iron culture do not betray oriental affinities until 1000 B. C. Schliemann's excavations show early Greek civilizations advancing in regular evolution but little previous to those of northern Europe, and not showing Egyptian influences until about 1500 B. C. The Swiss pile dwellings also show an uninterrupted advance from the stone through bronze and iron ages, the broad-headed intruders from Asia appearing here and there after the foundation of the earlier towns. The beginnings of these towns are at all ages from 5000 to 1000 B. C., the earliest being founded by the long heads and the later by the broad heads. The earliest beginnings of the autochthonous long heads were self-civilizations and far enough advanced to abandon a nomad life even in the Alps at 5000 B. C. No one can pretend to apply rules of origin of culture and of the men themselves to all the varieties and crosses of European man, until the ethnologists have untangled the mixture of types and determined where each variety really did arise. Nevertheless it is clear that to originate this high culture in the thinly settled inhospitable north so very little later than the southern form in its thickly settled communities, shows that the northern men must have had larger brains than the first southern civilized man.

EVIDENCE FROM HUMAN ONTOGENY.

From human ontogeny we get remarkably clear evidence of the early phylogenetic development of brain. Donaldson says (*The Growth of the Brain*) that the number of brain cells is complete at the end of the third month of foetal life, and that subsequently the individual cells increase in size a long time, in

some men even as long as until the 40th year of age, but no matter how long his brain may increase in power as a man grows up, he has not one single brain cell more than he had six months before he was born. Could evidence be clearer that he was an intelligent animal at a very remote period, even after making great deductions for that biogenic law of "the relegation of the final characters to earlier and earlier ontogenetic stages in the course of phylogeny?" (Weismann). We know of course that man did not acquire a large brain until after he had acquired a large body, yet the development in a four-months' foetus of all the brain cells it is to use throughout life must mean that man developed his brain phylogenetically a long time before he put it to useful work of making that geologically recent thing—civilization.¹

No amount of function can increase the number of the brain cells, for it is as impossible as increasing the number of our legs by running. This is positive proof, that evolution of brain occurred by the selection of the greater variations and not by functioning of brains placed in a severe environment. Ontogeny then shows that an easy tropical existence is incapable of originating man.

There are three generalizations which are now universally received. First, that a man in his development to full maturity

¹ It is rarely appreciated that the real thinking part of the brain is of very little bulk and could easily be packed away in such a little space as a 3-months' foetal skull. Donaldson says that the three billions of nerve cells are each $700 \mu^3$ in bulk, and a calculation will show that they "could easily be placed in 2.25 cu. cm.," and this is a mere thimbleful. If the immature foetal brain cells are of $1/10$ the diameter of the adult size, then they have $1/1000$ the bulk, or all the brain cells which a thousand three-months' foetuses are to use throughout life, could be put into a thimble. One-fourth of the brain is composed of supporting framework, blood-vessels, etc., and 90 per cent of the remaining 1200 cc. consists of fibres, while only 10 per cent or 120 cc. consists of gray matter. If only 2.25 cc. of this is cells, then there is a bulk of 117 cc. of the protoplasmic processes connecting cells together for coordination, and this is the real excellence of the human brain. Ramón y Cajal shows that there are scarcely any of these fibrillae in lower animals like frogs, and a progressive increase in number as we go higher, until we reach the enormous number in adult man. The early foetus likewise has none, and they grow out for a long time after birth.

passes through stages corresponding to the adult stage of prior less developed ancestors. Second, that savages closely resemble prior adult stages of civilized races. Third, and a corollary from these two, civilized children in their mental sphere very closely resemble present savages and prior adult ancestors. From these it is evident that all savages being in a condition of arrested development, must be branches which have migrated out of the environment which was causing higher evolution of brain.

Phylogenetic development is a very wobbly one since we cannot doubt that the environment was not necessarily such as to cause the evolution of forms in a straight series. Hence forms must have occurred out of line and it is a matter of economy for the foetus to skip them or make short cuts. Thus in the early stages of foetal life it is impossible to see traces of many a previous ancestral form, but late discarded characters are preserved more clearly the more recent they are. The useless lanugo or soft wool on the foetal body does not drop off until just before birth and sometimes not until some weeks after birth. That is, man was a highly intelligent being long ages before his body hair disappeared from the wearing of clothing during glacial times, there being a survival of the least hairy as the better adjusted to exist in rapid changes of temperature from the intense heat of a short tropical summer to the cold of a long winter when artificial clothing could be obtained.*

* I have never seen a logical explanation of the reasons for the disappearance of man's body hair. There could be no acquired character here to transmit and we doubt whether it ever could be transmitted. In the tremendous destruction of human life always going on, any tiny congenital variation must have been of great assistance or hindrance. The least hairy men must surely have been better able to stand the terribly hot summers and survive in greater numbers and transmit this variation to their offspring. In the winter they sought protection of caves and clothing and were put to no disadvantage. A continuous cold could not have caused this involution, nor continuous warmth, and it is a strong evidence for the evolution of man in glacial times. The earliest escapes from the north have retained their hair because the involution ceased—Ainos, Australians, Tasmanians, and Todas. Involution of the scalp hair did not take place, as the protection was an advantage, summer and winter, but when houses became warm it was an advantage to have little hair in the house and baldness began. In the hot habitations of modern life, there would be more deaths of those

Perhaps man attained to great intelligence before he reached his present stature, for at six years of age the brain has reached 9/10 of its adult size, and has nearly completed its growth at 9, a slight increase going on until 35 or even to 40, and at birth its proportional weight is the greatest. Now we know that the changes we see in man as he grows from infancy are precisely the changes we see as we pass from reasoning animals to savage man, barbarous and then semi-civilized man, but his full adjustment to modern civilized life does not occur until long after 21, generally not until 30 or even 35, and in a few men not until 40. During all this time, unless abnormally precocious, he closely resembles in his aspirations, desires, and actions, the full adult of some lower stage of culture, just as tales of Indian strife are so fascinating to boys. The lower we go among the races the sooner do the children mature mentally, so that in the savage we find boys of 18 who are fully matured adults. We can then conclude that a little growth of the size of brain cells and their connections but not of their number, may have taken place since man was savage but that as soon as division of mental labor occurred all cellular increase stopped. The long period from 9 years of age until 35, with but little or no skull increase is the ontogenetic equivalent of the long phylogenetic interval between mesolithic man to the modern Teuton with its little or no increase in skull capacity.

The skull of the man of Spy is very good in shape and considerably larger than many modern skulls, and yet the body is decidedly simian and this is just the condition of the bodily conformation of infants—simian long after a huge brain development. Until long after he was a highly intelligent animal, man must have had a daily struggle for food, and this habit of carrying everything to the mouth when in a state of constant hunger still persists as a perfectly useless habit in every infant. Indeed the evidence of early development of intelligence can

with much hair, and an increase therefore of baldness, were it not for the use of shears which have thus stopped the evolution of baldness by natural selection. Baldheaded men are better fitted for the changes of modern life just as hairless man were better fitted for the changes of glacial times.

be seen in so many of the ontogenetic stages that it would be tiresome to go further into details.

EVIDENCE FROM LANGUAGE.

Language is a very late phylogenetic acquirement for it is put on and off by races with comparative ease and, until fixed by writing recently, it was undergoing rapid evolution, and it has often been suggested that glacial man, though very intelligent, may not have had articulate speech. Children do not learn a language until after the brain is quite well advanced and their process of learning is nearly the same as that by which man evolved it. First there are cries, then imitative sounds for nouns, then after a long time verbs, and then the adjuncts. It is several years before adverbs and the more intricate parts of speech are comprehended. This corresponds to the fact that man did not need language until very late after he began to cluster into groups, for at first populations were extremely thin. Denmark could not support 500 savages of the stage of the lowest living man. Hence man talked only after his maximum brain development was well-nigh complete. The most archaic Aryan languages had words for abstract ideas which are very late in appearing and are not found among many existing savages. Finally the various classes of languages have absolutely nothing in common, showing that their origins are widely separated and occurred long after speechless brainy man spread over the earth. The general trend of opinion among comparative philologists is to abandon Max Muller's idea of an Asiatic Aryan origin and for very many reasons to place the primitive Aryan among the long heads in Europe between the 40th and 60th degrees of lat., long anterior to the Celto-Slavic invasion. These Aryan speaking invaders of the south of Europe are said to have died out as the migration was too rapid, the present population being survivors of earlier immigrants from the north. The comparatively recent invaders (Aryan) of Asia are also said to have become extinct in Persia and nearly so in India, where they arrived before 1000 B. C., probably by a southern route as the Macedonians did later, the northern route always being taken by the Asiatics going west. Asiatics indeed could not

have had sufficient brain to make such a language, for the language a race evolves is in strict relation to the brain development, the lowest savages having the worst, and when their knowledge increased, their poverty in words was overcome by making each word do many things by inflections. The longer a brainy race remains in a savage state before its language is fixed by writing, the higher is the evolution of the language. Thus late languages are simplified by the invention of more words and the omission of cumbersome inflections, and replace previous languages. The last of all, English, is driving out all others. Similarly the brainiest and most delayed of men, who developed the best and most delayed of languages, are ruling the earth—the Teutons.*

* *Language and Race*.—In reading over works upon human origins, it is astounding how much, which is now puzzling, is made clear by accepting a northern origin and a slow oozing migration for survivors and extinction following rapid migration. The matter is too enormous to do more than refer to here. In like manner such works as W. D. Whitney's "Life and Growth of Language" and André Lefèvre's "Race and Language," are illumined to a wonderful extent by such conceptions. The latter works—by the way—give such clear testimony as to our theories that a synopsis of a few points may be advantageous.

Though brain evolution may precede language evolution so that high civilizations may exist as in Egypt with inferior means of expression, yet both evolutions have gone on step by step together. After leaving the simian stage with its few sounds or clicks, the earliest man used imitative sounds for nouns and the first stage began, *i. e.* the *monosyllabic*. Until enough words were invented man depended to a large extent upon gestures. Some of the lowest races are even yet in that stage where gestures are necessary to explain words and they cannot converse in the dark. Later, among higher men needing more words and unable to invent them, the monosyllables were glued together for the purpose and the *agglutinative* language arose. The slurring of these additions gave rise to the *inflected languages*, and the highest races, by dropping all useless inflections, originated the *analytic* languages of which English is the most advanced. Races whose brain development is checked by migration cannot evolve a high language, nor can those checked by civilization as the Chinese, and the longer a brainy race remains savage in the north, the higher is its language. This evolution is in a geometric proportion as every other invention of man, and is very rapid at the end, so that the most of the advance in English has been since 800 A. D. and not fixed until within two centuries. Le-

EVIDENCE FROM ANATOMY.

