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METANTHROPOS

OR

THE BODY OF THE FUTURE

R. C. MACFIE

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TO-DAY AND TO-MORROW

For the Contents of the Series see the end of the book

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OR

THE BODY OF THE FUTURE

BY

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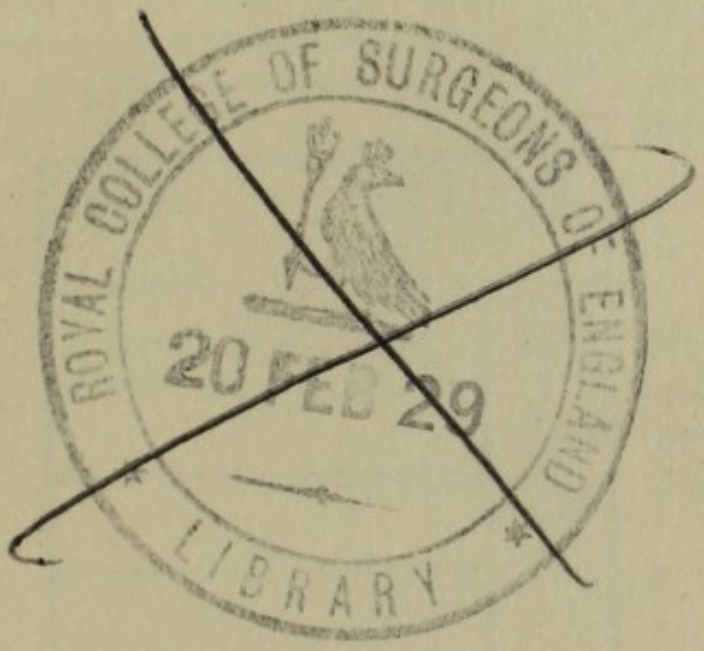

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CHAPTER I

" In the thought of To-morrow there is a power to upheave all thy creeds, all the creeds, all the literature of the nations, and marshall thee to a heaven which no epic dream has yet depicted. Every man is not so much a workman in the world as he is a suggestion of that he should be.
Men walk as prophecies of the next age."—

EMERSON.

" Man is no more than a phenomenon among phenomena, a natural object among other natural objects, his very existence an accident, his story a brief and transitory episode on one of the meanest of the planets."—A. J. BALFOUR.

" What is man but a species which during a brief period has been dominant over other species on a dwarf planet revolving round a dwarf sun which itself is an average undistinguished specimen of elderly stars which have seen better days ? "—

DEAN INGE.

METANTHROPOS

CHAPTER I

INTRODUCTORY

THE FUTURE OE MAN'S BODY IN ITS FAR PAST

"Even if we are descended from worms they were glorious worms." J. M. TYLER.

The Earth was probably born from the sun about four thousand million years ago, and life probably first appeared about a thousand million years ago, for though the final records of the rocks do not take us back further than about five hundred million years, yet the forms—trilobites and eurypterids—which we find in the most ancient strata do not represent the most primitive forms of life. It is believed that the first living things to appear were micro-organisms like bacteria, and it is probable that they swarmed in multitudes. millions of years before the Cambrian

trilobites, which were not primitive organisms but highly developed creatures of the crab kind. After the bacteria came protozoa, such as the amoeba ; after the amoeba, came the coelenterates, such as the sea-anemones, and so on, through worms to mollusca, insects, spiders, crabs. Anatomically and physiologically speaking, the line of ascent must have been something like that, so that the trilobites, belonging to the crab kind, were obviously comparatively late comers.

The worms were the Edisons of organic life. Their bodies were little laboratories where experiments in variations were made. They were the inventors of the crab, the spider, the fly, the oyster—the inventors of teeth, eyes, ears, nerves and blood-vessels. Well says Tyler that : " Even if we are descended from worms they were glorious worms," and Emerson :

" And striving to be man the worm
Mounts through all the spires of form."

The trilobite did credit to the worm : it was quite a successful invention : it persisted for millions of years without requir-

ing many alterations, and the crab to-day still carries on the prehistoric type. The insect, too, was a success, for it certainly has multiplied and varied and the spider at least has survival value, and shows by its web that it possesses a marvellous nervous system. But crab, insect, and spider, had few progressive potentialities, and the worm's greatest invention was undoubtedly the mollusc. For while crab, insect, and spider remained crab, insect, and spider, the mollusc, or at least *some* molluscs, became in turn fish, amphibian, reptile, mammal, and with every transformation enriched life with some new contrivance and carried forward some new organ for man. From the worm the human species got its red blood, from the tunicate its backbone ; from the fish its camera eye, from the Triton its five fingers, from the duckbilled platypus and the spiny ant-eater its mammary glands ; from the kangaroo its nipples ; from the hedgehog and anaptomorphid its placenta, and its neo-pallium. The wriggling worm and the placid oyster acquired fins, and hands, and feet, and eventually in a

thousand million years a few progressive bacteria were transmogrified into Newtons, and Kelvins, and Shakespeares, and Huxleys and Darwins, which made pleasant feeding for the other bacteria of more conservative tendencies. Five hundred million years ago a Londoner of to-day might have been a lamprey in the Tethys Sea ; three million years ago a salamander in an Gondwana marsh ; sixty million years ago a lemur in a forest of Lemuria.

Such then is the far past of man—a creepy-crawly, slimy, slithery, finny, furry past. Can we perhaps from such a past foretell his far future ? Can we map out a curve from the nebula through the amoeba, and worm, and pithecanthropus, and man, to the Metanthropos of the future ?

We cannot. We have no right and no reason to infer—as is so often done—that the rate of progress in the future will be equal, or nearly equal, to the rate of progress in the far past, or that we can judge of the direction and nature of future evolution from the direction and nature of evolutionary changes in the past. To

prophesy from the past to the future, when development has been so much an emergence of the novel, and unexpected, and astounding, and when progress occurring in so few individuals points to erratic or at least occasional causal factors—to prophesy from the past to the future and to say that in a thousand million years man's body will be to man's body to-day as a man to-day to a Silurian worm, is to prophesy most recklessly. We have no right to make any definite predictions : we have no right even to assume that matter to-day, and its radiant environment to-day are the same as they were some hundreds or thousands of million of years ago. Other large atoms besides the radio-active atoms known to-day may have been existent a thousand million years ago ; and the Earth and Sun in their journey through space may have come under the influence of rays that do not reach the Earth to-day. Germ-plasm is obstinate in its ways and conservative in its constitution ; but it has been proved that it can be grossly altered by penetrating " X " rays, and it is not impossible that more penetrating rays,

like Milligan rays, may have altered the evolutionary germ-plasm at various points *en route* between amoeba and man. We must remember, too, that a very small variation in the germ-plasm—the development from it for instance, of such a little endocrine gland as the pituitary may completely alter somatic development, and we must note that evolution has been rather rhythmical and explosive in its workings, hinting at cosmical or astronomical occasional causes and that there have been places and periods of passivity, and places and periods, as in the worm, in the worm age of great experimental activity. Zittel, the great paleontologist, after surveying the record of rocks, states that "fossil species remain within the limits of a single geological period (an interval comprising millions of years) fairly constant. With the beginning of a new epoch or period, however, which is usually indicated in the rocks by petrographical changes, a greater or lesser number of species either entirely disappears or is replaced by closely related, but at the same time more or less different

forms. Obviously, therefore, there have been periods when the process of transformation and the weeding out of organisms were greatly accelerated, and following upon those reconstructive periods intervals of repose have ensued during which intervals species have adhered to their characteristic forms with but little variation."

The same idea has been worked out by Professor Lull, who has shown the remarkable coincidences between the great blossomings of new forms of life and the great geological diastrophic changes. Perhaps it required the Himalayas to rise from the sea to produce the first breed of men! "There are," says Lull, "times of quickening the expression point of evolution and these are found coincident with geologic change. These coincidences are so frequent and so exact that the laws of chance may not be invoked to account for them. They stand to each other in the relation of cause and effect."

Such diastrophic evolution frustrates and baffles prophesy, and moreover, though we have no right to assume the

interposition of Will and Mind in the process of evolution, yet we have no right to deny the possibility nor even to deny that there is a good deal of presumptive evidence to support such an assumption.

We cannot argue from the far past to the far future, nor even from the far past to the near future. We can predict nothing of the future of man's body from its far phylogeny. So far as we can judge from the far past, man in a thousand million years may develop quite a different body : or it may be that he is as fixed and finished in his body as lingulae, and crabs, and sharks, and lancelets, and bacteria, seem to-day to be. The bacterium-crab sidled on famously till it became a crab, but it sidled no further : it has remained a crab for thousands of millions of years. The bacterium-newt went on developing for millions of years, and it seemed as if lizards were to be lords of the world, but its last experiments, the plesiosaurs, and dinosaurs, and pterosaurs, turned out to be complete failures, and the modern lizard is little better than its ur-ancestor. The past as recorded in the rocks is full not only

of splendid births, but of tragic abortions —full not only of happy inventions, but of disastrous blunders. Among the titanotheres alone eleven distinct species perished. Even in the case of man there have been misses as well as hits, for it seems likely that some of the first races of men prove unfit to survive. And any day there *may* be a great blossoming. The most we dare prophesy from the past general evolutionary career of man's body is that if it is going to progress its progress will be slow, possibly with rhythmical accelerations.

