

The Descent of Man
Charles Darwin (1874)

Classics in the History of Psychology

An internet resource developed by
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The Descent of Man (2nd ed.)
Charles Darwin (1874)

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INTRODUCTION.

The nature of the following work will be best understood by a brief account of how it came to be written. During many years I collected notes on the origin or descent of man, without any intention of publishing on the subject, but rather with the determination not to publish, as I thought that I should thus only add to the prejudices against my views. It seemed to me sufficient to indicate, in the first edition of my *Origin of Species*, that by this work "light would be thrown on the origin of man and his history"; and this implies that man must be included with other organic beings in any general conclusion respecting his manner of appearance on this earth. Now the case wears a wholly different aspect.

When a naturalist like Carl Vogt ventures to say in his address as President of the National Institution of Geneva (1869), "personne, en Europe au moins, n'ose plus soutenir la creation independante et de toutes pieces, des especes," it is manifest that at least a large number of naturalists must admit that species are the modified descendants of other species; and this especially holds good with the younger and rising naturalists. The greater number accept the agency of natural selection; though some urge, whether with justice the future must decide, that I have greatly overrated its importance. Of the older and honoured chiefs in natural science, many unfortunately are still opposed to evolution in every form.

In consequence of the views now adopted by most naturalists, and which will ultimately, as in every other case, be followed by others who are not scientific, I have been led to put together my notes, so as to see how far the general conclusions arrived at in my former works were applicable to man. This seemed all the more desirable, as I had never deliberately applied these views to a species taken singly. When we confine our attention to any one form, we are deprived of the weighty arguments derived from the nature of the affinities which connect together whole groups of organisms- their geographical distribution in past and present times, and their geological succession. The homological structure, embryological development, and rudimentary organs of a species remain to be considered, whether it be man or any other animal, to which our attention may be directed; but these great classes of facts afford, as it appears to me, ample and conclusive evidence in favour of the principle of gradual evolution. The strong support derived from the other arguments should, however, always be kept before the mind.

The sole object of this work is to consider, firstly, whether man, like every other species, is descended from some pre-existing form; secondly, the manner of his development; and thirdly, the value of the differences between the so-called races of man. As I shall confine myself to these points, it will not be necessary to describe in detail the differences between the several races- an enormous subject which has been fully discussed in many valuable works. The high antiquity of man has recently been demonstrated by the labours of a host of eminent men, beginning with M. Boucher de Perthes; and this is the indispensable basis for understanding his origin. I shall, therefore, take this conclusion for granted, and may refer my readers to the admirable treatises of Sir Charles Lyell, Sir John Lubbock, and others. Nor shall I have occasion to do more than to allude to the amount of difference between man and the anthropomorphous apes; for Prof. Huxley, in the opinion of most competent judges, has conclusively shewn that in every visible character man differs less from the higher apes, than these do from the lower members of the same order of primates.

This work contains hardly any original facts in regard to man; but as the conclusions at which I arrived, after drawing up a rough draft, appeared to me interesting, I thought that they might interest others. It has often and confidently been asserted, that man's origin can never be known: but ignorance more frequently begets confidence than does knowledge: it is those who know little, and not those who know much, who so positively assert that this or that problem will never be solved by science. The conclusion that man is the co-descendant with other species of some ancient, lower, and extinct form, is not in any degree new. Lamarck long ago came to this conclusion, which has lately been maintained by several eminent naturalists and philosophers; for instance, by Wallace, Huxley, Lyell, Vogt, Lubbock, Buchner, Rolle, &c..^[1] and especially by Haeckel. This last naturalist, besides his great work, *Generelle Morphologie* (1866), has recently (1868, with a second edit. in 1870), published his *Natürliche Schöpfungsgeschichte*, in which he fully discusses the genealogy of man. If this work had appeared before my essay had been written, I should probably never have completed it. Almost all the conclusions at which I have arrived I find confirmed by this naturalist, whose knowledge on many points is much fuller than mine. Wherever I have added any fact or view from Prof. Haeckel's writings, I give his authority in the text; other statements I leave as they originally stood in my manuscript, occasionally giving in the foot-notes references to his works, as a confirmation of the more doubtful or interesting points. During many years it has seemed to me highly probable that sexual selection has played an important part in differentiating the races of man; but in my *Origin of Species* I contented myself by merely alluding to this belief. When I came to apply this view to man, I found it indispensable to treat the whole subject in full detail.^[2] Consequently the second part of the present work, treating of sexual selection, has extended to an inordinate length, compared with the first part; but this could not be avoided. I had intended adding to the present volumes an essay on the expression of the various emotions by man and the lower animals. My attention was called to this subject many years ago by Sir Charles Bell's admirable work. This illustrious anatomist maintains that man is endowed with certain muscles solely for the sake of expressing his emotions. As this view is obviously opposed to the belief that man is descended from some other and lower form, it was necessary for me to consider it. I likewise wished to ascertain how far the emotions are expressed in the same manner by the different races of man. But owing to the length of the present work, I have thought it better to reserve my essay for separate publication.

Footnotes

[1] As the works of the first-named authors are so well known, I need not give the titles; but as those

of the latter are less well known in England, I will give them:- *Sechs Vorlesungen über die Darwin'sche Theorie: zweite Auflage*, 1868, von Dr. L. Buchner; translated into French under the title *Conferences sur la Theorie Darwinienne*, 1869. *Der Mensch, im Lichte der Darwin'schen Lehre*, 1865, von Dr. F. Rolle. I will not attempt to give references to all the authors who have taken the same side of the question. Thus G. Canestrini has published (*Annuario della Soc. dei Naturalisti*, Modena, 1867, p. 81) a very curious paper on rudimentary characters, as bearing on the origin of man. Another work has (1869) been published by Dr. Francesco Barrago, bearing in Italian the title of "Man, made in the image of God, was also made in the image of the ape."

[2] Prof. Haeckel was the only author who, at the time when this work first appeared, had discussed the subject of sexual selection, and had seen its full importance, since the publication of the *Origin*; and this he did in a very able manner in his various works.

PART ONE

Chapter I

THE EVIDENCE OF THE DESCENT OF MAN FROM SOME LOWER FORM

He who wishes to decide whether man is the modified descendant of some pre-existing form, would probably first enquire whether man varies, however slightly, in bodily structure and in mental faculties; and if so, whether the variations are transmitted to his offspring in accordance with the laws which prevail with the lower animals. Again, are the variations the result, as far as our ignorance permits us to judge, of the same general causes, and are they governed by the same general laws, as in the case of other organisms; for instance, by correlation, the inherited effects of use and disuse, &c.? Is man subject to similar malconformations, the result of arrested development, of reduplication of parts, &c., and does he display in any of his anomalies reversion to some former and ancient type of structure? It might also naturally be enquired whether man, like so many other animals, has given rise to varieties and sub-races, differing but slightly from each other, or to races differing so much that they must be classed as doubtful species? How are such races distributed over the world; and how, when crossed, do they react on each other in the first and succeeding generations? And so with many other points.

The enquirer would next come to the important point, whether man tends to increase at so rapid a rate, as to lead to occasional severe struggles for existence; and consequently to beneficial variations, whether in body or mind, being preserved, and injurious ones eliminated. Do the races or species of men, whichever term may be applied, encroach on and replace one another, so that some finally become extinct? We shall see that all these questions, as indeed is obvious in respect to most of them, must be answered in the affirmative, in the same manner as with the lower animals. But the several considerations just referred to may be conveniently deferred for a time: and we will first see how far the bodily structure of man shows traces, more or less plain, of his descent from some lower form. In succeeding chapters the mental powers of man, in comparison with those of the lower animals, will be considered.

The Bodily Structure of Man. It is notorious that man is constructed on the same general type or model as other mammals. All the bones in his skeleton can be compared with corresponding bones in a monkey, bat, or seal. So it is with his muscles, nerves, blood-vessels and internal viscera. The brain, the most important of all the organs, follows the same law, as shewn by Huxley and other anatomists. Bischoff,[3] who is a hostile witness, admits that every chief fissure and fold in the brain of man has its analogy in that of the orang; but he adds that at no period of development do their brains perfectly agree; nor could perfect agreement be expected, for otherwise their mental powers would have been the same.