There is so much nonsense written about the intelligence being independent of the size of the brain, that it is really necessary to digress at this point to call attention to the fact that intelligence strictly depends upon brain weight. The brain cells are the organs of thought and the more there are of them, other conditions being equal, the more thoughts can be produced. We are perfectly safe in the long run, in judging intelligence by the size of the skull. Donaldson shows that the brains of eminent men are the heaviest and their skulls the most capacious, though, we know little of the brain weight and cranial capacity of men successful in business and professional life. In excep-

tion, fèvre states that savages may wear out a language in fifty years so as to make it unrecognizable. In some savage tribes children cannot understand the grandparents. Thus a great diversity of languages in America is meaningless as a measure of time, for their origin. All other evidence points to rather late arrival, the "mounds" are recent, and there has not been time for much change in type or color.

Agglutinative languages as a rule are found in the lowest races of America, Africa, Oceanica, and Asia (Mongolian, Uralo-Altaic, Dravidian and Malay). Coptic and Berber groups have not progressed since the Pharaohs, remaining "suspended between agglutinative and inflection." Higher still are the Semitic languages with internal inflections really due to slow agglutination (Assyrian, Phoenician, Hebrew and Arab) and in accordance with their later arrival from the north. The external inflections of the Aryan show a separate origin, and upon their arrival they displaced Semites on every shore of the Mediterranean, and spread to India. The long stay of Semites has led to the belief that they were a Mediterranean race and not a northern one. The Hebrews who have returned north to their original European homes have prospered while others have not.

Separate origin is hinted at by the fact that the long-headed Australians and Tasmanians use suffixed particles while the neighboring broad-headed Polynesians used prefixed ones like the Dravidian tongues of India. Likewise the lower Guinea negroes use suffixes while the higher Kaffirs use prefixes. The clicks of the Hottentots and Bushmen are truly simian. The Eskimo's Asiatic origin is shown by the relationship of its language through *Aleoute* and *Tchoukche* to the Samoyed or Uralo-Altaic group of North Asia.

Whitney points out the low character of the languages of the lower races of South America, and the exceedingly high and beautiful language of the brainy agricultural Algonquins.

tional cases there are other things in the skull besides nerve tissue as we will subsequently more fully explain, and these easily explained cases are foolishly quoted as in some way proving that intelligence has nothing to do with the size of the brain. The real condition which marks off the human brain from all others is the wonderful intricacy of the system of fibres connecting its component parts, as before explained. In exceptional cases it is possible for these also to so vary that a small brain may be so well organized as to be more efficient than a

Lefèvre gives a wonderful collection of facts showing the condition of the unseparated Aryans, all of which can be best explained by a northern cold origin. It ends with this sentence, p. 259, "*but since they came late in time and with an already developed language and intelligence, they rapidly reaped the benefit of the inventions of their predecessors.*" And all this from a man who tries to show the western trend of Aryans instead of that to the South and East for 4000 years.

The great eclipse of Egyptian civilization between the 6th and 11th dynasties, may have been due to brainier barbarous invasions, for the renewal of civilization with everything new, even to the religion, writing, titles and names, was barbarous, coarse and rude; yet it culminated in the 12th dynasty into the greatest and most glorious period of Egyptian history. It was like the temporary eclipse of Southern Europe in our dark ages from northern barbarous invaders. In both cases a new civilization bloomed higher than the last, and then declined with the dying out of the unacclimatized new invading blood. In Egypt this "Middle Empire" was so feeble as to be overcome by an historical invasion of savage Semitic Hyksos or Shepherd Kings 2000 B. C., brainier than the surviving natives of the decrepit Empire. These invaders even included dark Hittites of Turanian stock from the cold north represented heavily clad and with Chinese types of faces as in two of the later kings of this line. This invasion of northerners can be likened to the present or rather modern invasion of southern Europe by northern types. The brainy northern Hyksos adopted the civilization they found and became true Pharaohs, just as the brainy savage northern Tartars after conquering the Chinese, became true civilized Chinamen.

John Fiske in a recent article (*The Atlantic*) states that in the time of Charles I., only five millions of people talked the language of Shakespeare, a century ago it was twelve millions, one-third of whom were in the United States. to-day there are more than 120 millions, three-fifths of them in the United States. He gives it as one proof of Anglo-Saxon domination, but he is here mistaken, for only a small percentage of English people are of Anglo-Saxon blood. The facts illustrate an invariable law that inferior languages melt away in contact with higher ones, and the highest of all—English—will eventually replace all others.

larger brain less intricately bound together with connecting fibres. Whether modern small brains are composed of better material or are better organized so as to be more efficient than larger prehistoric brains is also a possibility, but it is highly improbable as there is no evidence of it from a study of the large modern savage brain which so far as we know is just as well organized and has just as good substance per square inch of cortex and just as much cortex per cubic inch of skull as in the average civilized brain. The smaller modern brain is merely specialized—efficient but of limited range. Its possessor may be great in his specialty but a fool in other matters.

As the cells are on the cortex or surface, and as the cortex varies in thickness but very little in the normal and healthy, it follows that the greater the number of cells, the greater is the surface of the brain and the more it must be doubled up or convoluted. Goll long ago showed the relation between intelligence and increasing number of convolutions, and Rudolph Wagner, in 1860, showed that eminent men had more richly convoluted brains than the average. The brains of such men as Kant and Schopenhauer were not only richly convoluted but very heavy and their skulls proportionately large. It is also an invariable law that the average brain increases in complexity as it increases in bulk. The lower we go in the scale of human intelligence from the highest to the Bushmen, the simpler and less numerous are the convolutions and the smoother and more simian are the brains. Increased complexity is merely the path of least resistance, the only way of tucking more brain into a skull without the latter becoming impracticably large—a mere matter of selection or rather of economy. A marked degree of intelligence is then impossible without a large head and we can rest assured that the post-mortem examination will reveal a richly convoluted brain.

There is rapidly increasing evidence that the remarkable variation of human brains we have already mentioned as following biological laws, and the increasing number of smaller sizes, really mean specialization. This class of brain has not been recognized as of limited range though the possessors may have been noted specialists, and they have also given rise to very absurd statements that intelligence was totally independent of

the size of the brain. The variations in the anatomy of the brain are so great that the convolutions but a short while ago were believed to be jumbled together without plan, and it is only within the last few decades that the general plan has been made out and the various fissures and convolutions accurately defined and named. That this variety means specialization has been pointed out a long time. Edinger's *Anatomy of the nervous system* shows that special ability as in certain great men, commanders, business men, etc., is not due so much to big brains as to the development of special parts. An editorial in the *Jour. Amer. Med. Assn.*, Aug. 19, 1899, says, "Many brains have been studied from this standpoint, and to a remarkable degree there has been observed a constant increase in size and weight of special parts that bear a relationship to the kind of superior intelligence manifested. Great artists, for example, in whom the visual imagination is highly developed, have been found to show a corresponding increase beyond the average in size and weight of the representative visual centre in the occipital lobe. . . . In a newer but somewhat different sense, brain weight, including brain development with convolutional and cellular increase, is shown to be more or less of an index of intelligence." So we can accept as a proved fact that human brains in civilization are already specialized in accordance with the law of the great variation of parts developed to a great degree as compared with the same part in allied species.¹⁰

It cannot be expected that anatomical evidence of specialization should be either extensive or accurate at present, because we know so little of the localization of the brain functions. We

¹⁰ It is evident that the brain reached its highest evolution in weight many thousands of years before man showed any of those higher intellectual qualities now so characteristic. The brain was developed to assist survival if we may thus state the method of selection, and it is quite likely that there are no centres of these higher intellectual functions—certainly modern research has never found centres for morality, religious feeling, abstract reasoning, etc., and possibly never will. These higher intellectual qualities are believed to be the result of the action of the whole brain. It is additional evidence that the brain arose from the survival of the larger variations in an environment like the glacial when there was need of an excess of the preexisting brain centres found in the anthropoids.

know the position of the motor areas, and the centres for speech, and that sight is located behind in the occipital lobe and that smell and hearing are below in the temporal lobe. Beyond this very little is known in detail and absolutely nothing is known of the alleged parts of the brain presiding over the highest intellectual faculties. But from what we do know we certainly get splendid evidence that specialization of brain causes specialization in mental functions. Gambetta, for instance, one of the greatest of French orators, had the speech centres wonderfully convoluted, so that he had more than twice the machinery for remembering and speaking words than the average man. The rest of his brain was very small, sub-microcephalic, but he gives no evidence of having used more than his specially developed parts, for his judgments were notoriously defective. He was a talker because he was born with the tools to talk with, and he did not develop the tools because he talked, and he had no other tools like those of the big-headed Bismarck. Indeed Gambetta was an oratorical fool, like many a noisy American we all know. The great painter who was asked what he mixed his paints with, was correct in replying—"Brains," for without brains the sense of color alone is as useless as Gambetta's speech sense.

We then have very clear scientific explanations for the following facts: Pre-Columbian skulls from Illinois measure 24 ins. around (25 or 25½ in life), while the average specialized New Yorker's is only 22½ in life. The well-formed Engis skull is larger than the average European skull in height, width of forehead and capacity, 97 cu. ins., according to Dr. Simms. The skulls of Swiss lake dwellers are larger in every way than those of modern Swiss. Skulls from the catacombs of Paris are 21½ ins. around, about an inch more than that of modern Parisians; and those from Pompeii are larger than the skulls of modern Romans. Among small modern skulls may be mentioned that of St. Mausuy, Apostle of Belgic Gaul and later Bishop of Toul in Lorraine, Robert Bruce's and that of a Danish gentleman of the 17th century mentioned by De Quatrefages. These all are of the Neanderthal type, and they show that great abilities in theology, war, or business or specialties, do not require large skulls and also that the Neanderthal men were a highly intelligent race.

EVIDENCE OF SPECIALIZATION IN MODERN LIFE.

At present we seem to be surrounded with the evidences of the modern evolution of small specialized brains limited in usefulness to a very small sphere. One of the best teachers I ever had was of this type with a sub-microcephalic skull which could not possibly have contained more than 40 ounces of brain. He had a limited subject and taught only its rudiments, and though he never rose to great heights, in his limited sphere he was magnificent. His death did not cause a ripple on the ocean of humanity. My worst teacher on the other hand was probably the brainiest in the general meaning of that term. He was far from being a specialist. Since the curriculum of the university has become subdivided the more often do we find magnificent teachers in a limited field who are nonentities in all else.