CHAPTER II

"Man is a kind of miscarriage of an ape endowed with profound intelligence and capable of great progress."—METCHNIKOFF.

"It is quite certain that man has descended neither from the ape nor from any other animal."—

VIRCHOW.

"The slightness of the degrees of difference between species is a necessary consequence of their number since their number is so great. But the relationship between them—such that one species should originate from another, and all from the universal species or that all should spring from the teeming womb of a universal Mother—this would lead to ideas so monstrous that the reason shrinks from them with a shudder."—KANT.

"Phylogeny, e.g., *reconstruction of what has happened in the past is no science but a product of fantastic speculation."*—PROFESSOR LOTSY.

CHAPTER II

THE FUTURE OF MAN'S BODY IN HIS RECENT PHYLOGENY

"Man still carries in his bodily frame the indelible stamp of his lowly origin."

C. DARWIN.

In man's far phylogeny we found no encouragement to prophesy, yet perhaps if we restrict our attention to man's more recent evolutionary history we may be able better to discern the trend of his future germinal evolution.

Perhaps! But man's recent evolutionary history is mysterious, and obscure, we are not even sure of his precise lineage and of his nearest relatives. His anatomy certainly suggests or even insists that he should be put in the order of the primates along with lemurs, lorises, marmosets, capuchins, macaques, baboons, mandrills, gibbons, orangs, chimpanzees, gorillas *et hoc genus omne;* but nevertheless, it has proved almost impossible to decide his exact pedigree, and to determine which of

his primate kin are on the direct line of descent, and which are collaterals.

Darwin and Haeckel believed that man was descended from the Old World Catarrhine monkeys. "The Simiadae," Darwin writes, "branched off into two great stems from the New World and the Old World monkeys, and from the latter man, the wonder and the glory of the Universe, proceeded." With this pedigree Huxley agreed, and there are some scientists to-day such as W. K. Gregory and Smith Elliot who more or less still follow it. Smith Elliot traces man directly from Insectivores through Tarsoidea to Catarrhine Monkeys and makes Gibbon, Orang, Chimpanzee, Gorilla, Pithecanthropus consecutive branches of the main stem ending in *homo sapiens*, while in a volume of this series "*The Mongol in our Midst*," Dr. Crookshank argues that the Caucasian, Mongolian, and Black races are descendants respectively of the chimpanzee, the orang, and the gorilla.

Theories, however, which trace man's descent either from monkeys or the great anthropoid apes are not commonly held;

most of the leading authorities, such as Sir Arthur Keith, Professor J. A. Thomson, hold that the differences and the resemblances between ancient and modern men, and the ancient and modern monkeys and apes can be explained better by assuming men to be collaterals of monkeys and apes but not on the line of direct descent.

Anyhow, in the time of the ancient lemurs, men, and apes, and monkeys were probably all lemurs of sorts, and, as variations of lemurs, men and apes and monkeys, more or less simultaneously, began their career. Such a direct lineage of man from the lemurs appeals to one's sense of the eternal fitness of things ; for the lemurs are creatures notable for their power of twisting their necks, and of "looking before and after," and for the size of their eyes. In them the Eye, for the first time, took priority of the Nose, and in their neopallium were laid foundations of the great visual and tactile centres of association in the neopallium of the higher Primates.

Regarded as primates, sprung like other primates from a creature of the lemur

kind, man and the great apes have at least altered, and some of the alterations seem advantageous and may be considered progressive.

Wiedersheim counted in man fifteen organs which he considered improvements of the same organs in the ape, though, of course, improvement is a relative term, and seventeen organs that he considered degenerate.

Both man and the anthropoids have certainly increased in bulk, in agility, in dexterity, in strength, and especially in size of brain ; but these changes could not have been foreseen, and from them we cannot foresee what changes are to come. We have not even a right—as is so often done by those who ought to know much better—to assume that many of the special features now confined to monkeys and apes—*e.g.*, big brow-ridges, long arms, prehensile feet—were stages in the progress of humanity. Man, so science says, struck out a line of his own more than a million, perhaps two million years ago, and though some parallelism between his evolution and the evolution of his collaterals the

monkeys and apes is likely to have obtained at least for some time after divergence, we have no right to assume that there will ever be anything like complete parallelism and complete convergence. All the primates came from some tarsius or lemur-like creature, and the fact that some of the higher anthropoids acquired monkey tails, and great supra-orbital ridges, and great canine teeth, and bent femurs, does not mean that modern Man must at one time have had those acquirements, and that now he has reached a higher stage of development. We have not much idea what forms man passed through on his way from Tarsius or Lemur to *homo sapiens*, and we have no reason, or very little reason to believe that he once had an ape's receding jaw, and puny brain, and great supra-orbital ridges, simply because he came of the same stock as animals which to-day and for some time have possessed these advantages. As a matter of fact, so far as the bones of the skull go, man's skull is much more primitive than the bones of the skull of the great apes ; it is much more like the skull

of a Tarsius or a gibbon than the skull of a gorilla and it is extremely unlikely that modern man once possessed an ape anatomy and lost it. The skull of the great apes, indeed, has progressed much further than the skull of man, and it is more likely that the skull of modern man will even yet progress and grow more ape-like in its progress than that it was formerly ape-like and reverted to its present more primitive character. It may be objected that the Pithecanthropus, and the Piltsdown, and Neanderthal, and Rhodesian, and Heidelberg skulls show certain ape characters unlike those of modern man: but science tells us that these ancient men were not linear ancestors of modern man: they were side lines that perished, and perished probably just because of their ape-like progression. If these were on the direct line of descent of Man, or if modern man traced ancestry through ape-men, then it is extraordinary that modern man in the Neolithic Age showed a pure type without any stigmata of the Pithecanthropus or of the ape at all. The Cromagnon men were quite modern in type,

indeed, bodily speaking they were of a human type superior to the human type of to-day. As their skeletons show, they were a handsome, tall race. They had high, broad brows, aquiline noses, and prominent, well-shaped chins. The men had an average height of six feet one and a half inches, and possessed brains larger than the brains of the modern man, and, though the women were much smaller, even their brains were larger than the brains of an average Londoner to-day. The drawings and paintings, too, of the period show that the Cromagnon race had exceptional artistic talent. No doubt, even then, skulls with strongly marked brow-ridges sometimes cropped up; but we know very little of the physiological meaning of big brow sinuses, and we have no reason to assume that the big ridges were reversions to Neanderthal types: they were possibly environmental variations. Nor can the lower Grimaldi race with round high skulls be considered anything else than a comparatively new variety of *homo sapiens*.

Some, of course, still believe, with

Haeckel, that the human embryo climbs up its own genealogical tree, and claim that certain stages shown in the human embryo prove that *homo sapiens* passed through various ape and monkey stages and had once a tail, etc. They recognize in the " nose " of the human foetus, first the nose of a gilled fish, then the nose of a lunged fish, then the nose of an amphibian, and then the nose of a mammal. Who *knows?* But the doctrine of " recapitulation " is exceedingly questionable, and the fact that simian features, such as a tail or wrist vibrissae, appear in the human foetus no more proves that man is descended from a tailed primate, such as a monkey or lemur, than the fact that the foetus of an ape has a rounded chin, a big head, and a hairless body proves that the ape is descended from big-headed Neanderthal man.

Some of the appearances in the human embryo might be interpreted to mean that men are descendants of anthropoids, others that anthropoids are descended from men, and it is particularly to be noted that the foot in the human foetus climbs up no

genealogical tree, for it passes through no simian stages. "The foot," says Wood Jones, "as soon as ever it is formed in the embryo is of the characteristic human type; at no stage is it a monkey's or an ape's foot." "The curvature," says G. S. Miller, "is at all stages essentially as in the human adult; no true approach to the structure characteristic of the apes is visible." The peroneus tertius, too, a muscle characteristic of the human foot and leg, and found in no other animal, shows no anthropoid adaptations in its embryogenic development.

The similarity of embryogeny in the case of all mammals may indicate merely a case of homoplasy. Further, as Bolk has pointed out, what is to come is sometimes hinted in the embryo before it appears as a permanent character in the adult. The transient tail of the human foetus and the rounded chin of the anthropoid foetus may just as well be coming events that cast their shadow before, as relics of the past.

Only in the most general way does a study of man's obscure simian phylogeny

enable us to compare his present with his Eocene and Pliocene past and with the Eocene and Pliocene past of collateral stems, and such a general comparison enables us only in a most general way to guess the possible future of his body.