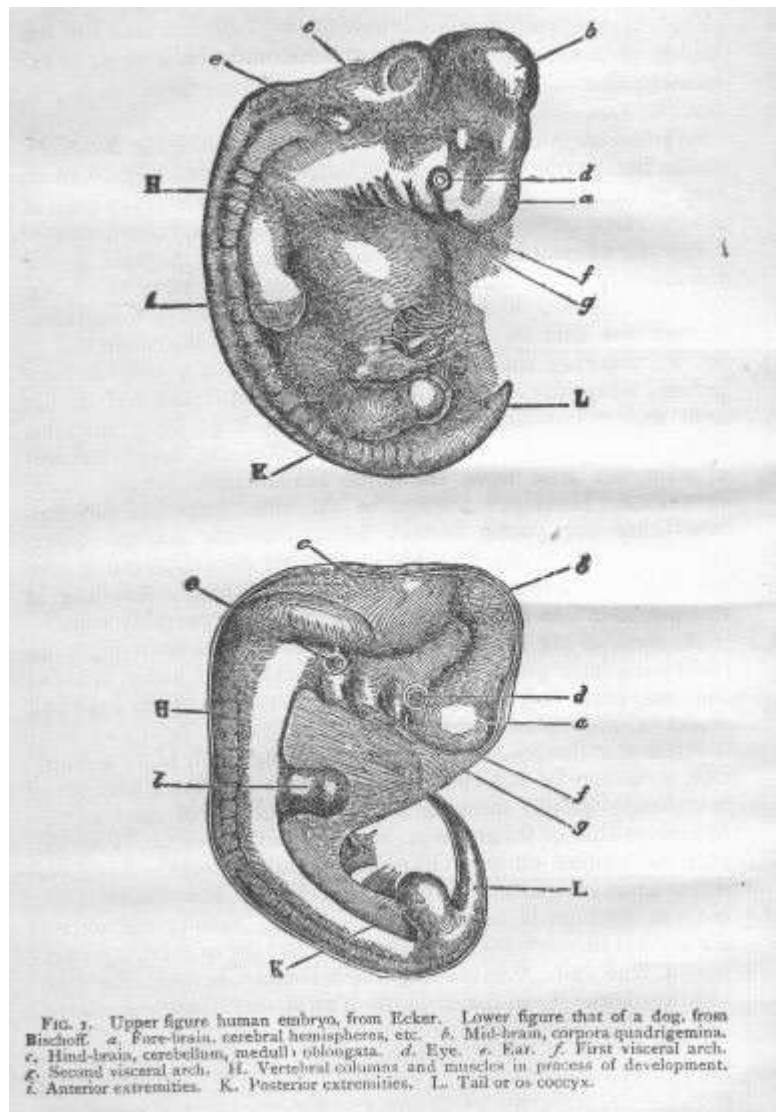
Vulpian[4] remarks: "Les differences reelles qui existent entre l'encephale de l'homme et celui des singes superieurs, sont bien minimales. Il ne faut pas se faire d'illusions a cet egard. L'homme est bien plus pres des singes anthropomorphes par les caracteres anatomiques de son cerveau que ceux-ci ne le sont non seulement des autres mammiferes, mais meme de certains quadrumanes, des guenons et des macaques." But it would be superfluous here to give further details on the correspondence between man and the higher mammals in the structure of the brain and all other parts of the body.

It may, however, be worth while to specify a few points, not directly or obviously connected with structure, by which this correspondence or relationship is well shewn.

Man is liable to receive from the lower animals, and to communicate to them, certain diseases, as hydrophobia, variola, the glanders, syphilis, cholera, herpes, &c.;[5] and this fact proves the close similarity[6] of their tissues and blood, both in minute structure and composition, far more plainly than does their comparison under the best microscope, or by the aid of the best chemical analysis. Monkeys are liable to many of the same non-contagious diseases as we are; thus Rengger,[7] who carefully observed for a long time the *Cebus azarae* in its native land, found it liable to catarrh, with the usual symptoms, and which, when often recurrent, led to consumption. These monkeys suffered also from apoplexy, inflammation of the bowels, and cataract in the eye. The younger ones when shedding their milk-teeth often died from fever. Medicines produced the same effect on them as on us. Many kinds of monkeys have a strong taste for tea, coffee, and spirituous liquors: they will also, as I have myself seen, smoke tobacco with pleasure.[8] Brehm asserts that the natives of north-eastern Africa catch the wild baboons by exposing vessels with strong beer, by which they are made drunk. He has seen some of these animals, which he kept in confinement, in this state; and he gives a laughable account of their behaviour and strange grimaces. On the following morning they were very cross and dismal; they held their aching heads with both hands, and wore a most pitiable expression: when beer or wine was offered them, they turned away with disgust, but relished the juice of lemons.[9] An American monkey, an *Ateles*, after getting drunk on brandy, would never touch it again, and thus was wiser than many men. These trifling facts prove how similar the nerves of taste must be in monkeys and man, and how similarly their whole nervous system is affected.

Man is infested with internal parasites, sometimes causing fatal effects; and is plagued by external parasites, all of which belong to the same genera or families as those infesting other mammals, and in the case of scabies to the same species.[10] Man is subject, like other mammals, birds, and even insects,[11] to that mysterious law, which causes certain normal processes, such as gestation, as well as the maturation and duration of various diseases, to follow lunar periods. His wounds are repaired by the same process of healing; and the stumps left after the amputation of his limbs, especially during an early embryonic period, occasionally possess some power of regeneration, as in the lowest animals.[12]

The whole process of that most important function, the reproduction of the species, is strikingly the same in all mammals, from the first act of courtship by the male,[13] to the birth and nurturing of the young. Monkeys are born in almost as helpless a condition as our own infants; and in certain genera the young differ fully as much in appearance from the adults, as do our children from their full-grown parents.[15] It has been urged by some writers, as an important distinction, that with man the young arrive at maturity at a much later age than with any other animal: but if we look to the races of mankind which inhabit tropical countries the difference is not great, for the orang is believed not to be adult till the age of from ten to fifteen years.[16] Man differs from woman in size, bodily strength, hairiness, &c., as well as in mind, in the same manner as do the two sexes of many mammals. So that the correspondence in general structure, in the minute structure of the tissues, in chemical composition and in constitution, between man and the higher animals, especially the anthropomorphous apes, is extremely close.



Embryonic Development. Man is developed from an ovule, about the 125th of an inch in diameter, which differs in no respect from the ovules of other animals. The embryo itself at a very early period can hardly be distinguished from that of other members of the vertebrate kingdom. At this period the arteries run in arch-like branches, as if to carry the blood to branchiae which are not present in the higher Vertebrata, though the slits on the sides of the neck still remain (see *f*, *g*, fig. 1), marking their former position. At a somewhat later period, when the extremities are developed, "the feet of lizards and mammals," as the illustrious von Baer remarks, "the wings and feet of birds, no less than the hands and feet of man, all arise from the same fundamental form." It is, says Prof. Huxley,[17] "quite in the later stages of development that the young human being presents marked differences from the young ape, while the latter departs as much from the dog in its developments, as the man does. Startling as this last assertion may appear to be, it is demonstrably true."

As some of my readers may never have seen a drawing of an embryo, I have given one of man and another of a dog, at about the same early stage of development, carefully copied from two works of undoubted accuracy.[18]

After the foregoing statements made by such high authorities, it would be superfluous on my part to give a number of borrowed details, shewing that the embryo of man closely resembles that of other mammals. It may, however, be added, that the human embryo likewise resembles certain low forms when adult in various points of structure. For instance, the heart at first exists as a simple pulsating vessel; the excreta are voided through a cloacal passage; and the os coccyx projects like a true

extending considerably beyond the rudimentary legs." [19] In the embryos of all air-breathing vertebrates, certain glands, called the corpora Wolffiana, correspond with, and act like the kidneys of mature fishes. [20] Even at a later embryonic period, some striking resemblances between man and the lower animals may be observed. Bischoff says "that the convolutions of the brain in a human foetus at the end of the seventh month reach about the same stage of development as in a baboon when adult." [21] The great toe, as Professor Owen remarks, [22] "which forms the fulcrum when standing or walking, is perhaps the most characteristic peculiarity in the human structure"; but in an embryo, about an inch in length, Prof. Wyman [23] found "that the great toe was shorter than the others; and, instead of being parallel to them, projected at an angle from the side of the foot, thus corresponding with the permanent condition of this part in the *Quadrumana*." I will conclude with a quotation from Huxley, [24] who, after asking does man originate in a different way from a dog, bird, frog or fish, says, "The reply is not doubtful for a moment; without question, the mode of origin, and the early stages of the development of man, are identical with those of the animals immediately below him in the scale: without a doubt in these respects, he is far nearer to apes than the apes are to the dog."