Without a paying specialty, the modern brainy man may be in actual want, while an imbecile with a special knack may make millions to be squandered by his nephews, for such men are not apt to have children. Thus an employe of an opera company was paid over five thousand dollars a year and he could scarcely write his name. Though densely ignorant he was a hail-fellow-well-met, with a railroad sense, if such an expression is allowable. He could get special terms for transporting his company, where other agents failed and he saved his company many thousands of dollars annually. A one-sided artist doing one thing may be highly paid and the philosopher may live in a garret. Thus the ability to make a good living—to survive in the modern struggle—has nothing to do with general intelligence but with special intelligence.

Every college in the world except the national ones at Annapolis and West Point, recognizes the fact that no two men are alike, and courses of instruction are constantly being specialized instead of fitting every shape into the same mould. Now they are training what brain there is, and not attempting to train a part which may not exist. One of our best types of specialized mind, Henry Ward Beecher, found the curriculum in his day, so completely unfitted for him that he had to neglect it; the mould was too narrow. On account of this lack of adjustment to the curriculum, it is the commonest thing to find

that a very large percentage of successful men were anything but shining lights at school. Corporations find the most extreme difficulty in securing the men for their special positions and when they do hit upon the right man, others offer such higher salaries that they are compelled to pay enormous salaries to retain their men. Perhaps we can also see why Washington should be so great, in spite of the fact that he was so little of a specialist in all other affairs that his contemporaries voted him stupid. He had reasoning faculties which made him the man for an environment which few could fill, and he succeeded where other more brilliant, narrower men would have failed. Indeed a modern army is a mass of specialists and the greatest difficulty is experienced in finding the right men for the right places, those succeeding in the lower ranks being often horrible failures in command, and men great at the top being sometimes the most complete failures in the lower positions, as were Grant and Napoleon. The logical faculty of reasoning may be highly developed in a small brain and its possessor be a very great man. This type of man is often unable to take any special part in the orchestration of civilization, but as leaders to direct and harmonize the efforts of other specialists they may be superb.

We all know plodding successful specialists of extremely limited mental horizon, scientific investigators too narrow to interpret their own results and discoveries, orators unable to write or even spell, George Combe and Dr. Gall with as little idea of numbers as an American aboriginal, mathematicians who are unable to talk, statesmen, like Webster, without business sense, but men ignorant of the existence of Shakespeare yet possessed of executive ability enabling them to manage vast affairs, while men noted in other respects may be so devoid of executive ability as to bungle every thing they attempt to manage. Practically we have every possible grade between degenerate imbeciles like Blind Tom, with but one developed faculty, and those having many faculties developed, the equally impracticable "Admirable Crichtons." With such normal variations in intelligence we cannot possibly get a unit of measure to judge men, for in civilization the word has become an indefinite immeasurable term.

The work of modern life—this “harmonious orchestration”—then, is accomplished by specialists, many of whom are so one-sided that they would have perished in a savage life. The average brain weight of these can well be markedly less than that of their savage ancestors as we have shown previously. But few people have the least conception of the low state of intelligence of the average civilized man in every nation due to this survival of the least intelligent. They are eclipsed by the more numerous variations. Lombroso quotes Scarfoglio as saying, “A good fifth of the people of Italy are still living in a savage state, dwelling in cabins that the Papuans would not live in, accommodating themselves to a food that the Shillooks would refuse, having a vision and an idea of the world not much more ample than that of the Kaffirs, and running over the land desiring and seeking servitude.” This is an extreme case, for the average man improves as we go north in Europe in direct proportion to that progressive increase of average brain we have noted.

The specialization of modern brains explains many a psychological paradox, for we are frequently astounded at the illogical beliefs of renowned men, who thus frequently ruin the work of a lifetime. When sick they are often a veritable harvest for all kinds of quacks and illogical treatments, just as Harold Frederick believed in Christian Science to his own undoing. Maudsley has called attention to the fact that few men really reason, only repeating parrot-like what they hear. Mr. Depew is credited with the amusing observation that it is generally possible to tell from a man's conversation what paper he reads, for the average man is often heard repeating the morning editorial. In the case of civilized man we have seen how impossible it may be for a man to reason outside of his own sphere. In such things as house-building he may depend on the architect, but in deciding whether vaccination is a delusion he acts for himself. Men of intelligence will carry a potato or wear an iron ring to ward off rheumatism. Wallace believed in spiritualism even after his proofs were shown to be fraudulent, and Eliot Coues is said to have believed in the reality of his ghostly visual hallucinations. Men who, like Gambetta, can talk, seem to flock to political life where more or less oratory is generally an essen-

tial. The more intelligent become statesmen but the smaller fry may be mere talking fools and their speeches nauseatingly illogical. Dr. Andrew D. White's "Warfare of Religion and Science" is a long series of the illogical actions of theologians similar to our own burning of witches. Wilberforce in his absurd fight against evolution is the type of these men, brilliant in one way but fools in many others. Every now and then we see articles calling attention to the survival of ancient and mediaeval superstitions and credulities, and we can rest assured that though such absurdities may be just as numerous as ever and may never disappear, yet they are becoming less and less harmful from the fact that men borrow ideas and unconsciously follow the lead of the better thinkers on whom they are dependent in modern organized society. The life of new absurdities is thus growing shorter, some, like the "gold cure" for drunkenness and "free-silver" for political ills, being very evanescent.

EVIDENCE OF INCREASE OF SPECIALIZATION IN OLDER
CIVILIZATIONS.

The gradual increase of brain variation in nations long under civilization explains another peculiarity which has been so often noted. No matter how low the average Southern European brain weight may be, there may be as many men of great skull capacity as in "newer" nations of much larger average. Though a great mass of the Italians may be steeped in savagery, that people now supplies many modern men of great ability. Furthermore old nations having a longer time to accentuate specialism by in-and-in breeding supply most of the great artists. American musicians are generally foreign born, and great actors are rarely native to America nor are the great painters, but the further south we go in Europe the more of these specialists do we find and fewer of those big types of men like Nansen."

"Jonathan Hutchison in an essay on "Genius" (Arch. of Surgery, 1900), suggests that possibly genius never arises in races recently civilized. He mentions that certain districts in England, noted as the birth-place of many men of genius, probably have the remains of the old Roman population. By genius is here probably meant the normal variations producing great special ability.

The Jews are an extreme type of the survival of specialists for they have during 14 centuries been subjected to a more powerful natural selection in this direction than other races. After the Aryan accepted Christianity a persecution of the Jew began and has continued with unrelenting fury. Thus placed in an unfriendly environment, his struggle for existence has been so intense that his nervous system has had more than it could stand, and he now furnishes a larger percentage of insanity, neurasthenia and other nervous diseases than any other race. Stunted in growth by bad food and bad living, compelled to flock to the Ghettos of the cities, and barred from outdoor employments until now unfitted for muscular labor, there must have been a tremendous mortality of those of less vitality, for they are the longest lived race in the world, and they can engage in the most deadly of trades—tailoring—and yet they are remarkably free from pneumonia and consumption. The terrible mortality in this weeding-out process is shown by the fact that their number is not nearly what it should be by a normal increase and their increase in a more friendly environment is very great. There must have been a greater survival of those able to take up a specialty and they are consequently more highly specialized than their persecutors, and better adjusted to the modern conditions and are taking the lead in many directions. Though they number less than ten millions, they have long controlled the financial world and have much to do with keeping the peace of Europe. In certain cities they control commerce. In science they have furnished many a great specialist, and in medicine they have been leaders for centuries, and in some of its specialties they have had a monopoly. In specialties of law and literature they are grand and in the specialized arts they may be superb like the De Reskes. The reverse of the picture is not so bright, for having so few men of more general capabilities the modern race furnishes few philosophers, statesmen and military leaders. Many a successful Jewish merchant has a microcephalic head with brain so small that he is almost imbecile except in matters of bargains. The elimination of those with a martial spirit still further benefits them for they are better adjusted to future conditions when wars will be less and less frequent. Maurice Fishberg (N. Y. Med. Jour., April 6, 1901) has elaborated the above points quite extensively.

EVIDENCE THAT MODERN SPECIALISM RESULTS FROM SELECTION
OF VARIATIONS AND NOT OF ACQUIRED MODIFICATIONS.

The tremendous adaptability of man has been fully enlarged upon by many writers, particularly by Dr. G. Archdall Reid ("The Present Evolution of Man"), and it gives rise to the impression that as all of man's mental stock in trade is acquired and not instinctive, we can train any child into any specialty, that is, if we take a negro child soon enough we can train him to be a Michael Angelo or a Gambetta. And this belief in the efficacy of education to make brain is held in spite of the fact that in every institution devoted to the education of the lower races, without a single exception, the curriculum has to be cut down to the mental level of the students. Negroes, for instance, get along famously until they reach the higher mathematics and other subjects requiring abstract reasoning, which are entirely beyond their mental range, and it is a well-known fact that a full-blood negro cannot go through West Point or Annapolis without such assistance as is never given to a white cadet.

We must digress a moment to show that specialism as well as brain weight are the result of the natural selection of congenital variations and not the selection of inherited acquired modifications, a fact which we should accept from the anatomical evidence. In the first place there is no proof that men like Gambetta acquired their oratorical powers, that is, developed their speech centres by oratory. J. C. Nott says that "There is no proof of the theory that the cultivation of the mind or one set of faculties can give expansion or increased size to the brain." In the second place, though congenital variations are transmitted there is not a particle of proof that acquired mental characters are ever transmitted. In spite of the widest acceptance of Weismann's extreme Neo-Darwinism, that is the denial of the transmission of any acquired modifications and the proof that every bit of organic evolution can be explained by the natural selection of congenital or fortuitous variations, there is an almost universal belief among physicians of the transmission by inheritance of acquired diseases and hence of all other modifications. Spencer and other extreme

believers in Lamarck's theories do not apply them to the vegetable world, nor to lower animals, nor to more than a small fraction of the characters of higher animals, while the other theory is universally applicable. We are constantly bombarded with articles on the "Inheritance of Acquired Characters" which assert that the increase of brain is a result of civilization and that the savage by thinking has acquired a big brain. On the contrary we have shown that the maximum average brain must have antedated civilization by many thousands of years. Evolution of brain is now, always has been and always will be a result of the inflexible law of the survival of fittest congenital variations or those best adjusted to an ever changing environment.