The comparison, however, tells us something of the past and present potentialities of the " genes " of his phylum, and some potentialities seen in other kindred animals but yet unrealized in his body may still be realized in years to come. We know that the germ-plasm of the phylum which he shared with the monkeys and apes must have contained in it the genes of all the animals—gorillas, pithecanthropoi, baboons, gibbons, etc :—to which it gave origin ; and we can at least entertain the possibility that in man's germ-plasm there still are genes, capable, in the right combinations and in the right environment, of developing some of the features in which monkeys and gibbons and the anthropoids have in the course of evolution outstripped man or varied from man. It is possible that certain simian or lemuroid genes latent to-day in man may come into

action and restore his hairy coat, and that, even without loss of his highly evolved brain, he may yet develop such useful organs as an orang's teeth, and a gorilla's great thorax and muscles, and a chimpanzee's long arms, or a monkey's tail. It is possible, too—so far as we can judge from phyletic phenomena—that gibbons, or monkeys, or great apes may revert to hairlessness like their cousins, and develop their neopalliums and become the hyper-anthropoi of the far future. If " bone for bone, muscle for muscle, nerve for nerve, there is an all-pervading similitude of structure " between man and the great apes—if even after a million of years there are still similarities, supposed to be genetic, in the integument, brain, reproductive organs, viscera, muscles, larynx, parotid, and other glands, fundus oculi, diaphragm, auditory ossicles, etc : surely there is some possibility that the two parallel phyla will yet converge in many characters at present dissimilar. We find in man even to-day occasional variations that would seem to point to convergence through the sudden activity of latent

genes. We find for instance, individuals and races that grow hairy like the great apes : we find in some cases children born with tails : we find men of the Neanderthal type suddenly cropping up.

So that, if from the facts of man's primate phylogeny we are to make any kind of phyletic prophecy, we are bound to admit that if his body is to progress further it is not altogether impossible that it will be on the lines seen in the anthropoids. And we are encouraged in this speculation if we accept Bolk's extremely interesting theory of the origin of most of the differentia between man and anthropoids.

According to this theory, man of to-day differs from the anthropoids mainly because of different action of his endocrine glands, and this obviously implies the possibility either of rapid convergence or divergence of the anthropoids and man. If, as Bolk and Keith and Starling have shown, all the organs of the body are regulated in their growth and function by such hormones, then plainly a very small change in the endocrine glands might give men tails, or chimpanzees chins, and the

future of man's body lies not so much in the potentialities of his germ-genes in general as in the activities of his endocrine glands—activities which, according to Bolk, probably depend mainly on diet.

But all this is little more than speculation and does not go to the root of the matter, for the chief anatomical differences between men and anthropoids are not differences of bony muscular structures, with their results in posture and function, so much as in differences in brain development. Whatever caused the growth in the neopallium, whether it was the inevitable result of the molecular machinery in the aeon-old germ-plasm or caused by local changes in some of the endocrine glands, such as the thymus, due to changed diet, the fact remains that the most striking feature of the evolution of the man has been the growth in size and complexity of the neopallium—that part of the brain which contains associative memory. It was this growth of the neopallium that made it possible for poor, naked, defenceless man, with his weak little jaws and arms, to survive through the fierce Glacial

Age. It is this neopallium which has made man the King of the Mammals and of the whole world to-day.

It is chiefly in the brain of man that we must find the future of his body, but the brain of man has developed on such special lines that its Primate relationships and likenesses shed no light on its probable future development. The brain of man despite its superficial likenesses to the brains of the great apes has gone, and will go, its own way and only in man's body itself can we find any clue to its future.

CHAPTER III

"In every well-tried path of evolution progress has practically come to an end."—E. G. CONKLIN.

"The idea that a characteristic could in any way increase as a result of selection is out of place in an exact or even a logical science."—BATESON.

CHAPTER III

THE FUTURE OF MAN'S BODY IN THE PRESENT OF MAN'S BODY

"If there be any who are sceptical about Evolution, let them remember their own: it is worth studying."

JULIAN HUXLEY.

Anatomically and physiologically speaking, the human body *at its best* must be adjudged a wonderful organism. It has attained an erect posture by "the turning"—as someone has said—"of an ordinary quadruped a quarter of a circle in the vertical plane." That prodigious feat (accomplished only very imperfectly by the other primates) implied and necessitated complicated correlated structural alterations all over the body from top to toe. "Ribs, vertebræ, sternum, body wall, and spinal muscle, diaphragm, pleuræ, lungs and heart underwent a simultaneous harmonious adaptational transformation. Among other things, the alteration in posture has required altera-

tion in all the mechanisms of balance from the otoliths to the plantar nerves, from the " red nucleus " to the os calcis, in the twenty muscles which balance the head, in the hundred and six muscles that move the legs, in the hundred and forty-four muscles of the spine and all the rest of them—and the ultimate ingenuity, complexity, and perfection of the automatic machinery are almost beyond human conception. When a man runs, or jumps, or even stands upright, some hundreds of muscles, and some thousands of nerves are working together : his will is driving not a four-in-hand, but a ten-thousand-in-hand, and is driving them, so to speak, by pressing a button.

So wonderfully do the nerves and muscles adapt themselves in the embryo to the new build and posture of the man that is to be, that Sir Arthur Keith, watching the muscles attaching themselves to the bones, confesses : " We cannot avoid the conclusion that the growth and development of young muscle cells are controlled by influences and means which work towards a functional result "—a

confession reminding us of Huxley's remark that in watching the growth of an embryo : " We are forcibly reminded of a modeller in clay," and of Aristotle's wise saying that, " Nature produces these things, which being continually moved by a certain principle contained in themselves arrive at a certain end."

We do not say that the musculo-nervous machinery of balance and locomotion is more perfect in men than in other animals—in each it is perfect in its own way and for its own purpose—we merely point out with what skill and success it has been adapted to his turn of a quarter of a circle in the vertical plane. As an erect mammal man runs, dances, leaps, hops, with an ease and a versatility that no quadruped can emulate, and his erect posture has given his upper limbs freedom and has resulted in the development of a hand with talented thumb whose dexterity is without equal in the animal world. It is true that he has not the strength of a gorilla nor the speed of a greyhound, but, taken all in all, a man at his best is a splendid creature, and a better, more

efficient organism than any other animal, not only because of his special general anatomical type, but because of a special cerebral organization able to make innumerable useful co-ordinations of his muscles.

We can imagine a man evolving the great jaws and muscles of a gorilla, and becoming larger and more powerful; but we do not see how that or any other considerable evolutionary anatomical variation could render a man more efficient and more able to maintain a secure and happy place in his environment. Short of some great evolutionary development which we cannot foresee or guess, there seems little room for further improvement in the human body, and Professor J. A. Thompson states that anatomists do not look for startling changes in man's general bodily structure, and Professor Conklin believes that "progress has practically come to an end."

Yet, even anatomically, an apparently perfect human body is not *quite* perfect, and variations are constantly appearing in it which indicate that evolution is still, for better or for worse, working away at it.

We find even in a perfect human body tissues, and organs, and bits of organs, which are apparently relics of structures useful in the animal ancestors of man, but useless or even dangerous in man to-day. These have been called " vestigia," and in his book, *The Structure of Man*, Professor Wiedersheim notes more than a hundred, all of them apparently useless and some of them a burden and dangerous. Among useless vestiges may be mentioned the functionless muscles of the ear, and the little fold of epithelium at the corner of the eye, which is believed to be a relic of the third eyelid of the lower mammals and which is useful in them for cleaning the surface of the eye, but which seems of no use in the human eye. In a perfect human body these would be removed, and it is *possible* that they are being gradually removed, even though we can detect no machinery in evolution (unless prescient purpose) competent to remove vestigia that are of no vital disadvantage.

But we must be careful how we use the word " vestigia " for Nature is usually wise, and many of the structures that may

seem useless relics may really be conserved for useful purposes. Not long ago the tiny pineal gland was considered a useless vestigium carried over from a reptile ancestor, and to-day we know that it is a very important endocrinal gland. Quite recently the great biologist Metchnikoff and the eminent surgeon Arbuthnot Lane considered both the appendix and the caecum and the great intestine to be useless structures which it would be well to extirpate. "It would be no longer rash to say," wrote Metchnikoff, "that not only the rudimentary appendix and the caecum, but the whole of the human large intestine are superfluous and that their removal would be attended with happy results," and accordingly many men and women lost part of their intestinal tract. But to-day it is recognized by Sir Arthur Keith and other distinguished authorities that both the appendix and the great bowel perform most useful parts in the human economy. The great bowel has important nervous connections with the central nervous system, and is dotted with some fifteen million little glands which

probably supply an internal secretion, and in Sir Arthur Keith's words, "we must conclude that it is not a useless or superfluous organ." The thick hair of the head and the thin hair of the body may or may not be residua; but even if residual they are probably useful, and being useful, they will probably be retained. Nature is very cunning and very ingenious, and with the same bricks she can construct on similar ground plans a great variety of construction. With vestigial muscles of a tail she supports the viscera in the erect pelvis; with the residuum of a reptile's central eye she makes an important endocrinal gland; with the residua of fishes' gill-arches she makes the auditory ossicles, with the vestige of an anteaters' hand she makes the beautiful little foot of a gazelle or a horse, by rearrangement and modification of the muscles and bones of a tarsius she make the human leg and foot, and finds it necessary to add only one muscle, the peroneus tertius. Nature is full of ingenuity and is continually making silk purses out of sows' ears.

It is true that evolution in the past has

worked largely by elimination—as we see, for instance, in the foot of the horse, in which five ancestral toes were reduced in the orohippus to four ; in the mesohippus to three ; and in the pliohippus to one. It is true, too, that in the highly differentiated type like man great changes are unlikely, and that some variations of the future are quite likely to be by the elimination—elimination for instance of parts like the little toe, and the wisdom tooth, and the ear muscles that already show signs of deficient survival vigour ;—but we must be careful not to condemn apparent vestigial remains too readily, for in the human body most of the vestigia are probably put to some use. We will not find in the mere removal of useless vestiges much room for the improvement of the body of man.