Rudiments. This subject, though not intrinsically more important than the two last, will for several reasons be treated here more fully. [25] Not one of the higher animals can be named which does not bear some part in a rudimentary condition; and man forms no exception to the rule. Rudimentary organs must be distinguished from those that are nascent; though in some cases the distinction is not easy. The former are either absolutely useless, such as the mammary of male quadrupeds, or the incisor teeth of ruminants which never cut through the gums; or they are of such slight service to their present possessors, that we can hardly suppose that they were developed under the conditions which now exist. Organs in this latter state are not strictly rudimentary, but they are tending in this direction. Nascent organs, on the other hand, though not fully developed, are of high service to their possessors, and are capable of further development. Rudimentary organs are eminently variable; and this is partly intelligible, as they are useless, or nearly useless, and consequently are no longer subjected to natural selection. They often become wholly suppressed. When this occurs, they are nevertheless liable to occasional reappearance through reversion- a circumstance well worthy of attention.

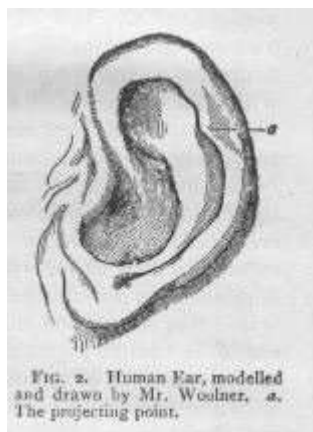
The chief agents in causing organs to become rudimentary seem to have been disuse at that period of life when the organ is chiefly used (and this is generally during maturity), and also inheritance at a corresponding period of life. The term "disuse" does not relate merely to the lessened action of muscles, but includes a diminished flow of blood to a part or organ, from being subjected to fewer alternations of pressure, or from becoming in any way less habitually active. Rudiments, however, may occur in one sex of those parts which are normally present in the other sex; and such rudiments, as we shall hereafter see, have often originated in a way distinct from those here referred to. In some cases, organs have been reduced by means of natural selection, from having become injurious to the species under changed habits of life. The process of reduction is probably often aided through the two principles of compensation and economy of growth; but the later stages of reduction, after disuse has done all that can fairly be attributed to it, and when the saving to be effected by the economy of growth would be very small, [26] are difficult to understand. The final and complete suppression of a part, already useless and much reduced in size, in which case neither compensation or economy can come into play, is perhaps intelligible by the aid of the hypothesis of pangenesis. But as the whole subject of rudimentary organs has been discussed and illustrated in my former works, [27] I need here say no more on this head.

Rudiments of various muscles have been observed in many parts of the human body; [28] and not a few muscles, which are regularly present in some of the lower animals can occasionally be detected in man in a greatly reduced condition. Every one must have noticed the power which many animals, especially horses, possess of moving or twitching their skin; and this is effected by the *panniculus carnosus*. Remnants of this muscle in an efficient state are found in various parts of our bodies; for instance, the muscle on the forehead, by which the eyebrows are raised. The *platysma myoides*, which is well developed on the neck, belongs to this system. Prof. Turner, of Edinburgh, has occasionally detected, as he informs me, muscular fasciculi in five different situations, namely in the axillae, near the scapulae, &c., all of which must be referred to the system of the *panniculus*. He has also shewn [29] that the *musculus sternalis* or *sternalis brutorum*, which is not an extension of the *rectus abdominalis*, but is closely allied to the *panniculus*, occurred in the proportion of about three per cent. in upward of 600 bodies: he adds, that this muscle affords "an excellent illustration of the statement that occasional and rudimentary structures are especially liable to variation in

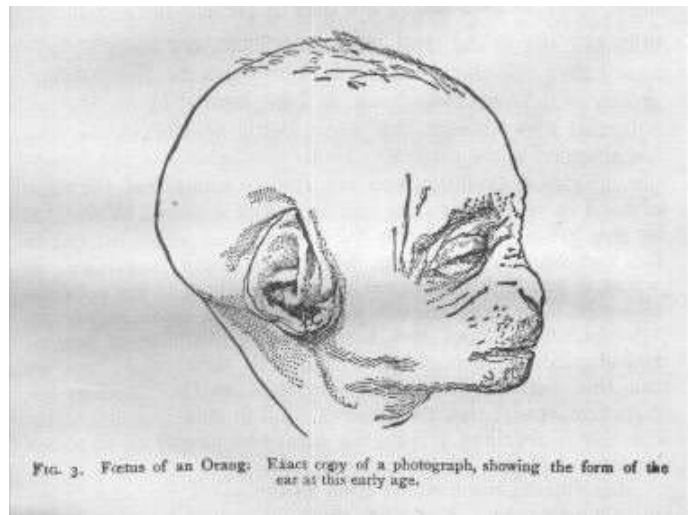
arrangement."

Some few persons have the power of contracting the superficial muscles on their scalps; and these muscles are in a variable and partially rudimentary condition. M.A. de Candolle has communicated to me a curious instance of the longcontinued persistence or inheritance of this power, as well as of its unusual development. He knows a family, in which one member, the present head of the family, could, when a youth, pitch several heavy books from his head by the movement of the scalp alone; and he won wagers by performing this feat. His father, uncle, grandfather, and his three children possess the same power to the same unusual degree. This family became divided eight generations ago into two branches; so that the head of the above-mentioned branch is cousin in the seventh degree to the head of the other branch. This distant cousin resides in another part of France; and on being asked whether he possessed the same faculty, immediately exhibited his power. This case offers a good illustration how persistent may be the transmission of an absolutely useless faculty, probably derived from our remote semi-human progenitors; since many monkeys have, and frequently use the power, of largely moving their scalps up and down.[30]

The extrinsic muscles which serve to move the external ear, and the intrinsic muscles which move the different parts, are in a rudimentary condition in man, and they all belong to the system of the panniculus; they are also variable in development, or at least in function. I have seen one man who could draw the whole ear forwards; other men can draw it upwards; another who could draw it backwards;[31] and from what one of these persons told me, it is probable that most of us, by often touching our ears, and thus directing our attention towards them, could recover some power of movement by repeated trials. The power of erecting and directing the shell of the ears to the various points of the compass, is no doubt of the highest service to many animals, as they thus perceive the direction of danger; but I have never heard, on sufficient evidence, of a man who possessed this power, the one which might be of use to him. The whole external shell may be considered a rudiment, together with the various folds and prominences (helix and anti-helix, tragus and anti-tragus, &c.) which in the lower animals strengthen and support the ear when erect, without adding much to its weight. Some authors, however, suppose that the cartilage of the shell serves to transmit vibrations to the acoustic nerve; but Mr. Toynebee,[32] after collecting all the known evidence on this head, concludes that the external shell is of no distinct use. The ears of the chimpanzee and orang are curiously like those of man, and the proper muscles are likewise but very slightly developed.[33] I am also assured by the keepers in the Zoological Gardens that these animals never move or erect their ears; so that they are in an equally rudimentary condition with those of man, as far as function is concerned. Why these animals, as well as the progenitors of man, should have lost the power of erecting their ears, we can not say. It may be, though I am not satisfied with this view, that owing to their arboreal habits and great strength they were but little exposed to danger, and so during a lengthened period moved their ears but little, and thus gradually lost the power of moving them. This would be a parallel case with that of those large and heavy birds, which, from inhabiting oceanic islands, have not been exposed to the attacks of beasts of prey, and have consequently lost the power of using their wings for flight. The inability to move the ears in man and several apes is, however, partly compensated by the freedom with which they can move the head in a horizontal plane, so as to catch sounds from all directions. It has been asserted that the ear of man alone possesses a lobule; but "a rudiment of it is found in the gorilla";[34] and, as I hear from Prof. Preyer, it is not rarely absent in the negro.