A child in its development tends to repeat exactly what its parents did in their development. We do not pretend to explain how or why it does this, but we are sure of it, as a fact, and the stockman is so sure of it that he will pay immense sums for colts before they are born. On account of the infinite variety of influences acting upon the ovum somewhat differently than upon the parents, when they were ova, it is impossible to conceive that the child could be exactly like its parents, hence it is acknowledged that congenital or hereditary variations may have their ultimate origin as acquirements due to the environment, though not the result of use or disuse. Nor is it possible for the child to copy both of its parents, and it is this amphimixis (Weismann) which causes variations, which render the possessor better fitted for survival than his brothers, and these variations as transmitted. The grandchildren vary more or less from their parental type, and their children from them. In this gradual tree-like spreading there is a survival of some lines while the others become extinct.

The mistake has been the assumption, that if a child tends to develop as its parents developed it must necessarily do everything else its parents did, and that all of the parents' acquired modifications, whether the result of use or disuse of parts or from any other cause, must also appear in the child whether it is subjected to the same causes or not. In spite of the fact that scientists the world over have been, for many years searching for instances of the transmission of acquired characters, not one

unchallenged case has been found—every published case being either a repetition of a congenital developmental variation in the parent, or explained on other grounds. To believe in the transmission of acquired modifications leads to all sorts of ridiculous situations, like Lamarck's famous statement that the neck of the giraffe is the result of the stretching of the necks of untold ancestors and not the result of the survival of only those with the longest necks, who could thus get food the best. I copy also the following illustrations: the child of the blacksmith should develop big muscles without special exercise in that direction, children of astronomers should develop astronomical knowledge and not learn it by painful application, and a mania for collecting coins should appear in a posthumous son, the son of a telegraph operator should be an operator too, and all professions would soon be family affairs. Since a large part of a man's mental acquirements may be modifications subsequent to the birth of his children we can see how hopeless it is to prove the transmission of mental modifications.

On the other hand suppose that a man by normal variation from his parents is born with a music sense by better organization of that part of his brain, for we all know that such talents are "born in" men, and every one knows that the children of musicians may so vary as to be more or less musical than their parents, and yet all be more musical than the average man. Suppose the most musical, marry musical women, and we thus have generations following some of whose members are increasingly musical by normal variation. This has happened in the family of Bachs and it is the same process as the development of the race-horse—a selecting of the best developed, and the intensification of the variation and not transmission of acquired modifications. Only a small proportion of them vary so as to be more specialized than the parents, so that they are not all great musicians, nor are all the race-horses great racers. Each child has to acquire its musical knowledge just as painfully as its parents, the only thing it inherits is the ability to do this. So the race-horse must be trained to run races, the only thing it inherits is the capacity for being trained. No amount of training of a horse to race will make it a racer without this innate capacity, nor can we thus make a singer or artist without the innate capacity.

Men argue that if the brain is educated and its possessor thinks more, his brain must enlarge like the blacksmith's arm-muscles, yet there is no more evidence that the exercise of ten brain cells will make them turn into twenty, than there is that the exercise of ten race-horses will make them turn into twenty. This power of increase as far as we know is restricted to the epithelial structures, and blood cells, for there is not a single case known of a man's skull ballooning out to accommodate a brain growing large from use. Indeed we have shown that the number of brain cells is fixed at the end of the 3rd month of foetal life, and is never increased thereafter by exercise—an acquired increase of cells due to function is impossible. Minot (Bost. Med. and Surg. Jour., March 28, 1901) elucidates the law, that cells by specialization invariably forfeit their power of multiplication. The educator is like a horse trainer—one trains the inherited brain cells or innate mental capacity and the other the innate racing capacity. There is then no ground for the belief that the children of educated men must be born with larger brains than their parents, when the fact is that by normal variations they are just as apt to be on the other side, and very frequently are.¹²

The only practicable way for intelligence to increase is exactly the way it increased in pre-historic times, by the brainiest man of one family marrying the brainiest woman of another, and some of their children must of necessity vary so as to be more intelligent than either parent, and by just such lucky marriages do we see great intelligence produced.¹³ As a common thing,

¹² Prof. Arthur Thompson in a lecture on "Heredity" at the R. I. of Great Britain, notes the tendency of the sons of great men to revert to the average and be more nearly normal than the parents. He shows that inheritance comes from innumerable ancestors, in the 10th generation back there are 1024 tenth great-grandparents, and he says, "it is the heavy weight of this mediocre ancestry which causes the son of an exceptional father to regress towards the general population mean." It is the old biological law, that offspring from exceptional individuals always tend to the mean. He also shows that the transmission of acquired character has not been proved, and that all heredity is due to transmission of fortuitous variations.

¹³ A recent study of British genius (Havelock Ellis, Pop. Sc. Mo., Feb., 1901) shows this gradual evolution, for certainly 40 per cent of eminent

through some trait we do not understand, sexual selection compels the marriage of intelligent people to very inferior mates and the normal but inferior children are erroneously called degenerate. Education has nothing to do with the matter one way or the other. If universities increased brain and this functional acquirement was transmitted, then university populations should become more and more exclusive—mere family affairs, but it is likely that if we trace the lineage of any educated man or great man, it will soon end in the great class of the normal average uneducated who carry on the species, just as Darwin only a few generations back is traced into the great normal yeomanry. All the universities then have not added one grain to the average of man's brain weight and never will, or they would be living examples of the absurdity of all the laws they themselves teach—the laws thought out by Darwin, Wallace, Brooks, Lankester, Weismann and a host of others.

Similarly by these laws, civilization has not added one grain to man's brain weight or it would be the transmission of acquired modifications. Brain can increase in only one way, when the environment is such that only the brainiest are the best fitted, and that time has long gone by, perhaps 20,000 years ago and even 200,000 for the early emigrants to the tropics. The average can never increase again until the environment becomes a "fool-killer" in every generation. Civilization is not a "fool-killer" as Dr. David Starr Jordan states, but it is a fool saver.

Dr. G. Archdall Reid ("The Present Evolution of Man") has applied all these laws of selection to show how men are by survival becoming more and more immune to disease so that some, like measles, are rarely ever fatal any more, and how we are becoming more and more immune to alcohol by the rapid elimination of the drunkards so that the races knowing alcohol the

men come from parents of decidedly more than average ability. C. W. Super (*ibid.*, Ap., 1901) states the same of the French and Italians. It was this fact that led Galton to his studies of Hereditary Genius. Ellis shows that the upper classes, already separated by intelligence, have built up British greatness and civilization, next to nothing having been contributed by the "teeming masses," or the average—the breeders who carry on the race.

longest are the least drunken, unless we preserve the natural drunkards by prohibition. He might have shown also that the killing of those most susceptible to small-pox has been stopped by vaccination and that our immunity in that direction is checked and epidemics may be just as fatal as ever excepting occasional ones like the last. But the details only interest us here to the extent that they prove the instant check to brain development by civilization.

INVOLUTION ALMOST IMPOSSIBLE.

After migration from the north, brain cannot diminish from partial disuse, for its size is retained by the law of "organic inertia," resulting from the power of heredity. It is explained by Weismann as the persistence of parts and habits long ages after the use for which they were evolved has been changed or has disappeared. Involution is extremely slow as though nature were reluctant to part from that which has been secured at so great expense, and offspring persist in copying parental forms. Hence brain is produced in children generation after generation as a result of this inertia and we now see big brains in some families in spite of the fact that for generations the ancestors have done very little mental work. Involution of the brain by a reversal of the process and the survival of the least intelligent and no others, would take just as long as its evolution—over a half a million of years, and involution by disuse would be as slow as the involution of the appendix vermiformis—hundreds of thousands of generations. Brain persists in spite of partial disuse.

SOME ABNORMAL VARIATIONS ARE DUE TO DEGENERATION.

Throughout this paper we have confined ourselves to normal healthy brains, yet very abnormal or diseased brains may do good work, even magnificent work, both as to quantity and quality, but the possessor be so degenerate as to leave no offspring or leave short-lived defectives. Every discussion of intelligence permits these diseased types to enter—the Byrons, Oscar Wildes, Napoleon, Daniel Webster and Kant—and apparently upset all legitimate conclusions. It is like trying to

find out the characters of the lung by studying pneumonic or tubercular ones. Dr. Simms' article in the *Pop. Sci. Mo.*, Dec., 1898, is full of these degenerates—the results of disease or accidents to the ovum. In normal healthy reproduction the offspring vary but little from the parental type and evolution proceeds by taking advantage of these minute variations. Hence when marked variations, freaks or sports occur it is a result of accident of some kind to the ovum or the result of disease and as a rule the line soon dies out. Now there are normal variations in the nervous system due to certain unknown variations in the character of the substance of the nerve cells, whereby some men are very stable or phlegmatic and others more and more nervous, excitable or unstable. The worst of these neurotics are called degenerates if they have certain physical malformations called stigmata. Now it is a fact that the neurotics are less fitted for reproduction than the more stable, for in them there seem to be more accidents to the ovum and an increase of degeneration from parent to child. The ovum does not confine itself to the developmental groove worn smooth and deep by millions of ancestors but from its very instability is easily pushed into any other path. Degeneration then, like every other variation may start by an acquired modification of the ovum, which also inherits an innate weakness which makes it more and more variable from generation to generation; but if it is not disturbed it may develop properly and frequently does. Yet it may be so feeble as to stop development as a microcephalic imbecile, now bounding ahead unchecked and making a macrocephalic genius, or perhaps bulging out on one side making the specialist like Gambetta or if the rest of the brain is worthless, making the idiots—savants like Blind Tom and the unhappy imbecile mathematical freaks.

As we have seen that great variety of brain development is normal in civilization, and that degeneration may merely intensify these normal variations, it is practically impossible to classify all the cases and to draw a line on one side of which all will be normal and on the other degenerate. There is no doubt of the degeneration of such marked types as the idiots-savants and the insane Charles and Mary Lamb, but the borderland types like Gambetta may be called normal by one psychologist

and decidedly abnormal or degenerate by another. Much as we may regret it, we cannot but conclude that our idols and some of our ideals, the men of genius are too far from the average to be normal variations, and a close examination shows very many to be degenerate.¹⁴ They are like the workers of the ant colony, unfitted for reproduction and generally the end of their line. They have done the most to advance civilization while the more stupid average men have carried on the species developing other men of genius when the family is sufficiently neurotic or the normal conditions are proper, for that some men of genius are normal cannot for a moment be doubted. It is not to be forgotten that the further a man varies from the average in the possession of great intelligence the more likely it is that he is not a normal variation but a result of unstable or degenerate development. But to call every normal variation an evidence of degeneration is arrant nonsense.¹⁵

Degeneration in addition to causing variations in size of brain, may cause the production of other materials in the skull besides the nerve cells, their connections and supporting framework. There may be much connective tissue, fat, water, etc., so that the weight gives us no clue to the intelligence of the man. No wonder then that macrocephalic imbeciles can do nothing with 70 ounces of poor material, but a healthy normal specialist do great things with 40 ounces of well organized material. Nor can the size or shape of the degenerate skull tell us anything of the contents, for there may be a layer of water between the skull and the brain or in the ventricles of the brain. Likewise the cortex itself, so constant in the normal may vary greatly in thickness in the degenerate. While hydrocephalus

¹⁴ See Lombroso's "Man of Genius"; Ellis and Galton above mentioned.