And *en passant* we may note that the wisdom teeth of the Rhodesian man who lived some 500,000 years ago *seemed* even then the downward path.

Again we must not confuse cultural and germinal deficiencies. Flat feet, myopia, bald heads, are prevalent in England

to-day, but we must not, therefore, prophesy that the body of the future is to have flat feet, myopia and a bald head. Many of these deficiencies are not germinal; they are due to bad habits of life and they can be removed by removing bad habits.

Only in one part of the body does there seem much prospect that evolution working on ordinary lines will bring forth something new, and something better than the best body to-day, and that is in the part where evolution since the time of the first primate—we might almost say since the time of the first mammal, has been particularly busy. The most characteristic feature of primates, and especially of the higher primates, is the neopallium, and the most characteristic feature of the neopallium is the layer of cells spread over the surface of all its convolutions. Though these cells collected together might be put into a small liqueur glass, yet they number nine or ten thousand million, and on their activity and co-ordinations, depend all the higher sensory motor and intellectual functions of man. The great

apes have outstripped man in some ways but in neopallium man has quite outstripped the great apes, and it is to its nervous elements that man owes his manual skill, his mental achievements, his memory, his volition, and all that makes him *homo sapiens*, the King of the animal world "with dominion over the fish of the sea and over the fowl of the air and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth."

Even here the position regarded from a general standpoint is not too hopeful.

For thousands of years cerebral evolution both in man and in the other primates *seems* to have ceased. The "clumsy, shuffling, loose-jointed," stodgy, Neanderthal man, must, we think, have had brains in his low-browed, long, big head at least equal to the average European brain to-day to survive through the stormy times in which he lived, and to combat successfully both glaciers and mammoths. It is true that the Pithecanthropus had and under-sized brain ; but a skull of the same Pleiocene period has since been

found at Wadyak in Java " of very large cranial capacity ": the Piltsdown skull was large enough to hold the brain of an Anatole France or a Liebig, and both Neanderthal and Cromagnon skulls were of larger cranial capacity than modern skulls. We see no reason to believe that the cerebral endowments of the best modern men are superior to the cerebral endowments of the best Cromagnon men or of the best Egyptians and Greeks. We find no certain signs of much development during the last 500,000 years and in historic times development seems to have been almost arrested. In his excellent little book, *The Stream of Life*, Julian Huxley (grandson of Thomas Huxley) states his opinion that: " There is no evidence of any upward change during the whole artistic period (and probably for much longer) in the higher level of intellectual, artistic, or ethical possibility. . . . The general run of human nature and human capacity has remained the same for thousands of years." Indeed, when one considers the intellectual subtlety, philosophic breadth, and artistic perfection of

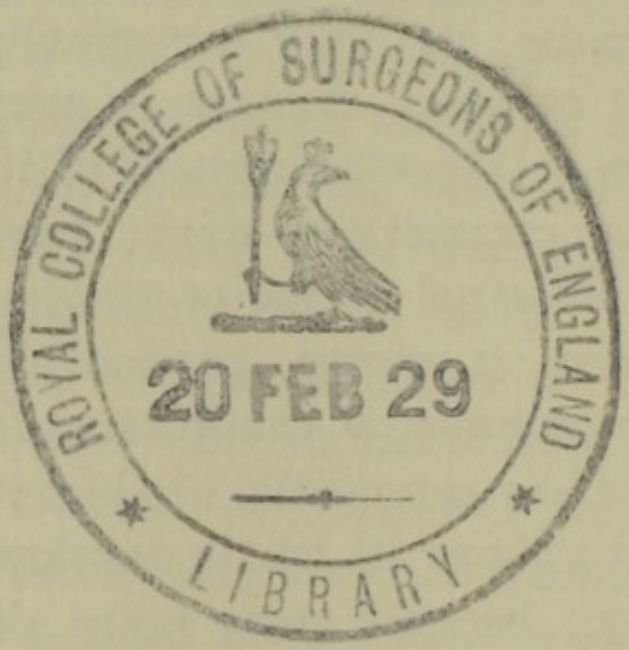
the Greek language one wonders whether the modern brain has not deteriorated, for it is pretty certain that it would take an average European brain thousands of years to elaborate such a vehicle of thought—if indeed it *ever* could elaborate such a language. *So far* there seem to be no signs of any new experiments of Nature : so far there are no signs of new senses or new faculties, for the alleged new psychic faculty is a sign chiefly of a degeneration of old intellectual faculties in those who claim it, in those who allege it, and in those who believe in it. There are no signs of new faculties or of new senses to-day. Even a calculating prodigy, even a Newton, or Beethoven, or Leonardo, or Shakespeare, does not transcend the swing of normal intra-species variation.

Nevertheless, there is still some room for hope ; we need not despair. In spite of prolonged inertia on the part of the neopallium it is part of the body where progress is most likely to make strides—the only part indeed, so far as we can see, where really new developments and really new acquirements are to be looked for.

In the outer cell-layer of the prefrontal region if anywhere, we may hope for active evolution such as occurred when the molluscs became vertebrates and when the vertebrates became mammals—firstly; because the outer layer of the prefrontal region of the neopallium is the most recent product of mammalian evolution dating back no further than man: secondly; because its very complexity offers room for complex changes—a very small alteration in the arrangement of its cells and nerve connections might have momentous intellectual or motor results: thirdly; because it seems particularly sensitive to environmental conditions and a little more or less interstitial or thyroid hormone might change its whole development: fourthly; because some areas do not seem yet quite organized or functionlly active, and fifthly; because as J. S. Bolton points out, even in normal individuals under normal conditions there are marked structural variations.

If, in the ordinary course of evolution, the body of man is going to progress, the neopallium and especially its higher as-

sociative centre seem most likely to be the seat of progress ; and it may be remarked that microscopic changes in the brain may have as much value in marking the bounds of a new species of man as a new tail or jaw in marking off a new species of ape.



CHAPTER IV

"Only labour is required to extend almost without limit our understanding of the human body and our control of its fate."—STARLING.

"Man is an animal, a highly cerebrated animal it is true, but still an animal. Being an animal he is therefore no angel. He hopes to become an angel eventually but he is certainly no angel now."

E. M. EAST.

"Our fathers bad, and we are like to be worse."

ROBERT BURTON.

CHAPTER IV

CAN MAN ALTER HIS FUTURE BODY?

"Not only onward shalt thou propagate thyself but upward."

NIETSCHE.

"I should advise no man to marry who is not likely to propagate intelligence."

S. JOHNSON.

There is another more interesting and perhaps more fruitful approach to the question of the future of man's body. We can approach the question from the point of view of the *machinery* of evolution and variation and from this point of view perhaps discover, not only if the machinery is likely to go on working in man's body, but whether man himself can, to some extent, control the working; and the question of man's control over his own evolution is perhaps the most interesting and most important in all biology.

It must be clearly understood that evolution in the sense of heritable variations causing permanent morphological, and functional changes in the body, though ex-

hibited in the body, takes place really and radically in the germ-plasm, and that it is useless to look for its main-springs in the glands, or brain, or other organs of the body.

In the course of some thousands of millions of years—so evolution tells—an ultra-microscopic dot of germ-plasm, known as a " bacterium " or " protobion " has transmuted itself, by a process of molecular reconstruction, associated with conjugation and fission, into another dot of germ-plasm, about the size of a full stop, part of which under suitable conditions may grow, in a few months, into a human baby. It has required thousands of millions of years of mysterious processes to grow from the one dot into the other, but it requires only a few months to grow from the second dot into the twenty-six trillion cells of a human infant. In the course of ages, the germ-plasm has not altogether lots its pristine bio-chemical characters—it still breathes, feeds, grows, divides, on the same principles as its ur-ancestors—but still its somatic accretions show that there must be almost infinite radical differences between it and the first dot.

It is the evolution of the germ-plasm we must consider—the alterations in the remarkable material which lead to somatic evolution,—and this evolution seems to be focussed in the so-called chromosomes of the germ-cells, and to depend on changes morphological or bio-chemical in their so-called "genes."

We have not to explain why an animal with a tail becomes an animal without a tail, we have to explain why one bud of germ-plasm produces a tail and another one does not, and no gradations of tails in the bodies explain that. To explain germinal evolution by its products is putting the cart before the horse. The tail does not grow longer or shorter because its predecessor was longer or shorter, but because the germ-plasm has altered to produce a longer or shorter tail. It is the germ-cells we must compare, not the tails.

According to the accepted theory of the germ-plasm, the germ-cell of any animal alive to-day is continuous by a process of budding with the germ-plasm of the first living organisms. For thousands of millions of years, as if endowed with immor-

tality, the first little cell and the chromosomes in it have gone on budding, budding, budding, budding, till the chain of buds between say an amœba and a man would reach out far beyond the solar system. As the germ-plasm—the wonderful material of life—budded, the genes in the budded cells altered and accordingly the organisms which developed from the cells altered too. So that on the chain of life stretching across the aeons, between an amœba and a man, may be pictured hanging in series, millions and millions of animals, amœbae, tunicates, lancelets, monotremes, shrews, lemurs, all the way up to the man. Regarded from this germinal point of view, which seems the correct point of view, man's pedigree is shown more accurately as a strawberry runner than a tree.