The celebrated sculptor, Mr. Woolner, informs me of one little peculiarity in the external ear, which he has often observed both in men and women, and of which he perceived the full significance. His attention was first called to the subject whilst at work on his figure of Puck, to which he had given pointed ears. He was thus led to examine the ears of various monkeys, and subsequently more carefully those of man. The peculiarity consists in a little blunt point, projecting from the inwardly folded margin, or helix. When present, it is developed at birth, and according to Prof. Ludwig Meyer, more frequently in man than in woman. Mr. Woolner made an exact model of one such case, and sent me the accompanying drawing (see fig. 2). These points not only project inwards towards the centre of the ear, but often a little outwards from its plane, so as to be visible when the head is viewed from directly in front or behind. They are variable in size, and somewhat in position, standing either a little higher or lower; and they sometimes occur on one ear and not on the other. They are not confined to mankind, for I observed a case in one of the spider-monkeys (*Ateles beelzebuth*) in our Zoological Gardens; and Mr. E. Ray Lankester informs me of another case in a chimpanzee in the gardens at Hamburg. The helix obviously consists of the extreme margin of the ear folded inwards; and this folding appears to be in some manner connected with the whole external ear being permanently pressed backwards. In many monkeys, which do not stand high in the order, as baboons and some species of *Macacus*,^[35] the upper portion of the ear is slightly pointed, and the margin is not at all folded inwards; but if the margin were to be thus folded, a slight point would necessarily project inwards towards the centre, and probably a little outwards from the plane of the ear; and this I believe to be their origin in many cases. On the other hand, Prof. L. Meyer, in an able paper recently published,^[36] maintains that the whole case is one of mere variability; and that the projections are not real ones, but are due to the internal cartilage on each side of the points not having been fully developed. I am quite ready to admit that this is the correct explanation in many instances, as in those figured by Prof. Meyer, in which there are several minute points, or the whole margin is sinuous. I have myself seen, through the kindness of Dr. L. Down, the ear of a microcephalus idiot, on which there is a projection on the outside of the helix, and not on the inward folded edge, so that this point can have no relation to a former apex of the ear. Nevertheless in some cases, my original view, that the points are vestiges of the tips of formerly erect and pointed ears, still seems to me probable. I think so from the frequency of their occurrence, and from the general correspondence in position with that of the tip of a pointed ear. In one case, of which a photograph has been sent me, the projection is so large, that supposing, in accordance with Prof. Meyer's view, the ear to be made perfect by the equal development of the cartilage throughout the whole extent of the margin, it would have covered fully one-third of the whole ear. Two cases have been communicated to me, one in North America, and the other in England, in which the upper margin is not at all folded inwards, but is pointed, so that it closely resembles the pointed ear of an ordinary quadruped in outline. In one of these cases, which was that of a young child, the father compared the ear with the drawing which I have given^[37] of the ear of a monkey, the *Cynopithecus niger*, and says that their outlines are closely similar. If, in these two cases, the margin had been folded inwards in the normal manner, an inward projection must have been formed. I may add that in two other cases the outline still remains somewhat pointed, although the margin of the upper part of the ear is normally folded inwards- in one of them, however, very narrowly. The following woodcut (see fig. 3) is an accurate copy of a photograph of the foetus of an orang (kindly sent me by Dr. Nitsche), in which it may be seen how different the pointed outline of the ear is at this period from its adult condition, when it bears a close general resemblance to that of man. It is evident that the folding over of the tip of such an ear, unless it changed greatly during its further development, would give rise to a point projecting inwards. On the whole, it still seems to me probable that the points in question are in some cases, both in man and apes, vestiges of a former condition.



The nictitating membrane, or third eyelid, with its accessory muscles and other structures, is especially well developed in birds, and is of much functional importance to them, as it can be rapidly drawn across the whole eyeball. It is found in some reptiles and amphibians, and in certain fishes, as in sharks. It is fairly well developed in the two lower divisions of the mammalian series, namely, in the Monotremata and marsupials, and in some few of the higher mammals, as in the walrus. But in man, the Quadrumana, and most other mammals, it exists, as is admitted by all anatomists, as a mere rudiment, called the semilunar fold.[38]

The sense of smell is of the highest importance to the greater number of mammals- to some, as the ruminants, in warning them of danger; to others, as the Carnivora, in finding their prey; to others, again, as the wild boar, for both purposes combined. But the sense of smell is of extremely slight service, if any, even to the dark coloured races of men, in whom it is much more highly developed than in the white and civilised races.[39] Nevertheless it does not warn them of danger, nor guide them to their food; nor does it prevent the Esquimaux from sleeping in the most fetid atmosphere, nor many savages from eating half-putrid meat. In Europeans the power differs greatly in different individuals, as I am assured by an eminent naturalist who possesses this sense highly developed, and who has attended to the subject. Those who believe in the principle of gradual evolution, will not readily admit that the sense of smell in its present state was originally acquired by man, as he now exists. He inherits the power in an enfeebled and so far rudimentary condition, from some early progenitor, to whom it was highly serviceable, and by whom it was continually used. In those animals which have this sense highly developed, such as dogs and horses, the recollection of persons and of places is strongly associated with their odour; and we can thus perhaps understand how it is, as Dr. Maudsley has truly remarked,[40] that the sense of smell in man "is singularly effective in recalling vividly the ideas and images of forgotten scenes and places."

Man differs conspicuously from all the other primates in being almost naked. But a few short straggling hairs are found over the greater part of the body in the man, and fine down on that of a woman. The different races differ much in hairiness; and in the individuals of the same race the hairs are highly variable, not only in abundance, but likewise in position: thus in some Europeans the shoulders are quite naked, whilst in others they bear thick tufts of hair.[41] There can be little doubt that the hairs thus scattered over the body are the rudiments of the uniform hairy coat of the lower animals. This view is rendered all the more probable, as it is known that fine, short, and pale-coloured hairs on the limbs and other parts of the body, occasionally become developed into "thickset, long, and rather coarse dark hairs," when abnormally nourished near old-standing inflamed surfaces.[42]

I am informed by Sir James Paget that often several members of a family have a few hairs in their eyebrows much longer than the others; so that even this slight peculiarity seems to be inherited. These hairs, too, seem to have their representatives; for in the chimpanzee, and in certain species of *Maeacus*, there are scattered hairs of considerable length rising from the naked skin above the eyes, and corresponding to our eyebrows; similar long hairs project from the hairy covering of the superciliary ridges in some baboons.

The fine wool-like hair, or so-called lanugo, with which the human foetus during the sixth month is thickly covered, offers a more curious case. It is first developed, during the fifth month, on the

eyebrows and face, and especially round the mouth, where it is much longer than that on the head. A moustache of this kind was observed by Eschricht[43] on a female foetus; but this is not so surprising a circumstance as it may at first appear, for the two sexes generally resemble each other in all external characters during an early period of growth. The direction and arrangement of the hairs on all parts of the foetal body are the same as in the adult, but are subject to much variability. The whole surface, including even the forehead and ears, is thus thickly clothed; but it is a significant fact that the palms of the hands and the soles of the feet are quite naked, like the inferior surfaces of all four extremities in most of the lower animals. As this can hardly be an accidental coincidence, the woolly covering of the foetus probably represents the first permanent coat of hair in those mammals which are born hairy. Three or four cases have been recorded of persons born with their whole bodies and faces thickly covered with fine long hairs; and this strange condition is strongly inherited, and is correlated with an abnormal condition of the teeth.[44] Prof. Alex. Brandt informs me that he has compared the hair from the face of a man thus characterised, aged thirty-five, with the lanugo of a foetus, and finds it quite similar in texture; therefore, as he remarks, the case may be attributed to an arrest of development in the hair, together with its continued growth. Many delicate children, as I have been assured by a surgeon to a hospital for children, have their backs covered by rather long silky hairs; and such cases probably come under the same head.

It appears as if the posterior molar or wisdom-teeth were tending to become rudimentary in the more civilised races of man. These teeth are rather smaller than the other molars, as is likewise the case with the corresponding teeth in the chimpanzee and orang; and they have only two separate fangs. They do not cut through the gums till about the seventeenth year, and I have been assured that they are much more liable to decay, and are earlier lost than the other teeth; but this is denied by some eminent dentists. They are also much more liable to vary, both in structure and in the period of their development, than the other teeth.[45] In the Melanian races, on the other hand, the wisdom-teeth are usually furnished with three separate fangs, and are generally sound; they also differ from the other molars in size, less than in the Caucasian races.[46] Prof. Schaaffhausen accounts for this difference between the races by "the posterior dental portion of the jaw being always shortened" in those that are civilised,[47] and this shortening may, I presume, be attributed to civilised men habitually feeding on soft, cooked food, and thus using their jaws less. I am informed by Mr. Brace that it is becoming quite a common practice in the United States to remove some of the molar teeth of children, as the jaw does not grow large enough for the perfect development of the normal number.[48]

With respect to the alimentary canal, I have met with an account of only a single rudiment, namely the vermiform appendage of the caecum. The caecum is a branch or diverticulum of the intestine, ending in a cul-de-sac, and is extremely long in many of the lower vegetable-feeding mammals. In the marsupial koala it is actually more than thrice as long as the whole body.[49] It is sometimes produced into a long gradually-tapering point, and is sometimes constricted in parts. It appears as if, in consequence of changed diet or habits, the caecum had become much shortened in various animals, the vermiform appendage being left as a rudiment of the shortened part. That this appendage is a rudiment, we may infer from its small size, and from the evidence which Prof. Canestrini[50] has collected of its variability in man. It is occasionally quite absent, or again is largely developed. The passage is sometimes completely closed for half or two-thirds of its length, with the terminal part consisting of a flattened solid expansion. In the orang this appendage is long and convoluted: in man it arises from the end of the short caecum, and is commonly from four to five inches in length, being only about the third of an inch in diameter. Not only is it useless, but it is sometimes the cause of death, of which fact I have lately heard two instances: this is due to small hard bodies, such as seeds, entering the passage, and causing inflammation.[51]

In some of the lower Quadrumana, in the Lemuridae and Carnivora, as well as in many marsupials, there is a passage near the lower end of the humerus, called the supra-condyloid foramen, through which the great nerve of the fore limb and often the great artery pass. Now in the humerus of man, there is generally a trace of this passage, which is sometimes fairly well developed, being formed by a depending hook-like process of bone, completed by a band of ligament. Dr. Struthers,[52] who has closely attended to the subject, has now shewn that this peculiarity is sometimes inherited, as it has occurred in a father, and in no less than four out of his seven children. When present, the great nerve invariably passes through it; and this clearly indicates that it is the homologue and rudiment of the supra-condyloid foramen of the lower animals. Prof. Turner estimates, as he informs me, that it occurs in about one per cent of recent skeletons. But if the occasional development of this structure in man is, as seems probable, due to reversion, it is a return to a very ancient state of things,

because in the higher *Quadrupedia* it is absent.