¹⁵ Civilization preserves degenerates who would have perished in prehistoric times; hence the results of degeneration become very marked in the older civilizations, and intensify the normal tendency to the production of great specialists and men of genius, we have noted so often above. All kinds of degenerate specialists, mental freaks or "sports," and psychological curiosities are thus becoming more and more numerous. They do not damage the race, as these lines perish very quickly from sterility.

usually results in serious mental impairment, there are numerous instances where recovery has taken place and the huge skull harbor a useful brain. Indeed it is even believed that such ballooning out of the skull has given chance for actual brain growth by expansion—probably a process of increase in size of the cells but not an increase in their number. Cuvier and Rubinstein were cases of this kind, both having had hydrocephalus and rickets in childhood and both are classed as degenerates.

It is nevertheless true that the size of the normal skull is in fairly close relation to the number of the cells it contains and it is a safe guide to the intelligence of the man whether that intelligence be of a general nature, as with the savage, or of a more special nature, as in civilization. In dealing with large numbers of skulls of a class this rule is safer still, for the variations neutralize each other, particularly among savages whose variations are less marked. The immense amount of work done in measuring skull capacities of various races from which so much was at one time expected and from which so much disappointment has resulted, may yet give us useful averages for very useful deductions as we will subsequently explain.

LESS VARIATIONS IN WOMAN'S BRAIN.

Havelock Ellis ("Man and Woman") gives the results of many investigations showing the greater uniformity of woman's brain and the greater variation in man's, which is in accordance with the law of the greater variation of the males in every species. The causes are so patent that we need not discuss them. Prof. Arthur Thompson (*Knowledge*, Oct., 1899) shows that the differences between men and women are less apparent among savages as we should expect from the greater uniformity of all skulls in savage life. Topinard also shows that though modern woman's skull is 150 to 220 cc. less than man's, the difference in prehistoric skulls (Troglydites of La Lozère) is only 99.5. A story is told of a Russian professor who evidently did not know these facts nor did he seem to appreciate the fact that a woman's body being smaller required less brain for the motor and sensory purposes. He was a great opponent of female education on account of the small size of the female brain.

It was a very grewsome hilarity brought forth after his death by the discovery that his own brain was less in weight than that of the average of women's. He was probably a specialized savant and capable of being very illogical when out of his mental sphere.

ILLUSTRATIONS FROM SPECIALIZED ANTS.

The ant colony is generally given a high place in the intellectual scale, one writer even placing it but little below man if not his equal, and as the individual brains are microscopic, the natural inference was that actual amount of brain is not of much moment after all. There is a failure to recognize that these huge colonies of dependent specialists are really huge animals in pieces instead of in one bulk as with mammals, and the huge brain instead of being in one mass is in tiny bits, each piece being supplied with legs, etc. If all the tiny bits were collected they would be perhaps as big as that of a higher mammal and in as great a proportion to the body weight as in the highest men. The law of weight and power here works an economy, for as animals increase in size the weight increases as the cube, and the strength as the square or the cross-section, so that land animals much bigger than elephants are mechanically impossible as their weight would break their bones. In the reverse direction the smaller the body the smaller need be the locomotive apparatus in the proportion of the cube root to the square root. Hence the apparatus needed to carry around and nourish these tiny bits of brain of the ant colony is thousands of times less than that needed if it were in one bulk. These tiny specialists emphasize the increasing specialism of man, for we are doing through natural selection exactly what the individual ants have done, becoming specialized parts of a huge intelligent social body which we serve and upon which we are wholly dependent for existence. The sum total of the ant's abilities is in the same relation to the abilities of one member as the sum total of knowledge of civilization exceeds that of any one man.

THE PLACES WHERE BRAIN INCREASED.

The explanation of the observed fact of the increase of brain as we go from the tropics to the north, leads to most fascinating

speculations as to the place of man's origin, which on other considerations is often put in the northern hemisphere. That locality is so reasonable and so in accordance with everything we have stated, that it will be profitable to discuss it from the standpoint that brain evolution must have required a cold climate.

In the first place, as the apes existed in Europe when the climate was hot and disappeared during the pliocene, showing an unfitness to an environment to which brainier creatures could become adjusted by selection, and as the apes have existed in the southern hemisphere with but little change for over two million years, it is quite evident that a hot climate will not cause brain evolution or the ape would have become extinct as in the north. This alone would indicate that tropical men are the descendants of immigrants from the north. Furthermore we know that at the time man arose, no part of the southern hemisphere could have had the proper degree of cold, for while the northern glacial winters were long and severe and the summers hot and short, the conditions were reversed in the south;—very long summers and short winters both milder than the present ones. Irrespective of the glacial times, the tropics have always been hot and could not have had the conditions for man's origin as Darwin and Huxley supposed. The tropics are still further out of the question as they would necessitate a migration to the north and this is contrary to the rule which makes living creatures spread most easily to the direction where the life is not so severe, and as far back as we can trace the human drift has always been southward as it is already becoming in the New World. Brinton's cradle of the race in Northern Africa could only refer to the pre-human ancestor, at a time when there was no cold as an obstacle to northern expansion. It is more reasonable to believe that when the cold came, it found a creature in the north capable of brain evolution, and that the increase of cold was so gradual that when it did culminate, it had already caused sufficient change to permit of survival. It seems as though it were a lucky combination of circumstances at the right time to produce man, just as lucky combinations have been the rule in the evolution of all living

forms. Unless the glacial period had come at that particular time, man would still be in the future. As a side thought it is interesting to apply this to other worlds that have gone through an earth-history. How many of them have had just such a lucky combination to evolve man? According to the doctrine of chances it is hardly likely that more than a very small number of the myriads of cooling globes are or have been inhabited by beings as intelligent as man, even if they had had the peculiar conditions necessary for the generation of living matter from highly complex non-living.

As both Northern Europe and Northern Asia must have possessed the right conditions we can look upon them both as the original brain factories, from which all races have spread southwards. The great Scandinavian glacier ended in a circle parallel to and just north of the 50° of north latitude. South of this ice-sheet in France and Germany, Russia and Asia would then be the earliest homes of man and his places of origin. Man did not arise and spread from a single centre but from wide areas, nor from a single pair but from innumerable pairs.

This is also in accordance with anthropological deductions. Heads are known to preserve their general relations of length to breadth through every vicissitude and the index is so fixed and imperishable that anthropologists use it as the best test for race, and it is the basis of all recent classifications. Sexual selection has no influence in changing the shapes of the skull nor originating new shapes, and there is no known way in which long-headed races can be changed to round-headed or the reverse. Hence there is a general tendency among anthropologists to divide all men into two groups—long-heads and round-heads and their variations. It is certainly an interesting thought that the long-heads arose in northern Europe and the broad-heads in northern Asia and that there was no intercourse between them for millions of years. The long-heads spread south throughout Africa and thence east as far as Australia and just a little beyond "Wallace's line," between Bali and Lombok, separating such widely different flora and fauna. The broad-heads spread east from Asia throughout all the rest of the Pacific east of "Wallace's line," to the western coast of America and

thence throughout America, later, perhaps very recently, spreading westward as far as the east coast of Africa displacing long-heads, just as we know they spread through Europe in the neolithic times."

VARIATION FOLLOWED MIGRATION FROM THE NORTH.

Natural selection can account for every variation of the complexion, stature, and hair of the long-headed men, from the blonde, tall Teuton, having wavy hair with oval cross-section, to the short, black, frail men, having wooly or bushy hair with flat cross-section. Natural selection can also explain all types of broad-heads as variations of the yellow, brown or copper skin, oval eyes, broad face, prominent molars, and long black, straight hair with circular cross-section, characteristic of the Mongol. It can also explain changes in the nostril, the flat open nose suitable to the tropics, being unsuitable to the north where it is known to be an element in that tendency of the tropical races to pulmonary congestions.

The Eskimo need not be considered a third type, but a cross for they are wedged between the two primitive stocks. They have extremely long heads as though they were the extreme northwestern expansion of the European type from Great Britain to Greenland and thence to Arctic America and Asia. They may indeed be descendants or relatives of that equally long-headed race, the remote ancestors of even the long barrow race. Yet they are "disharmonic," that is, they have broad faces, and they also have the brown complexion, oval eyes and straight black hair as though they were the extreme northeastern expansion of the Asiatic type, for Topinard states that they formerly

¹⁰ It is interesting to note that the Australians through all their tremendous migration still preserve their skull shape, for it is nearly the same as the most ancient European skulls, the Neanderthal. Geologists believe that formerly there was land connection between Europe and America, via Faroe Islands, Iceland and Greenland, facilitating an early migration of Eskimos who certainly lived as far south as 40°. There was also believed to be land connecting North Asia and North America, facilitating an eastern migration of Asiatics, and Fred. W. Starr states that our Indians still retain Japanese and Chinese characters.

lived in Asia at 40° of north latitude. They are undoubted crosses at the eastern frontier of the Asiatic type just as the similar disharmonic Cro-Magnon (long head and broad face) is looked upon as a cross at the western frontier of the broad-headed invasion of Europe, and just as the Basque is considered as a cross, though it has disharmony of the opposite type, broad head and long face, but here the head is really dolichocephalic for the head is really long but broadened at the temples and the type is really Mediterranean. Topinard (p. 44) states that some Eskimo skulls show evidence of hybridity.

Though natural selection cannot show any way in which one head type can be changed to the other, it is perfectly competent to explain the origin of the two types. Perhaps an animal diet and the accompanying conditions in Asia caused in man's ancestor the evolution of a short, thick-set powerful body with broad neck, face and head as the *necessary mechanical accompaniments*. In Europe, perhaps more of a vegetable diet may have resulted in the selection of a slender frail type with long body, and long neck, face and head as necessary accompaniments. This difference in physique is just what we find in Britain, between the short, frail, long-headed, native, long-barrow race, and the taller more massive, robust, fierce, intruding Asiatic round-barrow race of comparatively recent time."