There are about 5,000,000 species to-day, and they all owe their emergence to changes in the genes during the last 1,000 million years or so. It is a good deal of responsibility to put on genes, but science does so, and certainly there is good proof that to-day the inheritance of characters and the evolutionary emergence

of characters depends on genes—that if the chromosomes are destroyed no development can take place and that any alteration in a chromosome alters the organism's growth—gives it blue eyes, or brown eyes, rough hair, or smooth hair, masculinity or femininity, as the case may be. "The characters," says Professor Castle, "which differentiate one individual from another of the same species are determined by particles of chromatin each of which has a definite position in a particular chromosome." This, however, must be taken only as a working description of the significance of the genes, for as Professor H. S. Jennings points out in *Prometheus* of this series, "It is not true that particular characteristics are in any sense represented or condensed or contained in particular unit genes . . . . Into the production of any characteristic has gone the activity of hundreds of the genes if not all of them : and many intermediate products occur before the final one is reached. In the fruit-fly at least fifty genes are known to work together to produce so simple a feature as the red

colour of the eye ; hundreds are required to produce the normal straight wing, and so of all the other characteristics. And each of the co-operating packets is necessary, if any of the fifty is altered, the red colour of the eye is not produced."

The question then arises—why and how do the genes change ?

In Darwin's time the germ-plasm was supposed to be changed in some most mysterious way by the workings of the body that bore it, so that a blacksmith's use of his arms could so alter the germ-plasm that germ-cells in future would produce offspring with stronger arms, and that the elongation of the neck of a giraffe could so alter its own germ-plasm that it would in future produce little giraffes with longer necks. In brief, it was believed that the characters a body acquires in its lifetime could in some way induce the body's own germ-plasm to reproduce them at birth; but the body can acquire only such characters as its own germ-plasm gives it, and the germ-plasm is not altered in its inherent developmental characters by the normal chemical and physiological activities of

the body holding it. A study of the machinery of mutations merely shows us that they come mysteriously and spontaneously and that all we can do in the way of altering them is perhaps, when we have located them, to destroy them by the local application of chemicals or X-rays. The prospect of ever being able to alter the body of man by evoking new mutants is extremely remote.

Being, then, at the mercy of our genes must we despair like Bateman, who states that the "hope that by change in the conditions of life or by any external influences significant alterations whether of organisms amenable to experiment or of the human population must be abandoned"? No, there still remains to be considered *selection*, a factor so powerful that for long it was believed to have been the main agency in evolution—the only agency that gave evolutionary value to variations and mutations believed to have been thrown blindly out.

In one or two not unimportant respects, selection has already made important changes in the body of man.

It is almost certain that germ diseases such as consumption which slay men before they have had time to bear many children must have weeded out genes most vulnerable to certain diseases. We find to-day that in this way vulnerability to certain diseases is being weeded out of certain races. In Europe alcoholism and tuberculosis are diminishing, largely because families specially susceptible to these diseases have been gradually extirpated. We find that when an unweeded race even to-day is exposed to new diseases the vulnerable are weeded out by the thousands. In 1876, within twelve months of annexation, forty thousand Fijians died of measles. Samoa was similarly devastated in 1893. Whooping-cough decimated New Guinea in 1903. The influenza epidemic of 1917-18 slew fifteen to twenty-five per cent. of Tahitians. On the island of Saipan in 1919 only half per cent. of Caroline Islanders died of influenza while twelve per cent. of Chamorros perished.

There can be little doubt that germ diseases have selected and are still selecting men and races of men resistant to them ;

but selection, of course, presupposes innate differences—differences inherent in inheritable genes—of resistance. Smallpox, which was a deadly disease for centuries, never selected a race resistant to it, nor is plague likely to select a race resistant to it.

Also in certain "gene" diseases, selection is or has been at work. It is known that haemophilia, and albinism, and weak mindedness are gene diseases, and, in so far as the inheritors of these diseases are more liable to disease and death and so less likely to have offspring, in so far the genes of these diseases are gradually being weeded out.

War too must have exercised some selection but to what extent and in what ways it is very difficult to determine. On the average, in an equal hand-to-hand-to-the-death conflict the man of greatest strength and vigour must have survived. But a conflict is rarely equal, men in numerical superiority with better armour and better swords can massacre their physical superiors. And even in the days of hand-to-hand battles there was a much greater death-rate from disease than from violence. In former times, up, indeed till

this century, war selected rather by disease, than by weapons of war.

To-day death works indiscriminately in the battle-field ; but, since the fighting men are selected by the doctor before they enlist, their death, before propagating a full family, means a loss to mankind of certain genes above average value, and a heavy death-rate may even appreciably lower the physical average of the following generation. But however war selects. it selects only men, and the genes of the female survive and frustrate its selection.

Matrimonial selection, too, must have had its effect, though *how far* men have been selected by matrimonial selection is also very difficult to say. It is even difficult to decide whether the main selective factor has been the choice of the male or the female. Probably the choice by the male of the female. Barrie remarked that at Kirremuir they did not enquire, " Wha did she tak ? " but " Why did she get ? " and as a rule in the past, a woman had to take for husband the man who took her for wife.

It is certain that the choice of men has

been usually eugenic, and that men have chosen women whose secondary sexual characters—luxuriant hair, well-developed breasts, large hips, good complexions, and well-nourished bodies, have shown them fitted for motherhood. Men have chosen women fit to bear, to feed children and to transmit to them physical excellence. So far as the body goes the matrimonial choice of men has made for the preservation of any bodily mutations good for the race, and where for centuries there has been opportunity for free choice, as in aristocracies and among Turks of the harem class, the choice would seem to have resulted in the production of good bodies. It has resulted, however, in no new mutations and no evolution, merely in a selection of characters already on offer—blue eyes, good features, good figures, etc.

In so far as women have chosen men the choice has also usually been eugenic. They have chosen men for their energy and brawn, and virile characters in general.

So far as the body goes, matrimonial selection when freely exercised has tended to select good bodies, and even if it have

not resulted in new and exclusive mutations, it has helped to segregate, multiply, and preserve good bodily characters.

Matrimonial selection, so far as really sexual and natural, has also made for fertility. For sex-choice and sex attraction imply procreative impulse. The more healthy, robust, sexually attractive and marriageable a woman is the larger family is she likely to have. Dr. Helen Gamgee lately investigated five hundred very poor families in Hull and found that in the larger families of five or more children both mother and children were healthier than in the case of the smallest families of less than five. Further, the very largeness of the family will ensure it perpetuation, so that matrimonial selection working through fertility tends to propagate and multiply the fertile and bodily fit. It must be noted that fertility has a greater survival value than fitness—that is just what eugenic alarmists deplore—but the greater survival value of fertility involves no danger, for fertility nearly always signifies fitness.

Emigration and religion also select,

but we have not space here to discuss their action.

Selection also works in some very obscure ways. It has recently been suggested that alcohol by destroying weak sperm, may winnow out the strongest, and there is also probably some selection between gametes *in utero*.

To a certain extent, then, selection has been potent, and potent for good, and we might hope that it will make for further progress. But to-day the cry goes up that a cessation of selection in man is leading to a deterioration of man's breed and especially of the Anglo-Saxon race.

War long ago ceased to have selective value, and now disease ceases to select because doctors keep the unfit alive, and sexual selection ceases to select both because marriage has become an economic question and because the unfit sometimes breed faster than the fit. Karl Pearson, C. L. Morgan, Ray Lancaster, Professor McBride, R. L. Lock and many other authorities deplore the decadence of race.

We think the alarm is a false alarm. We think that natural selection by disease

has not been wholly for good ; we doubt that the general level of English humanity is falling or in danger of falling and we specially doubt whether medical intervention is doing so much harm.

After all, in what matter have doctors intervened ? With what great saving process of natural selection have they specially interfered ? By what means chiefly have they brought down the death-rate ?

The death-rate has declined chiefly because the death-rate from infantile enteritis has declined. But did infantile enteritis select with particular care and to good purpose ? It may sometimes have spared the strongest : but usually it has been a question not of the strength of the child, but of breast-feeding or bottle feeding, a question often merely of a clean or dirty bottle, and it is of course possible that the enteritis which slew some children also damaged the germ-plasm of the survivors.

It may be said that medicine has kept alive not only children who might have died of infantile enteritis, but invalids of all sorts—heart-cases, liver-cases, cancer-cases, and so on. We grant all that : but

still we do not admit that in so doing medical science has worked against the welfare or against the selective evolution of the race. Sometimes selection by disease can go too far. It is commonly believed that malaria pretty well extirpated all the geniuses of Greece, and if a Sir Ronald Ross had saved all the babies then there might have been more Platos or Aristotles. It would not be difficult to leave humanity to the mercy of typhoid, and smallpox, and infantile enteritis, and influenza, and other diseases and let the "de'il tak' the hindmost." But would those selected to survive be wisely selected or worth selecting? We might—in cases where resistance or immunity is a matter of genes and transmissible—establish a race invulnerable to certain diseases; but how much might we lose in such a lethal sieve. Ill health and even disease do not by any means always mean poor physical stock. In ninety cases out of a hundred they are not germinal but cultural or accidental. A man with a club-foot, or heart-disease, or cancer, or typhoid, may yet propagate sound children; and even if bodily infirmity

be sometimes transmitted there may chance to go with it cerebral genes that the world cannot afford to lose. Think how many of the great personalities of the world have been ailing or defective men and women—Cowper, Lamb, Stevenson, Comte, Schumann, Nietsche, Chopin, Heine, Francis Thompson, Napoleon, Mahommed, St. Paul, Julius Caesar, Alexander the Great, Carlyle, Swift, Pope. Certainly, "The unborn have a right to be well-born," yet most of us would prefer to be born of a delicate Stevenson or Huxley than of a robust Dempsey or Haackenschmidt.