There is another foramen or perforation in the humerus, occasionally present in man, which may be called the inter-condyloid. This occurs, but not constantly, in various anthropoid and other apes,[53] and likewise in many of the lower animals. It is remarkable that this perforation seems to have been present in man much more frequently during ancient times than recently. Mr. Busk[54] has collected the following evidence on this head: Prof. Broca "noticed the perforation in four and a half per cent of the arm-bones collected in the 'Cimetiere, du Sud,' at Paris; and in the Grotto of Orrony, the contents of which are referred to the Bronze period, as many as eight humeri out of thirty-two were perforated; but this extraordinary proportion, he thinks, might be due to the cavern having been a sort of 'family vault.' Again, M. Dupont found thirty per cent of perforated bones in the caves of the Valley of the Lesse, belonging to the Reindeer period; whilst M. Leguay, in a sort of dolmen at Argenteuil, observed twenty-five per cent to be perforated; and M. Pruner-Bey found twenty-six per cent in the same condition in bones from Vaureal. Nor should it be left unnoticed that M. Pruner-Bey states that this condition is common in Guanche skeletons." It is an interesting fact that ancient races, in this and several other cases, more frequently present structures which resemble those of the lower animals than do the modern. One chief cause seems to be that the ancient races stand somewhat nearer in the long line of descent to their remote animal-like progenitors.

In man, the *os coccyx*, together with certain other vertebrae hereafter to be described, though functionless as a tail, plainly represent this part in other vertebrate animals. At an early embryonic period it is free, and projects beyond the lower extremities; as may be seen in the drawing (see fig. 1) of a human embryo. Even after birth it has been known, in certain rare and anomalous cases,[55] to form a small external rudiment of a tail. The *os coccyx* is short, usually including only four vertebrae, all ankylosed together: and these are in a rudimentary condition, for they consist, with the exception of the basal one, of the centrum alone.[56] They are furnished with some small muscles; one of which, as I am informed by Prof. Turner, has been expressly described by Theile as a rudimentary repetition of the extensor of the tail, a muscle which is so largely developed in many mammals.

The spinal cord in man extends only as far downwards as the last dorsal or first lumbar vertebra; but a thread-like structure (the *filum terminale*) runs down the axis of the sacral part of the spinal canal, and even along the back of the coccygeal bones. The upper part of this filament, as Prof. Turner informs me, is undoubtedly homologous with the spinal cord; but the lower part apparently consists merely of the pia mater, or vascular investing membrane. Even in this case the *os coccyx* may be said to possess a vestige of so important a structure as the spinal cord, though no longer enclosed within a bony canal. The following fact, for which I am also indebted to Prof. Turner, shews how closely the *os coccyx* corresponds with the true tail in the lower animals: Luschka has recently discovered at the extremity of the coccygeal bones a very peculiar convoluted body, which is continuous with the middle sacral artery; and this discovery led Krause and Meyer to examine the tail of a monkey (*Macacus*), and of a cat, in both of which they found a similarly convoluted body, though not at the extremity.

The reproductive system offers various rudimentary structures; but these differ in one important respect from the foregoing cases. Here we are not concerned with the vestige of a part which does not belong to the species in an efficient state, but with a part efficient in the one sex, and represented in the other by a mere rudiment. Nevertheless, the occurrence of such rudiments is as difficult to explain, on the belief of the separate creation of each species, as in the foregoing cases. Hereafter I shall have to recur to these rudiments, and shall shew that their presence generally depends merely on inheritance, that is, on parts acquired by one sex having been partially transmitted to the other. I will in this place only give some instances of such rudiments. It is well known that in the males of all mammals, including man, rudimentary mammae exist. These in several instances have become well developed, and have yielded a copious supply of milk. Their essential identity in the two sexes is likewise shewn by their occasional sympathetic enlargement in both during an attack of the measles. The *vesicula prostatica*, which has been observed in many male mammals, is now universally acknowledged to be the homologue of the female uterus, together with the connected passage. It is impossible to read Leuckart's able description of this organ, and his reasoning, without admitting the justness of his conclusion. This is especially clear in the case of those mammals in which the true female uterus bifurcates, for in the males of these the *vesicula* likewise bifurcates.[57] Some other rudimentary structures belonging to the reproductive system might have been here adduced.[58]

The bearing of the three great classes of facts now given is unmistakeable. But it would be superfluous fully to recapitulate the line of argument given in detail in my *Origin of Species*. The homological construction of the whole frame in the members of the same class is intelligible, if we admit their descent from a common progenitor, together with their subsequent adaptation to diversified conditions. On any other view, the similarity of pattern between the hand of a man or monkey, the foot of a horse, the flipper of a seal, the wing of a bat, &c., is utterly inexplicable.[59] It is no scientific explanation to assert that they have all been formed on the same ideal plan. With respect to development, we can clearly understand, on the principle of variation supervening at a rather late embryonic period, and being inherited at a corresponding period, how it is that the embryos of wonderfully different forms should still retain, more or less perfectly, the structure of their common progenitor. No other explanation has ever been given of the marvellous fact that the embryos of a man, dog, seal, bat, reptile, &c., can at first hardly be distinguished from each other. In order to understand the existence of rudimentary organs, we have only to suppose that a former progenitor possessed the parts in question in a perfect state, and that under changed habits of life they became greatly reduced, either from simple disuse, or through the natural selection of those individuals which were least encumbered with a superfluous part, aided by the other means previously indicated.

Thus we can understand how it has come to pass that man and all other vertebrate animals have been constructed on the same general model, why they pass through the same early stages of development, and why they retain certain rudiments in common. Consequently we ought frankly to admit their community of descent: to take any other view, is to admit that our own structure, and that of all the animals around us, is a mere snare laid to entrap our judgment. This conclusion is greatly strengthened, if we look to the members of the whole animal series, and consider the evidence derived from their affinities or classification, their geographical distribution and geological succession. It is only our natural prejudice, and that arrogance which made our forefathers declare that they were descended from demigods, which leads us to demur to this conclusion. But the time will before long come, when it will be thought wonderful that naturalists, who were well acquainted with the comparative structure and development of man, and other mammals, should have believed that each was the work of a separate act of creation.

Footnotes

[3] *Grosshirnwindungen des Menschen*, 1868, s. 96. The conclusions of this author, as well as those of Gratiolet and Aebly, concerning the brain, will be discussed by Prof. Huxley in the appendix

[4] *Lec. sur la Phys.*, 1866, p. 890, as quoted by M. Dally, *L'Ordre des Primates et le Transformisme*, 1868, p. 29.

[5] Dr. W. Lauder Lindsay has treated this subject at some length in the *Journal of Mental Science*, July, 1871: and in the *Edinburgh Veterinary Review*, July, 1858

[6] A reviewer has criticised (*British Quarterly Review*, Oct. 1, 1871, p. 472) what I have here said with much severity and contempt: but as I do not use the term identity, I cannot see that I am greatly in error. There appears to me a strong analogy between the same infection or contagion producing the same result, or one closely similar, in two distinct animals, and the testing of two distinct fluids by the same chemical reagent

[7] *Naturgeschichte der Saugethiere von Paraguay*, 1830, s. 50

[8] The same tests are common to some animals much lower in the scale. Mr. A. Nicols informs me that he kept in Queensland, in Australia, three individuals of the *Phaseolartus cinereus*, and that, without having been taught in any way, they acquired a strong taste for rum, and for smoking tobacco

[9] *Brehm, Illustriertes Thierleben*, B. i., 1864, 75, 86. On the *Ateles*, s. 105. For other analogous statements, see ss. 25, 107.