"Haeckel states that "the human race is a branch of the catarrhine group, he was developed in the old world, and sprang from apes of this group, which have long been extinct." The new world or platyrrhine group separated from the parent stem a long time anterior to the evolution of the catarrhine group, and did not progress as did the old world forms, or it would have developed into man in the American glacial period. Haeckel also called attention to the fact that the two surviving anthropoids of the western group—chimpanzee and gorilla—are dolichocephalic, while the two survivors of the eastern group—gibbons and orang-otangs—are brachycephalic. Topinard says "many reasons lead to the belief that all the dolichocephales are originally from Europe and Africa and the brachycephalic from Eastern Asia. The low negritoes of India are round heads, and similar early types in Africa are long headed like the Australians. The finding of gibbons (*pliopithecus*) in the upper miocene of France, does not contradict its eastern origin. The dolichocephalic *Dryopithecus* of middle miocene of France is a lower form than the Gorilla or Chimpanzee and therefore perhaps an ancestor of them.

No matter how the two head forms arose, in each there was a survival of the largest and the two shapes became fixed forever. Arising as a result of mechanical necessity their shape became immaterial, hence variations should become more and more common and marked. Natural selection can also explain changes and variations in the cephalic index of emigrant races, for as a frail body might change in the course of millenniums to one more robust, mechanical laws could make the head less dolichocephalic in many of them, and the reverse process would occur in the other type.

Arising then in the north, there would be a necessary and inevitable migration south as soon as the increasing intelligence reduced the death rate below the birth rate. Such extensive migrations in glacial times are not difficult to understand, for at the same time the mammoth travelled around the world in the northern hemisphere. The earliest emigrants then were the least brainy and their brain increase stopped as soon as they escaped from the north. For instance, the ancestor of the *Pithecanthropus* of Java was one of the first products of the brain factory of the north and could not have been a result of evolution in Java. Higher specimens arrived later and exterminated him. That his remains were in the mid-pleistocene does not mean that he originated then, for his origin may have been a long time previous to this. As time went on, the newer types as they migrated in that everlasting expansion still going on, invariably found earlier lower types in possession, like the Helots and the Canaanites. Topinard mentions numerous traditions of conquering nations finding even ape-like inhabitants. Later still, the brainy savages when they arrived south found that their predecessors had established civilizations and flourished in dense masses.

The widespread story of a deluge must be a modified tradition from glacial times when terrific floods occurred each summer. They must have made such a profound impression as to leave traces in myths long after the migration was forgotten. No wonder also that as language was a late evolution, the earlier emigrants could invent but a crude speech and the longer the brainier races used articulate speech before it became fixed by writing the higher the language became. The very earliest

racess must have migrated long before the body hair fell off as a result of the evolution we have mentioned, so that the Todas, Tasmanians, Ainos of Japan and the pygmies, (Negrittos) may represent types of emigrants from the two stocks who left before the ancestors of any other living races.

Nigrescence may give us a means of measuring the time of a race's migration south. A reasonable explanation of it in the tropics is the fact that it assists heat radiation and in pliocene times it must have been universal. Blondeness actually induces higher temperature and is as useful in the north as it is fatal in the tropics. Hence brunetteness has increased by natural selection in those going south and decreased in those remaining north. The latter have become the tall Teuton and the former the dark Mediterranean type, and those reaching the tropics being the blackest must have undergone this selection the longest and must be among the descendants of the earliest emigrants from the north. We can easily presume 200,000 years to evolve this blackness and this corresponds to about the time the skull capacity of the stay-at-homes should have reached its maximum by evolution in the north. Races going south beyond the tropics could well have produced a lighter color by a reversal of the selection. This is just as slow a process and we can judge that it will take just about 100,000 years to render blondes fit to live in the tropics.¹⁸

¹⁸ There is another reason for the evolution of dark skins in the tropics, for Havelock Ellis states (Pop. Sc. Mo., 1900) that Charcot, Unna, Hammer, Bowles and others have demonstrated that the violet rays of light "have an influence on the human skin which in the first place, at all events, is destructive and harmful in a high degree." Sunburn, snowburn, and snowblindness are thus caused and they can be avoided by excluding violet light with yellow veils or by painting the skin brown. Nature does this in the tropics, and also in the Arctic regions. Blondes are equally out of place in both extremes. Von Schmoedel in a paper before Munich Anthropol. Soc. (see Dr. R. W. Felkin, Jour. Trop. Med. 1900, or N. Y. Med. Jour., Oct. 27, 1900), states that it is only the excessive amount of chemical rays which are harmful and cause exhaustion from increased chemical change. He advocates dark, opaque clothes, and not white which allows the rays to go through and injure the skin. This explains the tendency to wear black clothing in the tropics, for it radiates heat better than white as well as excluding the dangerous light rays.

The broad heads can well be imagined to have been exposed to much light or to have been kept from the severest cold by the geological formation of Asia which until recently was mostly inland seas, and have not evolved the Teutonic bloneness for that reason and as "new-comers" in northwestern Russia they are disappearing before the natives. The European invasion, though much earlier, has mostly disappeared except in the highlands. The Eskimos being of the native stock are lasting longer but even they are geologically recent and no one knows but that they may be destined to extinction. The American Indian is generally believed to be a late expansion and none of them in the north have had anywhere near the 250,000 years to get blonde as

All skin changes are matters of selection of congenital variations and not due to sunburn, for Topinard shows that white races burned dark like the Jews of Africa, invariably have white children. Such acquired characters are no more transmitted than are deformed feet of Chinese women, or deformed heads of savages, or the absence of prepuce in Jews after several hundred generations of circumcision. It is not at all uncommon for children to be born with black hair which turns flaxen within a few months. This atavistic ontogenetic evidence is very strong that man's ancestor was not blonde, but that bloneness is a late evolution.

Actinic rays are fatal to the great majority of pathogenic bacteria, as well as to other forms of protoplasm, and Finsen has been curing all localized superficial skin infections, such as lupus, by concentrated violet and ultra-violet rays. He even cures many superficial cancers (Metzerott, *Nat. Med. Rev.*, Mar., 1901). He showed long ago that these rays do penetrate, and confirmed Witmark's discovery that they and not the heat rays caused sunburn, and that pigmentation in all forms of life is the result of survival of individuals, which can keep out these rays by permanent pigment or temporary pigment-like tanning. W. C. Borden shows that light penetrates so easily the white man's body that it is possible to photograph through it by special apparatus. Light, then, probably is an important item in the modern treatment of tuberculosis. On the other hand, light is so irritating in other infections (variola, varicella, rubeola and scarlatina) that the exclusion of actinic rays by the old method of red light, red curtains, etc., is actually a scientific treatment, and is said to shorten variola, render it mild and prevent suppuration and pitting.

On page 29 we have given illustrations showing the southern drift of blonde conquerors whose soldiers died out leaving them the rulers of dark natives—a condition which has existed throughout Europe for several thousand years.

have the Teuton, and those going to South America have had sufficient time to increase their Asiatic brunetteness, but not to get black. It may be remarked that from intermixture there are surviving blondes as far south as Sicily and perfect brunettes in the extreme north of Europe.

TIME OF MIGRATION.

The time at which a race left its home in nature's brain factory should be best judged by the average skull capacity, presuming that in both Europe and Asia the increase in brain proceeded at about the same rate. Of course nothing exact can be expected as conditions may have combined occasionally to cause an increase in brain long after migration, as was the case with the northern American Indians on the eastern and the Celto-Slav on the western extreme of the Asiatic type, and there has undoubtedly been a ceaseless crossing of the brainy new-comers with the less brainy people they find occupying the southern lands. This may not have been so very marked after all as it is the rule for conquerors to die out if they change too quickly from one climate to another. Successful migrations have been excessively slow and not cataclysmic—anthropologists having changed opinions just as geologists have dropped all their cataclysmic theories. Races, after becoming adjusted, may remain fixed to the soil, unchanged for thousands of years, and in spite of being overrun by repeated conquests they are said to be indestructible. The negro is the same as our earliest records and Gadow says, "The difference between the oldest inhabitants of Egypt, the Naquada, and the present Fellahin are very slight." It is interesting to note that Dr. Petrie describes both classes of men, straight hair and curly hair as the earliest immigrants in Egypt and we know that even until the present time there has been a constant stream into that death-trap, for they all die out.

As a rough estimate, with nothing definite about it, but as a peg to hang a thought upon, we may assume that the following table shows when the various old world races reached their maximum brain development by migration from the north or from cessation of the glacial epoch.

Races.	Years ago.	Cu. ins. skull.
Lowest tropical savages.....	200,000	60
African negroes	160,000	70
North African and Berber.....	120,000	80
Chinese and Akkadian	100,000	85
South European (Mediterranean) type.	60,000	90
Central Europe	40,000	95
North Europe (Teutonic)	20,000	100

(See also Chart II.)

As the glacial time is in a sense still with us this brain evolution may have been going on here and there in the north until the Christian era. Malays seem to differ so greatly that they can be assumed to be survivors of a continuous stream from the earliest times. The Polynesians, though antedating the Malays according to anthropologists, may be comparatively late though earlier than the last Malays.

Do not the small Peruvian heads rather indicate that they are the earliest eastern wave of the Asiatic race which had evolved the necessary brain to get across the water? even antedating the Polynesian? The navigation of the Pacific is a mere nothing to the present peoples and offers no bar to such a migration. Joseph Jacobs ("The Story of Geological Discovery") says, "A native of Tahiti, named Tupaia, drew out for Cook a map of the Pacific, extending over forty-five degrees of longitude (nearly 3000 miles), giving the relative size and position of the main islands over that huge tract of ocean." Do the Peruvians not show the high antiquity of man in America and yet show why no wholly satisfactory evidences of glacial man are found? The Incas found that the year was a little less than $365\frac{1}{4}$ days and they used the Gregorian calender 300 years before it was invented in Europe, and this development of astronomy surely took as long a time as the Egyptian or the Akkadian. If they had stayed in the less friendly environment of the Pacific they would still be Polynesians if not exterminated by later arrivals.

THE RATE OF MIGRATION.