So long as human zygotes of all breeds have such unknown potentialities—so long as brain genes and muscle genes may be separately transmitted—so long as disease and debility are often accidental and sometimes associated with valuable genes—so long medical science—with a very few important exceptions, must try to keep alive the unfit and it is not likely to damage the human stock much by doing so. The future of the human body will not be brightened by letting the diseased and ailing die.

As concerns differential fertility and a larger birth-rate in the lower classes, there is also little cause for alarm. Equally well-fed and cared for, the lower classes are in most ways—though not in height and beauty—physically the equal of the upper classes, and their apparent inferiority to-day is mainly nurtural. During the war the writer examined a good many thousands of recruits from the slums and found most of them of wretched physique, ill-nourished, undersized, but yet when they were placed in healthier conditions they developed into comparatively robust men, and showed by their endurance under active service, that the stock was radically good. The C 3's were born of C 3 environment not of C 3 genes.

Luckily the genes are almost fool-proof and generations of evil nurture may still leave the physical potentialities of the stock quite unimpaired, or almost quite unimpaired.

Whether there is some risk that the mental average of the nation will be lowered by a decrease in the fertility of the upper and professional classes and by

an increase in the fertility of the lower or working classes is a debatable question. It may be doubted whether the intellectual classes are a product of any kind of segregation. They have not long been in existence, and it is difficult to believe that they are a fixed separate breed like the Samurai in Japan. There have been, and still are, families who transmit intelligence, as if by means of dominant genes, *e.g.*, the Darwins, the Huxleys, the Balfours, the Walpoles, the Gregorys, the Haldanes, the Listers, the Bernouillis, but these are rare, and as a rule there are no intellectual dynasties, merely intellectual individuals who usually seem to come sporadically from unintellectual stock. "Nor in time," said Emerson, "is the race progressive, Phocion, Socrates, Anaximander, Diogenes are great men, but they leave no class."

To-day, some of the most active intellects in England have come from stock neither socially nor intellectually prominent, and we venture to say that the average intelligence of an Irish or Scottish peasant is higher than the average among peoples

who have been selected—or ought to have been selected, if selection is at work—by generations of city life. On the whole, the genes of the Anglo-Saxon peoples are pretty evenly distributed, and there is little fear of decadence through infertility of its better classes or through intermarriage of the masses and classes.

The cry that indiscriminate marriage is ruining stock is no new cry. "By bad breeding," wrote Robert Burton, "it comes to pass that our generation is corrupt, we have many weak persons both in body and mind, many feral diseases raging among crazed families, *parentes peremtores*, our fathers bad, and we are like to be worse."

That was three hundred years ago, and yet the English race is going strong.

Yet though there is not much fear of permanent decadence by matrimonial mistakes, and much likelihood of racial progress by instinctive sexual selection, nevertheless, a little might be done to promote progress by preventing marriages altogether undesirable.

By preventing, for instance, the mar-

riage of the feeble-minded some kinds at least of feeble-mindedness might be almost stamped out, but it would take many generations to do so, for the genes of feeble-mindedness are various and recessive, and, behaving as Mendelian recessives, would come to light only when two individuals with the same or suitable recessive genes married, and, even then, would be evident in only one out of four children. Something might also be done in the same way to reduce the number of the insane ; but it would be a very difficult matter, because there are so many varieties of insanity; because the gene-combinations of genius, are often very complex, and may be produced once and never again; and because insane members not infrequently occur in families whose average members are specially distinguished. Dr. Lange investigated the history of forty-four families with a bad history of insanity and nervous disease, and in twenty-eight of these families he found two Cabinet ministers, one ambassador, three bishops, three judges of the Supreme Court, four head masters, eight

consulting physicians, nine university professors, twenty-three doctors of science or of the arts, many members of Parliament, town-councillors, business men and Government officials, two very distinguised statesmen, besides seventy-two other members eminent as poets, painters, sculptors, architects, musicians, inventors, authors, etc.

Families like the Zeroes, Kallikaks, Jukes, and Nams, so often cited, are not fair examples. They must have had a very unusual number of pathological genes : they probably lived in bad environment : and it is no more fair to draw conclusions as to persistent bad heredity from their cases than to draw conclusions as to persistent good heredity from such families as the Darwins, and Huxleys, and Haldanes. "It is quite possible, of course," says T. H. Morgan, "that an inherited defective dominant character might furnish the starting point for these histories, but that the subsequent events are all due to 'bad blood' or defective 'germ-plasm' remains to be seen."

Something can certainly be done by

practical negative eugenics to improve the brain and body of the future, but at present not very much. The time is not yet ripe for what Galton would call a "Jehad." It is true that in certain American States sterilization of intellectual and moral defectives has been legalized; but, so far, we believe the law has rarely been put into operation.

Something too, can be done by education, and by compulsory medical examination. In Austria and Germany there have been for some years bureaus to give advice to those about to marry; and the Fascist League at Genoa is organizing a medical consultation bureau where those who contemplate matrimony can both be certified free from tuberculosis, venereal diseases or other infections and also be counselled after marriage.

But might it not be possible to improve the race not only by preventing bad marriages but by making good "crosses"? By crossing animals and plants we have succeeded in producing new and valuable varieties and might it not be possible to do the same in the case of man?

Perhaps; but with much greater difficulty; for,—as it is rather a platitude to remark—the characters, physical and mental we wish to produce in man are not so simple and so singular as those we wish to produce in plants and animals; indeed it would be very difficult to come to any unanimous agreement as to what qualities in man are most desirable. "The points of a good or bad citizen," says Thomas Haxley, "are really far harder to discern than those of a puppy or a short-horn calf." An employer of Labour might desire to produce morons and Robots with big muscles; a philosopher might wish to cultivate the neopallium at the expense of the limbs; a poet the emotional genes at the expense of the practical ones. It is one thing to breed a sheep, or a cow for milk; it is one thing to produce a wrinkled yellow or green pea; but another thing to produce an ideal man. Certain varieties we could breed from Mendelizing characters in men, we could breed for tallness, or beauty—it has been done unconsciously and consciously already—we might in time—if it were worth doing—breed in

such simple Mendelizing characters as a Hapsburg lip or an extra finger, or toe, or a rib ; but, as Castle asserts : " The characters which conform with Mendel's law as Mendel understood it, involving dominance and segregation in 3.1 ratios are comparatively few. They also relate to the more superficial, less important, and more recently evolved characters of organisms."

There is very little to be done by selecting or combining the few characters of the body that Mendelize as simple units, and we can do nothing at all to evoke new mutations in the germ-plasm.

Nevertheless, the more important genes or linkages of genes vary in their developmental capacity within certain limits—the limits of the species—and by matrimonial selection it should be possible to reach the highest limits in indisputably advantageous characters and to prevent the multiplications of types in which the advantageous genes are at a low ebb. This is just what healthy matrimonial selection usually does, and, as Professor Cattell remarks, " Cupid is a safer guide in matrimony than a licensing board." A

man is attracted by a woman with well-developed breasts and with luxuriant hair indicating that as a mother she would be able to breast-feed her children, and he marries her, and has daughters who inherit their mother's breasts, and hair. A woman is attracted by the man with broad shoulders, and small hips, and good limbs, indicating his strength, and his capacity for fighting and for fatherhood. A man is attracted by a woman's gentle and unselfish ways, indicating that she would be a loving wife and mother, and he marries her, and her daughters (and sons in some good form) probably inherit their mother's maternal virtues. A woman is attracted by the intellectual force of a man dictating his power to get a place in the sun for his family, and she marries him and his sons inherit their father's virility. There is indeed in healthy mutual attraction, a most admirable device to effect a blend of the best characters in both sexes, a device whose subtle efficiency no bureau of matrimonial advice can emulate. As a rule, too, attraction is assortative so that deep calls to deep and

like marries like, and thus there is a tendency to augment the same good qualities. Probably matrimonial selection has had something to do with collecting and heaping up the genes of families like the Darwins, and Haldanes, and Huxleys, and Bachs,—Charles Darwin it will be remembered took a wife from an intellectual family—the Wedgewoods.

The law of assortative selections cuts both ways, for like seeks like also among the unhealthy and every matrimonial adventure probably brings the stock however fertile it may be—a bad stock is sometimes particularly fecund—nearer to the extinction that awaits the hopelessly unfit. "Whatever may be its present short-comings," says Holmes, "sexual selection is an evolutionary factor of magnificent possibilities." It does not in the strict sense of the word evolve: it produces nothing new, but it selects and augments the best in the genes that evolution has offered. And though it can move the race upwards only within the limits of the racial genotype yet the movement may be wide enough to mean life or death to a

whole nation. Even if the genes are there, yet if they are there at their lowest, then the race or nation will be at the mercy of any race or nation that has made more of the same or almost the same material.