[10] Dr. W. Lauder Lindsay, *Edinburgh Veterinary Review*, July, 1858, p. 13

[11] With respect to insects see Dr. Laycock, "On a General Law of Vital Periodicity," British Association, 1842. Dr. Macculloch, Silliman's North American Journal of Science, vol. xvii., p. 305, has seen a dog suffering from tertian ague. Hereafter I shall return to this subject

[12] I have given the evidence on this head in my Variation of Animals and Plants under Domestication, vol. ii., p. 15, and more could be added.

[13] Mares e diversis generibus Quadrumanorum sine dubio dignoscunt feminas humanas a maribus. Primum, credo, odoratu, postea aspectu. Mr. Youatt, qui diu in Hortis Zoologicis (Bestiariis) medicus animalium erat, vir in rebus observandis cautus et sagax, hoc mihi certissime probavit, et curatores ejusdem loci et alii e ministris confirmaverunt. Sir Andrew Smith et Brehm notabant idem in Cynocephalo. Illustrissimus Cuvier etiam narrat multa de hac re, qua ut opinor, nihil turpius potest indicari inter omnia hominibus et Quadrumanis communia. Narrat enim Cynocephalum quendam in furorem incidere aspectu feminarum aliquare, sed nequaquam accendi tanto furore ab omnibus. Semper eligebat juniores, et dignoscebat in turba, et advocabat voce gestuque

(Classics Editor's note: note footnote [14] appears in the text.)

[15] This remark is made with respect to Cynocephalus and the anthropomorphous apes by Geoffroy Saint-Hilaire and F. Cuvier, Histoire Nat. des Mammiferes, tom. i., 1824

[16] Huxley, Man's Place in Nature, 1863, p. 34.

[17] Man's Place in Nature, 1863, p. 67.

[18] The human embryo (see upper fig.) is from Ecker, Icones Phys., 1851-1859, tab. xxx., fig. 2. The drawing of this embryo is much magnified. The embryo of the dog is from Bischoff, Entwicklungsgeschichte des Hunde-Eies, 1845, tab. xi., fig. 42 B. This drawing is magnified, the embryo being twenty-five days old. The internal viscera have been omitted, and the uterine appendages in both drawings removed. I was directed to these figures by Prof. Huxley, from whose work, Man's Place in Nature, the idea of giving them was taken. Haeckel has also given analogous drawings in his Schopfungsgeschichte.

[19] Prof. Wyman in Proceedings of the American Academy of Sciences, vol. iv., 1860, p. 17

[20] Owen, Anatomy of Vertebrates, vol. i., p. 533

[21] Die Grosshirnwindungen des Menschen 1868, s. 95

[22] Anatomy of Vertebrates, vol. ii., p. 553

[23] Proc. Soc. Nat. Hist., Boston, 1863, vol. ix., p. 185

[24] Man's Place in Nature, p. 65.

[25] I had written a rough copy of this chapter before reading a valuable paper, "Caratteri rudimentali in ordine all' origine dell' uomo" (Annuario della Soc. d. Naturalisti, Modena, 1867, p. 81), by G. Canestrini, to which paper I am considerably indebted. Haeckel has given admirable discussions on this whole subject, under the title of "Dysteleology," in his Generelle Morphologie and Schopfungsgeschichte.

[26] Some good criticisms on this subject have been given by Messrs. Murie and Mivart, in Transactions, Zoological Society, 1869, vol. vii., p. 92

[27] Variation of Animals and Plants under Domestication, vol. ii pp. 317 and 397. See also Origin of Species.(OOS)

[28] For instance, M. Richard (Annales des Sciences Nat., 3d series, Zoolog., 1852, tom. xviii., p. 13) describes and figures rudiments of what he calls the "muscle pedieux de la main," which he says is sometimes "infiniment petit." Another muscle, called "le tibial posterieur," is generally quite

absent in the hand, but appears from time to time in a more or less rudimentary condition

[29] Prof. W. Turner, Proceedings of the Royal Society of Edinburgh, 1866-67, p. 65.

[30] See my Expression of the Emotions in Man and Animals, 1872, p. 144.

[31] Canestrini quotes Hyrtl. (Annuario della Soc. dei Naturalisti, Modena, 1897, p. 97) to the same effect

[32] The Diseases of the Ear, by J. Toynbee, F. R. S., 1860, p. 12. A distinguished physiologist, Prof. Preyer, informs me that he had lately been experimenting on the function of the shell of the ear, and has come to nearly the same conclusion as that given here

[33] Prof. A. Macalister, Annals and Magazine of Natural History, vol. vii., 1871, p. 342

[34] Mr. St. George Mivart, Elementary Anatomy, 1873, p. 396.

[35] See also some remarks, and the drawings of the ears of the Lemuroidea, in Messrs. Murie and Mivart's excellent paper in Transactions of the Zoological Society, vol. vii., 1869, pp. 6 and 90

[36] Über das Darwin'sche Spitzohr," Archiv für Path. Anst. und Phys., 1871, p. 485

[37] The Expression of the Emotions, p. 136.

[38] Muller's Elements of Physiology, Eng. transl., 1842, vol. ii., p. 1117. Owen, Anatomy of Vertebrates, vol. iii., p. 260; *ibid.*, on the walrus, Proceedings of the Zoological Society, November 8, 1854. See also R. Knox, Great Artists and Anatomists, p. 106. This rudiment apparently is somewhat larger in Negroes and Australians than in Europeans, see Carl Vogt, Lectures on Man, Eng. transl., p. 129.

[39] The account given by Humboldt of the power of smell possessed by the natives of South America is well known, and has been confirmed by others. M. Houzeau (Études sur les Facultés Mentales, &c., tom. i., 1872, p. 91) asserts that he repeatedly made experiments, and proved that Negroes and Indians could recognise persons in the dark by their odour. Dr. W. Ogle has made some curious observations on the connection between the power of smell and the colouring matter of the mucous membrane of the olfactory region as well as of the skin of the body. I have, therefore, spoken in the text of the dark-coloured races having a finer sense of smell than the white races. See his paper, Medico-Chirurgical Transactions, London, vol. liii., 1870, p. 276

[40] The Physiology and Pathology of Mind, 2nd ed., 1868, p. 134.

[41] Eschricht, "Über die Richtung der Haare am menschlichen Körper," Muller's Archiv für Anat. und Phys., 1837, s. 47. I shall often have to refer to this very curious paper

[42] Paget, Lectures on Surgical Pathology, 1853, vol. i., p. 71.

[43] Eschricht, *ibid.*, ss. 40, 47

[44] See my Variation of Animals and Plants under Domestication, vol. ii., p. 327. Prof. Alex. Brandt has recently sent me an additional case of a father and son, born in Russia, with these peculiarities. I have received drawings of both from Paris.

[45] Dr. Webb, "Teeth in Man and the Anthropoid Apes," as quoted by Dr. C. Carter Blake in Anthropological Review, July, 1867, p. 299

[46] Owen, Anatomy of Vertebrates, vol. iii., pp. 320, 321, and 325

[47] "On the Primitive Form of the Skull," Eng. transl., in Anthropological Review, Oct., 1868, p. 426

[48] Prof. Montegazza writes to me from Florence, that he has lately been studying the last molar

teeth in the different races of man, and has come to the same conclusion as that given in my text, viz., that in the higher or civilised races they are on the road towards atrophy or elimination.

[49] Owen, *Anatomy of Vertebrates*, vol. iii., pp 416, 434, 441

[50] *Annuario della Soc. d. Nat. Modena*, 1867, p. 94

[51] M. C. Martins ("De l'Unite Organique," in *Revue des Deux Mondes*, June 15, 1862, p. 16) and Haeckel (*Generelle Morphologie*, B. ii., s. 278), have both remarked on the singular fact of this rudiment sometimes causing death.

[52] With respect to inheritance, see Dr. Struthers in the *Lancet*, Feb. 15, 1873, and another important paper, *ibid.*, Jan. 24, 1863, p. 83. Dr. Knox, as I am informed, was the first anatomist who drew attention to this peculiar structure in man; see his *Great Artists and Anatomists*, p. 63. See also an important memoir on this process by Dr. Gruber, in the *Bulletin de l'Acad. Imp. de St. Petersbourg*, tom. xii., 1867, p. 448.