The rate of movement in these successful migrations, must have been very slow, because it is an invariable rule that rapid migrations are fol-

lowed by extinction, there being no such process as acclimatization, as Ripley and others have proved. It is a law that a marked change of environment is fatal to any species of living thing, slow changes in environment only kill off the unfit and allow the fittest to form new species by that slow process of natural selection. Topinard (372) says, in referring to the sterility of some transplanted races, "the failure to become acclimatized seems to attack the germ in its very earliest development." Dumont (*Civilization et Dépopulation*, p. 156) shows that the poor aborigines have a higher birth rate than immigrants dwelling in towns and fertile plains. He shows also that various races in a country disappear in the inverse order of their appearance, as in France where the Frank has been absorbed by the Gaul. G. de Laponge (*La Vie et la Mort des Nations*, *Revue int. de Sociologie*, page 421, 1894) shows the invariable decadence of the dominating minority of intruders in a population from lessened birth rate, etc., and their eventual elimination, and the regaining of power by the lower inferior subjugated elements. With this return to power there is a lapse towards barbarism of course—a decadence of the civilization built up by the intruders.

The degeneration of all ancient civilizations is due to the fact that they have resulted from the rapid immigration of brainy races into a country of milder climate, occupied by inferior earlier arrivals; and have then died out, leaving the civilization in the hands of the stupid serfs. There are probably few or no traces of the men who developed the civilization of Chaldea, Persia, India, Egypt, Greece and Rome. The modern inhabitants in each place are not degenerate but strictly normal descendants of the lower classes—degenerate people die out invariably. The stupidity of the fifth of Italians elsewhere mentioned is not degeneration, but is probably an indication of descent from paleolithic predecessors of even the Etruscans, and they have not been able to advance in such a mild climate. Taylor gives (*Origin of Aryans*) very many illustrations of the above law of extinction after rapid migration. In my article on *Acclimatization* (*Phil. Med. Jour.*, Apr. 7, 1900) there are given the reasons for this extinction but we need not detail them here.

It is generally believed that without slavery, civilization would have been impossible. The presence of earlier inferior men in the conquered lands has thus been the real basis of civilization, for without their physical labor as slaves or serfs, the unacclimatized intruders could not have done the work. It would have killed them just as it kills whites to labor in the tropics now. The earliest records in Nippur show us upper classes in the cities, unable to live on their farms which are worked by lower aborigines. A similar state of affairs existed in prehistoric Europe. Only in modern times does machinery take the place of slavery.

The earlier products of the northern brain factory were thus invariably used as tools or as a higher domestic animal by the later products, and

this is exactly what Americans must do in the Philippines or be killed by the climate.

The actual rate of successful migration must have been very slow—a mere oozing along the soil of the lowlands, the paths selected can be seen at a glance at a relief map of the world. If in travelling south, a family would not wander more than a mile from its birthplace, it would take 4000 generations to reach Central Africa, say 100,000 years. There would be such a slow change in environment that the survival of the fittest could take place, and the race change.

The unfit blondes, least immune to disease, etc., would die most and the African types could well arise in this time. Acclimatization then is secured by evolving a new type, for those who finally reach the new climate may bear as little resemblance to their ancestors who started the movement, as negroes to the Teutons. All the lower races of men then are the result of a tremendous evolution, and it is absurd to call them degenerate descendants of higher ancestors, for such an involution is unknown. They are just as normal as the anthropoids, which are far from being degenerate men. In America there is so much less difference of type that we must presume a far less time for man's presence. Agassiz discovered that all the great races of men were confined to zoological provinces like other animals, and he recognized by the way that man like every other animal would die out if removed from his zone, and he got over the difficulty of human origin by supposing a separate creation for each variety of man in his own zone. Lyell, Dr. Morton, Bates, etc. (see Lyell, p. 496), showed that the American was an exception to these zones, arriving since the glacial he has not had time to differentiate types like the negro and Teuton. The dolichocephalic Eskimos were evidently the earlier arrivals, branches formerly living in Asia, at about 40 degrees of latitude (originally, of course, coming from Europe by an ice route), and in the 12th century they ranged as far south as the Potomac. The later brachycephalic Indians, coming from Asia, drove them north, where they are said to be dying out. No white colonies flourish nearer the equator than 40 degrees of latitude, the lower latitudes are never as prosperous as the higher. The southern hemisphere has no climate fit for Teuton except a bit of South America. Dr. Fred. Starr, of Chicago, thinks whites in America are reverting to the Indian type. Such a process would take immense time if it is to occur, but it is not likely that it will. It is more logical to assume that northern Indians, being new-comers were slowly changing to types found in northern Europe. To change an American so as to make him fit to live in the Philippines, is to make him a Malay or Negrito, and this would take ages, if it ever could be accomplished.

We have given numerous illustrations of these invasions from north to south, or highland to lowland (pp. 29 and 36) but it will do no harm to state a few more, as they all show a southern drift of brainier people conquering earlier arrivals. Very numerous illustrations are given in Taylor's "Origin of the Aryans" and in Dumont's "Civilization et

Dépopulation." Prof. Hilprecht's latest excavation at Nippur (Kengi or "Calneh in the land of Shinar") shows that the highly civilized Sumerians, the oldest known inhabitants, were constantly menaced by northern hordes, and were finally overthrown 4500 B. C. by barbarian Semites from the north, under the world-conqueror, Lugalzaggisi. He accepted the civilization of the conquered people and carried it on. After a temporary revolt the enervated Sumerians were again overwhelmed by barbarian Semites, who in their turn were overwhelmed about 2200 B. C. by northern hordes of Asiatics, the Turanian Elamites, from the highlands of Elam. These barbarians, talking an Akkadian dialect, sacked Nippur and departed. What a counterpart all this is to the similar repeated invasion of northern barbarians into the Mediterranean states, destroying and sacking, then accepting the civilization and carrying it forward.

How well this ancient southern drift is still kept up to repair the damage of extinction by tropical climates is illustrated in the following quotation from an article (Cosmopolitan, July, 1900) by Mr. Alex. H. Ford, upon the territorial expansion of Russia: "A steady stream of soldiers is still pouring over the Caucasus Mountains into the country of Iran, while from every outpost in Central Asia forces are marching southward for the advance into Persia and northwest Afghanistan, while across the Caspian sails a line of ships bearing men to fill the places of those who have gone forward." It is curious that the men who have undergone the greatest brain evolution, by reason of longest residence north, are now dividing the world into two parts, one controlled from the N. W. of Europe and the other from the N. E. of Europe; all of Europe south of 42 degrees latitude has no interest in this control. The two northernmost, Great Britain and Russia are gradually approaching each other in S. E. Asia, where future wars of supremacy are predicted, the frontier passing through China. "Russia has moved southward (in the region between the Caspian Sea and China) forcing civilization and peace upon ten millions of the most savage and predatory people the world has ever known." We can assume that Russian railroads will keep civilization alive for all time to come, for colonization has been replaced by spheres of influence or dependencies under temporary rulers who replace each other and then return north to their homes. Russian invasion of Manchuria is the most recent southern drift and it cannot be stopped by any earthly power.

The following quotation from Lord Macaulay's essay on "Warren Hastings" (see Edinburgh Review, 1841, p. 180) shows the drift of men to the tropics from vigorous climates where they were developed. "The people of Central Asia had always been to the inhabitants of India what the warriors of the German forests were to the subject of the decaying monarchy of Rome. The *dark*, slender and timid Hindoo shrank from a conflict with the strong muscles and resolute spirit of the *fair race*, which dwelt beyond the passes. There is reason to believe that, at a period anterior to the dawn of regular history, the

CHART IV.—MAN'S FAMILY TREE.

people who spoke the rich and flexible Sanscrit came from regions lying far beyond Hyphasis and the Hystaspes, and imposed their yoke on the children of the soil. It is certain that, during the last ten centuries, *a succession of invaders descended from the West on Hindostan*; nor was the course of conquest ever turned back towards the setting sun, till that memorable campaign in which the cross of St. George was planted on the walls of Ghizni."

The Emperors of Hindostan themselves came from the other side of the Great Mountain ridge, and it had always been their practice to recruit their armies from the hardy and valiant race from which their own illustrious house sprang.

The Chinese likewise, an Akkadian race from the western highlands, travelled to the lowlands of the east before 2500 B. C., finding a low people, who were driven to the mountains where their descendants, the Miao-tse are still found. The Chinese thus became fixed forever, and became an easy prey to vigorous Mongol invaders from the north, who conquered them time and again. The present brainy Manchu rulers are Mongols from the north.

We have mentioned (p. 24) the fact that Egyptian civilization, by tradition and other evidence, was not imported, but arose on the soil. Yet the whole course of Egyptian history gives evidence of one invasion after another of barbarous northern brainier people. The earliest monuments show two types, one coarse and African and the other refined and North Asiatic.

Finally, in America there has always been a southern drift, for there have been repeated conquests of Central America and Mexico by northern tribes, the Aztecs being very late. Probably the Algonquins would have been the Aryans of the new world if given time. There is still a drift from N. to S. in America to replace Southern families ever on the verge of extinction. Already the United States resembles Europe, in the north we find blonde Teutons, and in the south, brunette Mediterranean types.

The family tree (*Chart IV*) is added to show graphically the facts we have brought out as to the dual origin of man. The eocene and miocene are copied from Haeckel, that is, the primitive primates *prosimia* existed in the early eocene with 44 teeth of the same formulæ as the other eocene mammals (3-1-4-3). From these arose the fossil lemurs (3-1-4-3), the necrolemurs (adapides, 2-1-4-3), and the younger autolemurs (stenopides, 2-1-3-3), resembling present lemurs. It also gave a branch in the late eocene, the *simia* (2-1-3-3) or ancestors of all monkeys. The platyrrhine (2-1-3-3) new-world monkeys branched off early, and the other branch of *catarrhine* or old-world monkeys (2-1-2-3, our present formula) came in the early miocene. An early branch was the *cynopithica* (dog apes) or tailed babboons, and the later branch was the *anthropoidæ* or tailless apes in the middle miocene. Here I place the hypothetical division of this generalized ape into eastern brachycephalic and western dolichocephalic because the gibbons, the

oldest and lowest, date from this horizon. The earliest branch was the *pliopithecus* in European (late miocene), the next was the *troglodytes sivalensis* in the early pliocene in India, and the last and most developed was the *pithecanthropus* of the late pliocene or early pleistocene, all related to the unchanged present gibbons. In the pliocene the gorilla was the first of the western branches and the chimpanzee the last, as it is the most human of the apes. The orang is intermediate in time between last two, but from eastern stem. The Veddahs (the most ape-like of men) must have branched early and gone south from the eastern stem. Then later came from the western stem the Australians, Africans, Berbers and Mediterranean types. From the eastern stem the Polynesians were first, though perhaps preceded by the Americans. Latest was the Alpine branch which invaded Europe, crossing with the Teutons as the extreme west to make disharmonic Cro-magnon. The Eskimo disharmonic cross comes from very early branches of both eastern and western stem, probably as early as the African and Polynesian branches. The geological times are distorted to make the tree more intelligible, for the pleistocene is made largest, whereas the eocene should be. From these main branches it is possible to insert every known subrace and even tribe.