We do not for a moment see any reason to believe that the average innate mental and physical qualities of the working classes are dangerously debased, and that their fecundity and the fecundity of the feeble-minded imperil the survival value of the English race. The C_3's that abound in industrial areas are mostly due as we have already said not to deficiencies of nature but to deficiencies of nurture, But, on the other hand, we do think that there are some disturbing symptoms of intellectual and moral degeneracy—probably of cultural origin—in the middle and upper classes, of the Anglo-Saxon peoples.

A race or species, however good, cannot maintain a dominant position in the world unless sufficiently prolific. The French, though a fine race, are bound, owing to their low birth-rate to be economically and biologically swamped by more fertile races, and already seem reconciled and

committed to intermarriage with their darker colonial races, which must amount to race suicide. The Russians and the Italians and the Chinese, on the other hand, simply because so prolific, are bound to colour the future of humanity.

Now, in respect of birth-rate Anglo-Saxon peoples are in danger. Among Anglo-Saxon peoples the birth-rate has steadily fallen and in England it is now the lowest in Europe, if not in the world. This is mainly due, not to loss of natural fertility; it is mainly due in the better classes at least, to later marriage and to birth-control—precautions taken to prevent the birth of many children; but it is none-the-less a symptom of decadence, and none-the-less it means directly and indirectly the decline and fall of Anglo-Saxon greatness. For virile and great people do not take precautions to reduce their families to one or two. The warmth and optimism that are at the back of love and vigour welcome children. The glorification of prudence is not a mark of greatness, and if motor cars increase as children decrease, its *bona fides* is at least open to

suspicion. The low birth-rate is bad, not only in so far as it has reached a stage when the population of England is bound to decrease ; it is bad as a sign that the quality of the people is deteriorating genetically.

We find with the reduced birth-rate, other signs of bodily degeneration especially relevant to the facial future of the nation. We find Englishwomen not only increasingly unwilling, but increasingly unable to suckle their offspring : we find that their breasts often remain undeveloped : we find that cases of difficult labour are growing commoner, and knowing as we do the close relationship between a woman's breasts and her reproductive system—between a woman's breasts and her emotional psychology—knowing, too, the part played by a woman's breasts in sexual attraction, we cannot help fearing that something is radically wrong. Moreover women's bodies are growing leaner, and bonier, and straighter in the line, and less feminine ; in many cases the desire for a home and children is fading ; and the average young woman of to-day cuts her hair short—*Venus ipsa non placeret*

comis nidata, capite spoliata—affects masculine garb, and displays an ambition to look like a powdered degenerate boy. It is true that the average woman of the middle-class to-day is taller and perhaps muscularly stronger than her grandmother; but she has made bone and muscle at the expense of nerve and vital vigour meant for maternity and emotion ; her pelvis is often narrowed by muscular exercise and she is as little capable of bearing fine children as of suckling them. She has less sexual appeal, less sexual response, and less health and vigour than the women of former generations. Indeed, it is very rare to-day to see a young woman who does not use, and does not *require* to use, rouge for anæmic cheeks and lips, and powder for a glossy nose—indeed so rare is it, that women use them as a matter of course, and even in public. Add to these things the decrease in the marriage rate, and the increase in the divorce rate, and we certainly seem to have symptoms of at least superficial decadence. The symptoms, moreover, are noted by foreigners, and it is deplorable to find that English-women

are held up in foreign papers as a warning.

We find, too, in Englishmen signs of decadence natural or nurtural. We find young men who take more interest in the lie of their hair and in the cut of their clothes than in virile exercise of mind and body, who no longer have the masculine love of fresh healthy eugenic women and the masculine loathing of paint and powder. We find an increasing tendency to sexual perversities. But on the whole, signs of decadence are more common in women than in men, perhaps because women are more imitative.

How far these things are transient and due to temporary evil environmental influences, influences emanating from a few decadents it is hard to say. Certainly many environmental influences are bad to-day, and they may be created by an influential few. The theatre, the cinema, novels, poetry, dancing, modern decadent painting and music, modern irreverence, and lack of reticence, modern sexual cynicism certainly constitute (by whomever constituted) an evil moral environment, and a considerable part of modern

decadence in women may be superficial and due to the influence of such environment.

But even transitory and superficial decadence may have far-reaching dysgenic effects. If love, in the sense of strong physical and spiritual attraction between a man and a woman, have even temporally weakened: if men no longer are drawn to women by their health—by their full breasts, and luxuriant hair, and well-formed limbs, and red lips, and fresh complexions, and feminine psychology—if nowadays women are so camouflaged with paint and powder and so attenuated by the decrees of fashion that there is little possibility of distinguishing the healthy and wholesome from the unhealthy and unwholesome—if men have grown so accustomed to paint and powder as to lose the love of the healthy and fresh —if sexual selection is no longer eugenic and no longer a matter of deep personal affinity—if men and women through modern dances and plays become sexually blasé—if the best men and women marry late and have small families—if religion and morality are out of fashion—if these things are so, and in so far as they are so,

the race is suffering and must suffer for perhaps more than one generation.

These things *are* so in certain sections of society to-day, but nevertheless the majority of men and women are not yet touched by decadence, and the Anglo-Saxon stock with its mixture of Nordic, and Celtic blood is so stable and so good that there is no fear of any lasting deterioration. In the little village of Lymington to-day there live ten women with an average of 15 children each, and not one woman is childless; and so long as there is such vitality and fecundity as that in the English stock England need not despair. Even if, for the time being, certain of the genes have depreciated in value, the same genes and the same possibilities of sexual selection remain and the stock will probably revert to its old high mean, and perhaps in the final Metanthropos to a higher level still. We cannot agree with L. Darwin "that the nation as a whole is steadily deteriorating as regards its *inborn* qualities." It is not possible to destroy good stock by cultural influences and very difficult even by pernicious selection to lower its mean for long. Each step in

genetics, as Bateson affirms, "has rather compelled the recognition of genetic determinism and the hope that by change in the conditions of life or by any external influences significant alterations can be induced in succeeding generations. . . . of the human population must be abandoned."

To-day with the exception of the little measures of negative eugenics we have indicated, we are not in a position to interfere with the potentialities of the germplasm: the most we can do is to promote eugenic marriages so as to raise the means of species to its highest possible point, and to improve the environment of men so that the genes at least will not suffer from bad nutritional conditions, as it is possible germplasm sometimes does suffer. To try to-day consciously and deliberately to breed for special features would be absurd. "If," says Professor Cattell, "there were a central directing agency which had the power as well as the wisdom to control mating within the group something could undoubtedly be done slowly to elevate the general average of bodily vigour and innate power within the group. This could be done most

rapidly by polygamy which would permit of a relatively rigid selection of sires ; less rapidly under monogamy by a selection of parents among both sexes." More quickly still no doubt by ectopic gestation. But the social consequences as Cattell points out would be monstrous.

We are not competent to select for others: we are not competent to direct the mingling of the genes, and we do not believe with the Vice-Chancellor of Birmingham University that sterilization is the best mode of selection. Man is both a mind and a body : his personality is a most varied, versatile, and subtle thing, and selection must be made with an eye to the whole result, as a living man. We cannot do it scientifically : we cannot co-ordinate and integrate so many correlated factors. It can be done only successfully *two* by *two* through the clairvoyance of sexual attraction which chooses a body for a soul, and a soul for a body—in " the will " as Nietsche says " of two to create one, who is more than they who created him." It would be impossible to walk if we had consciously to move and co-ordinate each of the individual muscles and nerves

involved in the act of walking, and still more impossible to walk if we concentrated only on one or two muscles ; but the mind integrates the action ; and so, in sexual choice the attraction of man for woman and woman for man, by some subconscious integral calculus, integrates all the factors at work and makes the right choice for posterity. " There is more rationality in thy body than in thy best wisdom," thus spake Zarathustra. The best practical eugenics would be measures to remove the camouflage of artificial conditions of all sorts, from titles and dollars, to rouge and powder, and to render it economically and socially possible for each man and woman to marry the man and woman of his and her choice. Not unwisely have men for thousands of years glorified and worshipped love, and so long as love—a love that is now at once physical and spiritual and that makes a choice momentous both for mind and body—selects—so long as no attempts are made to improve the breed by polygamy and ectopic gestation, so long is the future of the body of man safe, and we may rest assured that the Me-

tanthropos of the future will at least represent to the full the best of mind and body that the human germ-plasm contains.

Even without any further evolution of the genes, the human race might be raised and we believe will be raised to a vastly higher level simply by ordinary sexual selection (which will have an ever-increasing selective importance) and by improvements in environment.

It is unlikely that selection by disease and drink will ever render man innately immune to all diseases and drink ; but it is certain matrimonial selection will select a healthy race, and that science will find cures or prophylactics for all diseases, from measles and cold in the head to cancer and drunkenness. It is more than possible that medical science will be able by a single vaccine or serum to render a man immune all his life to all germ diseases. It is almost certain that by means of endocrines and vitamins other diseases will be conquered if indeed they are not eradicated by sexual selection. At present by the hormone "insulin" the deadly disease diabetes can be kept indefinitely in check ; by thyroid

extract goitre is cured, by vitamin D rickets; by vitamin B beri-beri; by vitamin C scurvy; and the possibilities in such ways are tremendous.