[53] Mr. St. George Mivart, *Transactions Phil. Soc.*, 1867, p. 310

[54] "On the Caves of Gibraltar," *Transactions of the International Congress of Prehistoric Archaeology*, Third Session, 1869, p. 159. Prof. Wyman has lately shewn (*Fourth Annual Report*, Peabody Museum, 1871, p. 20), that this perforation is present in thirty-one per cent of some human remains from ancient mounds in the Western United States, and in Florida. It frequently occurs in the negro.

[55] Quatrefages has lately collected the evidence on this subject. *Revue des Cours Scientifiques*, 1867-1868, p. 625. In 1840 Fleischmann exhibited a human foetus bearing a free tail, which, as is not always the case, included vertebral bodies; and this tail was critically examined by the many anatomists present at the meeting of naturalists at Erlangen (see Marshall in *Niederland. Archiv fur Zoologie*, December, 1871)

[56] Owen, *On the Nature of Limbs*, 1849, p. 114.

[57] Leuckart, in *Todd's Cyclopaedia of Anatomy*, 1849-52, vol. iv., p. 1415. In man this organ is only from three to six lines in length, but, like so many other rudimentary parts, it is variable in development as well as in other characters

[58] See, on this subject, Owen, *Anatomy of Vertebrates*, vol. iii., pp. 675, 676, 706.

[59] Prof. Bianconi, in a recently published work, illustrated by admirable engravings (*La Theorie Darwinienne et la creation dite independante*, 1874), endeavours to show that homological structures, in the above and other cases, can be fully explained on mechanical principles, in accordance with their uses. No one has shewn so well, how admirably such structures are adapted for their final purpose; and this adaptation can, as I believe, be explained through natural selection. In considering the wing of a bat, he brings forward (p. 218) what appears to me (to use Auguste Comte's words) a mere metaphysical principle, namely, the preservation "in its integrity of the mammalian nature of the animal." In only a few cases does he discuss rudiments, and then only those parts which are partially rudimentary, such as the little hoofs of the pig and ox, which do not touch the ground; these he shows clearly to be of service to the animal. It is unfortunate that he did not consider such cases as the minute teeth, which never cut through the jaw in the ox, or the mammae of male quadrupeds, or the wings of certain beetles, existing under the soldered wing-covers, or the vestiges of the pistil and stamens in various flowers, and many other such cases. Although I greatly admire Prof. Bianconi's work, yet the belief now held by most naturalists seems to me left unshaken, that homological structures are inexplicable on the principle of mere adaptation.

Chapter II

ON THE MANNER OF DEVELOPMENT OF MAN FROM SOME LOWER FORM.

It is manifest that man is now subject to much variability. No two individuals of the same race are quite alike. We may compare millions of faces, and each will be distinct. There is an equally great amount of diversity in the proportions and dimensions of the various parts of the body; the length of the legs being one of the most variable points.[60]

Although in some quarters of the world an elongated skull, and in other quarters a short skull prevails, yet there is great diversity of shape even within the limits of the same race, as with the aborigines of America and South Australia- the latter a race "probably as pure and homogeneous in blood, customs, and language as any in existence" -- and even with the inhabitants of so confined an area as the Sandwich Islands.[61] An eminent dentist assures me that there is nearly as much diversity in the teeth as in the features. The chief arteries so frequently run in abnormal courses, that it has been found useful for surgical purposes to calculate from 1040 corpses how often each course prevails.[62] The muscles are eminently variable: thus those of the foot were found by Prof. Turner [63] not to be strictly alike in any two out of fifty bodies; and in some the deviations were considerable. He adds, that the power of performing the appropriate movements must have been modified in accordance with the several deviations. Mr. J. Wood has recorded [64] the occurrence of 295 muscular variations in thirty-six subjects, and in another set of the same number no less than 558 variations, those occurring on both sides of the body being only reckoned as one. In the last set, not one body out of the thirty-six was "found totally wanting in departures from the standard descriptions of the muscular system given in anatomical text books." A single body presented the extraordinary number of twenty-five distinct abnormalities. The same muscle sometimes varies in many ways: thus Prof. Macalister describes[65] no less than twenty distinct variations in the palmaris accessorius.

The famous old anatomist, Wolff,[66] insists that the internal viscera are more variable than the external parts: *Nulla particula est quae non aliter et aliter in aliis se habeat hominibus*. He has even written a treatise on the choice of typical examples of the viscera for representation. A discussion on the beau-ideal of the liver, lungs, kidneys, &c., as of the human face divine, sounds strange in our ears.

The variability or diversity of the mental faculties in men of the same race, not to mention the greater differences between the men of distinct races, is so notorious that not a word need here be said. So it is with the lower animals. All who have had charge of menageries admit this fact, and we see it plainly in our dogs and other domestic animals. Brehm especially insists that each individual monkey of those which he kept tame in Africa had its own peculiar disposition and temper: he mentions one baboon remarkable for its high intelligence; and the keepers in the Zoological Gardens pointed out to me a monkey, belonging to the New World division, equally remarkable for intelligence. Rengger, also, insists on the diversity in the various mental characters of the monkeys of the same species which he kept in Paraguay; and this diversity, as he adds, is partly innate, and partly the result of the manner in which they have been treated or educated.[67]

I have elsewhere[68] so fully discussed the subject of Inheritance, that I need here add hardly anything. A greater number of facts have been collected with respect to the transmission of the most trifling, as well as of the most important characters in man, than in any of the lower animals; though the facts are copious enough with respect to the latter. So in regard to mental qualities, their transmission is manifest in our dogs, horses, and other domestic animals. Besides special tastes and habits, general intelligence, courage, bad and good temper, &c., are certainly transmitted. With man we see similar facts in almost every family; and we now know, through the admirable labours of Mr. Galton,[69] that genius which implies a wonderfully complex combination of high faculties, tends to be inherited; and, on the other hand, it is too certain that insanity and deteriorated mental powers likewise run in families.

With respect to the causes of variability, we are in all cases very ignorant; but we can see that in man as in the lower animals, they stand in some relation to the conditions to which each species has been exposed, during several generations. Domesticated animals vary more than those in a state of nature; and this is apparently due to the diversified and changing nature of the conditions to

which they have been subjected. In this respect the different races of man resemble domesticated animals, and so do the individuals of the same race, when inhabiting a very wide area, like that of America. We see the influence of diversified conditions in the more civilised nations; for the members belonging to different grades of rank, and following different occupations, present a greater range of character than do the members of barbarous nations. But the uniformity of savages has often been exaggerated, and in some cases can hardly be said to exist.[70] It is, nevertheless, an error to speak of man, even if we look only to the conditions to which he has been exposed, as "far more domesticated"[71] than any other animal. Some savage races, such as the Australians, are not exposed to more diversified conditions than are many species which have a wide range. In another and much more important respect, man differs widely from any strictly domesticated animal; for his breeding has never long been controlled, either by methodical or unconscious selection. No race or body of men has been so completely subjugated by other men, as that certain individuals should be preserved, and thus unconsciously selected, from somehow excelling in utility to their masters. Nor have certain male and female individuals been intentionally picked out and matched, except in the well-known case of the Prussian grenadiers; and in this case man obeyed, as might have been expected, the law of methodical selection; for it is asserted that many tall men were reared in the villages inhabited by the grenadiers and their tall wives. In Sparta, also, a form of selection was followed, for it was enacted that all children should be examined shortly after birth; the well-formed and vigorous being preserved, the others left to perish.[72]

With kine and horses, Kurnus! we proceed
By reasonable rules, and choose a breed
For profit and increase at any price:
Of a sound stock, without defect or vice.
But, in the daily matches that we make,
The price is everything: for money's sake,
Men marry: women are in marriage given
The churl or ruffian, that in wealth has thriven,
May match his offspring with the proudest race:
Thus everything is mix'd, noble and base!
If then in outward manner, form, and mind,
You find us a degraded, motley kind,
Wonder no more, my friend! the cause is plain,
And to lament the consequence is vain.

(The Works of J. Hookham Frere, vol. ii., 1872, p. 334.)

If we consider all the races of man as forming a single species, his range is enormous; but some separate races, as the Americans and Polynesians, have very wide ranges. It is a well-known law that widely-ranging species are much more variable than species with restricted ranges; and the variability of man may with more truth be compared with that of widely-ranging species, than with that of domesticated animals.