Folk-lore studies have now made it possible to assert positively that races of men in like stages of development and in like environments, progress alike and evolve like fancies and ideas. Similar conditions, arts, etc., are not necessarily borrowed. Hence we can see no reasonable objection to the fact that similar conditions are found in the branches and twigs of the two stems of our hypothetical dual human development.

Races in both sides of this tree undoubtedly underwent similar evolution in characters like color, size, etc., due to environment. Hence every color can be found in each side. In the same way classifications according to hair may (like Haeckel's tables) contain races from each branch, though of course it is difficult to see why hair should change in shape by adjustment to changes in environment. Twigs of the main branches represent present races, and as they are sure to have crossed, we must expect to find an infinite variety in every branch.

The dual classification is really but a modification of De Quatrefage's triple one, uniting his negro and white branches into the longheads, and calling his yellow the broadheads, and removing the broadhead whites from his white race to the eastern branch.

CONCLUSIONS.

A legitimate conclusion to draw from all this is that as civilization and brain development have gone on hand in hand, the lower races which have not taken part in it are forever unfitted for it. Though specialized enough to take up some few special employments as an intruder in civilization, they cannot carry on the advance by themselves. They are also barred out

more effectually the sooner they escaped from the factory of brain. The negro is a survival of men who migrated too soon and whenever he is left alone he invariably reverts to ancestral life as in Haiti. His color and physique bar him from the best parts of this country where he quickly perishes, and the struggle in a civilized environment is causing such degeneration that he is producing a tremendous crop of degenerates in the south from bad food, bad habits and exposure. Crime, consumption and insanity increase and hasten the inevitable extinction. He is sure to become extinct and is not an exception to the rules of acclimatization as Shaler states.

The domestic animals are also mentioned as exceptions to the law of acclimatization by change of type, yet almost every one is wholly unadjusted to the climate where man takes it, and would promptly perish were it not protected from the climate. Others, such as dogs, surviving in every climate without protection, have actually changed in type like the bears. Eskimo dogs and polar bears are both killed by the heat, and tropical bears, as well as Mexican dogs, will die in the Arctics unless housed. Human parasites follow the same law and would die unless kept alive in an artificial environment independent of climate. No living thing will stand marked change of climate without change of type through destruction of unfit.

When Morel wrote his great epoch-making work on human degeneration prior to the publication of Darwin's and Wallace's theories, he undoubtedly opened a mine of enormous value, but he was woefully wrong in considering the lower races as degenerate forms of the higher—a mistake following from the general conception of a primitive high type of man. This mistake still tinctures scientific as well as popular literature. The lower races are smaller brained though absolutely normal, and perfectly adjusted to an environment deadly to a Frenchman. I can add my own slight experience to the effect that among the lower races I have found as little or less evidence of degeneration as among the higher. This condition of nervous instability is merely one of the natural methods of cleaning any race of its most unfit. The Chinese seem to lead with the greatest per cent of degenerates and the races on the north shores of the Mediterranean are a close second.

Does it not seem also that evolution of brain stopped in Asia long ages before it did in Europe and that all Asiatics are jet-sam of evolution? The only ones who went ahead were the restless ones who were forced into Europe from the teeming areas of the north of Asia—and who became the ancestors of the Celto-Slavic or Alpine stock who certainly have helped civilization as much as any other race, and who are part of the newest and most vigorous of moderns—Russia.

Our New York Indians are doing very well, as they had evolved a large brain and were really the pre-historic Aryans of the new world, yet they are not able to do anything towards the advance of civilization, though far in advance of the Peruvians and Aztecs. Some of them are living about as the lower Italians, both survivors of lower races in a civilization built up around them by brainier intruders.

Comparative theology has long shown the strict relation between the kind of religion and the kind of civilization, and it really should not be necessary to call attention to the fact that they both depend upon brain development nor to deny that religion causes civilization as Dr. Reid states ("The Present Evolution of Man"), and as the clergy have been in the habit of preaching for generations. If there is any relation it is the other way, for in mediaeval times theology has done the most to retard civilization. The further natural selection increases the brain the higher are the religious concepts. Mohammedanism is always found no higher than barbarism because that is the limit of the religious conception of people who have not brain enough to go beyond barbarism after their migration south, and it is absurd to say that it is a cause of their civilization. These people refuse to accept Christianity because they are incapable of understanding it, and if they could accept it, then, if that religion is the cause of civilization, they should at once become highly civilized, which we know the Christian Abyssinians have not done. When Christianity arose it was too abstract and advanced for the mass of Jews and it had to travel north in search of brain. The Romans too could not understand it and they only accepted it as a political measure from outside influence from the north. Indeed races accepting Christianity invariably change it to accord with their own

mental state, our own negroes even mixing it with voodooism. Taylor has shown that in Europe ("Orig. of the Aryans") there is a close relation between race and religions, that Italy cannot become Protestant nor Scandinavia accept the southern form, and that religious wars have always been race wars and we know that the latter are always wars of expansion for more room. Thus there has been a regular and progressive evolution of religion going on side by side with the evolution of brain and civilization, and in a geometrical ratio like civilization, for at the present time the theology of our pulpits would have caused the burning at the stake of its believers only a few centuries ago. Even thirty years ago the clergy would have been scandalized by present sermons.

Instead of recognizing that brain, which had developed for the sole end of surviving natural adversities, had subsequently been devoted to another purpose—civilization—writers announce all sorts of causes of man's brain development. The long period of infancy is stated as a cause by John Fiske, but it is a result of an evolution having nothing to do with the brain. Mammals arose simply because by normal variations some animals were able to give a trifle of nourishment to their young, and this slight advantage was really a tremendous one in the end, for it was the determining cause for survival where others like the saurians, though highly specialized became extinct as soon as enemies increased. It followed that those giving nourishment and care longest were able to survive in spite of physical feebleness. Hence the prolonging of infancy and pregnancy resulted ages before the brain developed to its maximum, and the earlier mammals were almost as brainless as the saurians. It is undoubtedly true that the more intelligent beings were able to look after their young the best and survived in larger numbers, but a long infancy by itself without other conditions of severity in the environment will not enlarge the brain any faster than it has done for the apes.

Articulate speech has also been given as a cause of brain development, whereas we have shown that it is a very recent result of brain development. The erect posture freeing the anterior limbs for development into arms and hands, is very closely connected with brain development, for the two went on simul-

taneously, each the cause, as well as the effect, of the other, for one is impossible without the other. Brainier animals not having the best variations in arm and hand were not as favorably situated as those which happened to have both variations—slight increase of brain as well as slight increase of arm specialization.

Let us relegate to the scientific garret all those predictions of the future big-headed man with attenuated body and the wide-hipped women with birth canals large enough for the children's heads. We need never be afraid of the narrow-hipped women dying out from inability to give birth to children. Future specialized brains will be small enough—they are small enough now, too small for their possessors' judgments to be trustworthy except in their narrow specialty and often not even in that. Nor need we be afraid of the future specialist being as limited as the idiot Blind Tom, such variations being always the result of degeneration and doomed to extinction. The fittest is and will be the specialist having sufficient intelligence besides to think over and utilize his special abilities to the greatest good. Such evolution cannot possibly be racial deterioration as Col. H. Elsdale asserts (*19th Cent.*, Aug.). Far from deterioration, it is evidence of very high social evolution. Men who do not know that evolution means the survival of the fittest and not necessarily the survival of what they may consider the best, are apt to enlarge upon the forced survival of the criminal, the feeble-minded and the specialist and claim that man upsets the laws of evolution. Man is unable to upset any law any more than he destroys the laws of gravitation by the invention of a balloon. He is just as much subject to evolution now as ever for "there is no truce to the struggle for existence." The evolution of the specialized small-brained man in civilization is never lawless but follows the law of the survival of the fittest—he is an item in that "change from a state of indefinite incoherent homogeneity to a state of definite heterogeneity" of the modern social body. He becomes an artist in the "harmonious orchestration of specialists."

Writers like John Fiske who think we have, through intelligence, escaped the influence of evolutionary laws, have wholly

missed the essential idea of evolution. Instead of having escaped man seems now to be in a second stage of tremendously rapid evolution in the direction of specialization, an evolution more rapid even than that of the glacial times, for there is a marked change in the last 2000 years. It is another of Le Conte's "critical periods" (see p. 14), separating eras. The glacial period separated long eras of anthropoids and man, and this new critical period separates Le Conte's "Psychozoic era" into two parts of era of savage man, and the future era of specialists. Civilization will change us but we will not be degenerated, any more than frail hairless man is a degenerate gorilla.

In very many other respects man is now undergoing a most rapid evolution, but as it involves other characters than the brain we need only touch upon it. Men are always overcrowded for that is the basis of evolution, but the density of population is so great now that if we did not keep pace with it in our sanitary arrangements, to remove our own poisons, more than 9/10 of us would die. Thus in unsanitary England in the 14th century it is said that half of the four million people died of plague and one-fourth of the 100 millions in Europe. We are now eliminating those least immune to diseases of crowds such as consumption and typhoid, for these susceptibles are unfit for the environment. The most immune survive as the fittest, so that eventually all men will be immune to lung diseases like the Jews. We will also be immune to typhoid, or the crowd diseases will no longer be fatal, just as mumps, measles, etc., have ceased to be fatal in infancy. We need not follow it further, for it has been enlarged upon by Reid in "The Present Evolution of Man," it is only mentioned as further evidence that in other characteristics, as well as in brain, we are in a "critical period" of Le Conte, and undergoing a most tremendously rapid evolution. The cause of the last "critical period," the glacial climate, is not a bit more powerful factor, than the changes in living brought about by the present critical period—recent civilization.

In a remarkable posthumous paper (Cosmopolitan, March, 1901), Grant Allen rails against the British social system which preserves as parasites in the aristocracy, such inferior men and does its best to repress its best brains. He shows that there is

great variation in all families and states that "all men are born free and unequal." This is a curious mixture of two axioms and is not true. It is an axiom of political life, that "all men are born free and equal" and this is true; but in their other relations it is only true of paleolithic savages, for it is a law that,

Civilized men are born dependent and unequal.