Not only can the hormones and vitamins be used to cure diseases they can also be used to control growth. Vitamin A promotes growth, the hormones of the pituitary gland are responsible for giants and dwarfs, the hormones of the sexual glands control the secondary sexual charaters. At present science has only begun to realize the importance of these substances; but when their action is better understood the general local growth of the human body and the efficient functioning of the brain will be largely controllable, and we may be able, not only to produce men of from five feet to eight feet of various builds as desired but to influence to some extent temperament and mental characters. It is not likely, however, that by any hormones we shall ever be able to control—as is sometimes asserted—the genetic evolution of the body: evolution is a matter of the genes and does not work by alterations in amounts of individual chemical substances, but by a mysterious

"holistic" machinery, which we can easily partially or wholly destroy, but which luckily we cannot direct. The most we can hope to do in the way of altering genes, is perhaps by means of a hormone to bring latent genes into action. On such a principle if there be still in our germ-plasm—as is just barely possible—genes of a tail and a hairy skin, it might be possible by administering hormones to produce a prehensile tail or a hairy skin, and the desirability of permitting such simian variations may become the subject of legislation among the Metanthropoi of 5000 A.D.

Professor Haldane, has jokingly suggested that some day the electioneering cry will be: "Vote for Macpherson and a prehensile tail for your great grandchildren!"

That youth will be prolonged and life extended by means of injections of hormones or transplantations of certain glands is highly likely. To-day Steinach by vasectomy, and Voronoff by grafting the interstitial glands of monkeys, have succeeded in rejuvenating, for a time at least, old men, and there is no doubt that their methods will be improved and that a

certain extension of working life is in prospect. Quite apart from selection, the Metanthropoi of future millenniums will probably all be centenarians, but that life can be indefinitely prolonged is very unlikely. It is possible, as we know, and as Carrell has shown, to prolong the life of simple cells and tissues almost indefinitely and the germ-plasm in man's body to-day has a life of at least 1,000 million years, but multicellular complex organs seem inevitably to die. Death is the price we pay for our multiplexity.

All the hygienic and dietetic lessons we have learned in the previous centuries will doubtless be put to good use. The Metanthropoi even of 2,000 A.D. will dress wisely, and eat and drink wisely, and exercise wisely; and it is possible that ways will be discovered to transform radiant energy into biotic vigour, and it is possible, though not likely, that new synthetic food will be discovered of more nutritional value than those at present in use.

In all cultural ways the full development of man's genes will be promoted and the time will come when every man will be

developed to the full extent of his innate potentialities and when the mean of most of his innate potentialities raised by sexual selections will be much higher than to-day.

The main advance, however, in the Body of Future Man will probably be—as we have already more than once stated—in his neopallium, and the possibilities of advance in that direction come very especially under the control of sexual selection and are almost infinite. The mental and moral differences between men are ten times greater than their bodily differences. A good athlete can jump twice as far as a very poor one : but the mind of a Newton or a Tennyson is incomparably better than the mind of a moron or even than the mind of the average man to-day. It is chiefly in mind that races and individuals differ, and the real boundaries between men are not varieties of language or colour but varieties of mind. What actual new genetic " orchestrations "—to borrow Professor J. A. Thomson's fine term —may be forming in the neopallium to-day we do not know. It is possible that entirely new faculties may be in course of forma-

tion. In his brilliant book of this series, *Gallio*, Mr. J. N. Sullivan declares that the human mind "may come to realize imaginatively as well as logically the four-dimensional space-time continuum." Further evolution of the brain—especially in the so-called silent areas—is far from impossible, but, even without evolution the possibilities of new and good selections and of progressive selection of these is very great. The faculties of the mind—the mathematical, the philosophical, the religious, the amatory—are infinite in their several and combined potentialities. The genes that enter into them must be almost like the sand of the sea-shore, and every new combination of genes is pregnant with possibilities. It must be realized too that every man's body is a result of the interaction of the germ-plasm and its environment and is variable to some extent—to the extent of fluctuating variations—according to its environment, and that in a very deep and special sense is this true of the brain, for the environment of the brain as a thinking, feeling organ is infinitely variable and so in its case the product—in the form of

thought, feeling and personality,—of brain and environment is almost infinite. The brain itself is an exquisitely sensitive, incredibly complicated instrument, which varies not only with the blood and oxygen supplied to it, but responds as a new creation to every influence that impinges upon it, to books, to colours, to sounds, to memories, to pains, and a very small alteration, either in its receptive mechanism or in its intellectual and moral environment, may mean a vast difference in mentality. In the complexity of the brain in a changing and progressive intellectual environment we have incalculable opportunities for change; and the Metanthropos of the future will live a richer, fuller life than the men to-day, partly because sexual selection will have improved his brain and partly because previous generations of brains will have improved his brain's environment, giving it books, aeroplanes, music, wireless, means of travel, etc., etc. What will be the intellectual environment of man 5,000 years later it is impossible to say, but certainly it will be a tremendously wide and varied environment, able to

waken thoughts and feelings unknown to generations in simpler environments.

The main progress of the brain and of man's cerebral life within the limits of the genes will depend almost entirely on love and sexual selection. It is love—blind, clairvoyant love—that will choose the combinations that will make the brain, and with the brain the whole conscious being of Future Humanity. So far, love has chosen chiefly through men, and men have been attracted chiefly by the physical—a form of choice to which the dress of modern woman pays ample testimony—but more and more as the bodies of men and women get sufficiently selected the choice will be mutual and will depend on the conscious or subconscious recognition of intellectual and moral characters. In view of the vast intellectual and moral differences that already obtain between man and man, and race and race, the moral and intellectual results of conscious and subconscious sexual selection on a moral and intellectual basis will be revolutionary, even in the absence of further evolution. Certainly it will be impossible to breed true, to breed

exact duplicates—to have mass production of geniuses ; but nevertheless it will be possible, in time, to breed almost numberless varieties of the highly moral, the highly intellectual, and there seems some likelihood that the Metanthropoi of the future will be divided into nations akin in mental and moral outlook. To a certain extent that is so to-day. The French, the English, the Japs, the Jews, the Hindus and other races are differentiated quite as much by mind as by body ; and matrimonial selection on a basis ever increasingly intellectual and moral (though always necessarily to some extent physical) will greatly increase such differentiation.

Ever-growing cosmopolitanism and internationalism will probably make the Metanthropoi of a few millenniums ahead composite and very alike in physical features—all approaching the most beautiful and efficient possible within the species of *Homo sapiens* ; —but greater, and wider, and more fastidious matrimonial selection on a moral and intellectual basis will produce at once intellectual and moral heterogeneity, and intellectual and moral

segregation. There will be nations of saints, of poets, of scientists, of painters.

In what direction the cerebral faculties of man will chiefly progress it is difficult to predict, but love is an emotion closely associated with beauty and with religion, and love will probably select the lovely and the moral—indeed only by such selection is humanity likely to survive the instruments of slaughter now in the hands of blind politicians. In the words of Kant: "The cosmic evolution of Nature is continued in the historic development of humanity and completed in the moral perfection of the individual."

Love is the crown and consummation of all things—the great purpose that throbbed in the fire mist and worked through amœba and monkey up to man, and so long as love exists, and love selects, there is hope for the future of Humanity. And we may hope not only that the best we know will be selected and saved and mingled in new and noble physical and intellectual and moral phenotypes, but that the same mysterious Power that drew us out of the fire mist has still greater evolutionary destinies in store for us.

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A lucid account of the nature of sleep, with reference to body, brain, and mind, and an analysis of dreaming. A plea is put in for the suppression of avoidable noises, and a forecast is made of the direction which future research will take.

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The marvellous evolution the body has already achieved provides no clue to its future, nor is it likely to be affected by eugenic measures. Future progress in man's body will depend mainly on a subtle sexual selection of cerebral variations as manifested in mental, moral, and æsthetic qualities, which will have momentous spiritual consequences.

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The writer traces the development of the film from its crude but astonishing beginnings as a 'show' to its future as one of the artistic marvels of the world. The film as an art form, it is contended, really began without any inspiration.

Fortuna, or Chance and Design. By NORWOOD YOUNG.

This is a study of the paradoxical 'laws of chance', as illustrated in the game of roulette, played at Monte Carlo. The author discusses the conflict between chance and design. He refutes the common belief, upon which all systems of gambling are founded, that in a game of chance the past can affect the future. He considers the emotions of gamblers, their hopes, fears, and superstitions.

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What can the medical profession, the social worker, the school teacher, the parent, and the general public do to help the youthful delinquent ? Methods are outlined of dealing with this urgent and difficult problem.

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This distinguished piece of work makes clear for the general reader the present position of astronomical science. The nature of the earth, the solar system, the stars, and the physical universe in general is discussed with supreme clarity, and their future prospects boldly estimated.

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How will the child live in the future, how will he be treated by parents, nurse and school, what will education become in the future, these are some of the points raised by the author.

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