Not only does variability appear to be induced in man and the lower animals by the same general causes, but in both the same parts of the body are effected in a closely analogous manner. This has been proved in such full detail by Godron and Quatrefages, that I need here only refer to their works.[73] Monstrosities, which graduate into slight variations, are likewise so similar in man and the lower animals, that the same classification and the same terms can be used for both, as has been shewn by Isidore Geoffroy St-Hilaire.[74] In my work on the variation of domestic animals, I have attempted to arrange in a rude fashion the laws of variation under the following heads:- The direct and definite action of changed conditions, as exhibited by all or nearly all the individuals of the same species, varying in the same manner under the same circumstances. The effects of the long-continued use or disuse of parts. The cohesion of homologous parts. The variability of multiple parts. Compensation of growth; but of this law I have found no good instance in the case of man. The effects of the mechanical pressure of one part on another; as of the pelvis on the cranium of the infant in the womb. Arrests of development, leading to the diminution or suppression of parts. The reappearance of long-lost characters through reversion. And lastly, correlated variation. All these so-called laws apply equally to man and the lower animals; and most of them even to plants. It would be superfluous here to discuss all of them;[75] but several are so important, that they must be treated at considerable length.

The Direct and Definite Action of Changed Conditions.- This is a most perplexing subject. It cannot be denied that changed conditions produce some, and occasionally a considerable effect, on organisms of all kinds; and it seems at first probable that if sufficient time were allowed this would be the invariable result. But I have failed to obtain clear evidence in favour of this conclusion; and valid reasons may be urged on the other side, at least as far as the innumerable structures are concerned, which are adapted for special ends. There can, however, be no doubt that changed conditions induce an almost indefinite amount of fluctuating variability, by which the whole organisation is rendered in some degree plastic.

In the United States, above 1,000,000 soldiers, who served in the late war, were measured, and the States in which they were born and reared were recorded.[76] From this astonishing number of observations it is proved that local influences of some kind act directly on stature; and we further learn that "the State where the physical growth has in great measure taken place, and the State of birth, which indicates the ancestry, seem to exert a marked influence on the stature." For instance, it is established, "that residence in the Western States, during the years of growth, tends to produce increase of stature." On the other hand, it is certain that with sailors, their life delays growth, as shewn "by the great difference between the statures of soldiers and sailors at the ages of seventeen and eighteen years." Mr. B. A. Gould endeavoured to ascertain the nature of the influences which thus act on stature; but he arrived only at negative results, namely that they did not relate to climate, the elevation of the land, soil, nor even "in any controlling degree" to the abundance or the need of the comforts of life. This latter conclusion is directly opposed to that arrived at by, Villermé, from the statistics of the height of the conscripts in different parts of France. When we compare the differences in stature between the Polynesian chiefs and the lower orders within the same islands, or between the inhabitants of the fertile volcanic and low barren coral islands of the same ocean,[77] or again between the Fuegians on the eastern and western shores of their country, where the means of subsistence are very different, it is scarcely possible to avoid the conclusion that better food and greater comfort do influence stature. But the preceding statements shew how difficult it is to arrive at any precise result. Dr. Beddoe has lately proved that, with the inhabitants of Britain, residence in towns and certain occupations have a deteriorating influence on height; and he infers that the result is to a certain extent inherited, as is likewise the case in the United States. Dr. Beddoe further believes that wherever a "race attains its maximum of physical development, it rises highest in energy and moral vigour." [78]

Whether external conditions produce any other direct effect on man is not known. It might have been expected that differences of climate would have had a marked influence, inasmuch as the lungs and kidneys are brought into activity under a low temperature, and the liver and skin under a high one.[79] It was formerly thought that the colour of the skin and the character of the hair were determined by light or heat; and although it can hardly be denied that some effect is thus produced, almost all observers now agree that the effect has been very small, even after exposure during many ages. But this subject will be more properly discussed when we treat of the different races of mankind. With our domestic animals there are grounds for believing that cold and damp directly affect the growth of the hair; but I have not met with any evidence on this head in the case of man.

Effects of the increased Use and Disuse of Parts.- It is well known that use strengthens the muscles in the individual, and complete disuse, or the destruction of the proper nerve, weakens them. When the eye is destroyed, the optic nerve often becomes atrophied. When an artery is tied, the lateral channels increase not only in diameter, but in the thickness and strength of their coats. When one kidney ceases to act from disease, the other increases in size, and does double work. Bones increase not only in thickness, but in length, from carrying a greater weight.[80] Different occupations, habitually followed, lead to changed proportions in various parts of the body. Thus it was ascertained by the United States Commission[81] that the legs of the sailors employed in the late war were longer by 0.217 of an inch than those of the soldiers, though the sailors were on an average shorter men; whilst their arms were shorter by 1.09 of an inch, and therefore, out of proportion, shorter in relation to their lesser height. This shortness of the arms is apparently due to their greater use, and is an unexpected result: but sailors chiefly use their arms in pulling, and not in supporting weights. With sailors, the girth of the neck and the depth of the instep are greater, whilst the circumference of the chest, waist, and hips is less, than in soldiers.

Whether the several foregoing modifications would become hereditary, if the same habits of life were followed during many generations, is not known, but it is probable. Rengger[82] attributes the thin legs and thick arms of the Payaguas Indians to successive generations having passed nearly

their whole lives in canoes, with their lower extremities motionless. Other writers have come to a similar conclusion in analogous cases. According to Cranz,[83] who lived for a long time with the Esquimaux, "The natives believe that ingenuity and dexterity in seal-catching (their highest art and virtue) is hereditary; there is really something in it, for the son of a celebrated seal-catcher will distinguish himself, though he lost his father in childhood." But in this case it is mental aptitude, quite as much as bodily structure, which appears to be inherited. It is asserted that the hands of English labourers are at birth larger than those of the gentry.[84] From the correlation which exists, at least in some cases,[85] between the development of the extremities and of the jaws, it is possible that in those classes which do not labour much with their hands and feet, the jaws would be reduced in size from this cause. That they are generally smaller in refined and civilized men than in hard-working men or savages, is certain. But with savages, as Mr. Herbert Spencer[86] has remarked, the greater use of the jaws in chewing coarse, uncooked food, would act in a direct manner on the masticatory muscles, and on the bones to which they are attached. In infants, long before birth, the skin on the soles of the feet is thicker than on any other part of the body;[87] and it can hardly be doubted that this is due to the inherited effects of pressure during a long series of generations.

It is familiar to every one that watchmakers and engravers are liable to be short-sighted, whilst men living much out of doors, and especially savages, are generally long-sighted.[88] Short-sight and long-sight certainly tend to be inherited.[89] The inferiority of Europeans, in comparison with savages, in eyesight and in the other senses, is no doubt the accumulated and transmitted effect of lessened use during many generations; for Rengger[90] states that he has repeatedly observed Europeans, who had been brought up and spent their whole lives with the wild Indians, who nevertheless did not equal them in the sharpness of their senses. The same naturalist observes that the cavities in the skull for the reception of the several sense-organs are larger in the American aborigines than in Europeans; and this probably indicates a corresponding difference in the dimensions of the organs themselves. Blumenbach has also remarked on the large size of the nasal cavities in the skulls of the American aborigines, and connects this fact with their remarkably acute power of smell. The Mongolians of the plains of northern Asia, according to Pallas, have wonderfully perfect senses; and Prichard believes that the great breadth of their skulls across the zygomas follows from their highly-developed sense organs.[91]

The Quechua Indians inhabit the lofty plateaux of Peru; and Alcide d'Orbigny states[92] that, from continually breathing a highly rarefied atmosphere, they have acquired chests and lungs of extraordinary dimensions. The cells, also, of the lungs are larger and more numerous than in Europeans. These observations have been doubted, but Mr. D. Forbes carefully measured many Aymaras, an allied race, living at the height of between 10,000 and 15,000 feet; and he informs me [93] that they differ conspicuously from the men of all other races seen by him in the circumference and length of their bodies. In his table of measurements, the stature of each man is taken at 1000, and the other measurements are reduced to this standard. It is here seen that the extended arms of the Aymaras are shorter than those of Europeans, and much shorter than those of Negroes. The legs are likewise shorter; and they present this remarkable peculiarity, that in every Aymara measured, the femur is actually shorter than the tibia. On an average, the length of the femur to that of the tibia is as 211 to 252; whilst in two Europeans, measured at the same time, the femora to the tibiae were as 244 to 230; and in three Negroes as 258 to 241. The humerus is likewise shorter relatively to the forearm. This shortening of that part of the limb which is nearest to the body, appears to be, as suggested to me by Mr. Forbes, a case of compensation in relation with the greatly increased length of the trunk. The Aymaras present some other singular points of structure, for instance, the very small projection of the heel.

These men are so thoroughly acclimatised to their cold and lofty abode, that when formerly carried down by Spaniards to the low eastern plains, and when now tempted down by high wages to the gold-washings, they suffer a frightful rate of mortality. Nevertheless Mr. Forbes found a few pure families which had survived during two generations: and he observed that they still inherited their characteristic peculiarities. But it was manifest, even without measurement, that these peculiarities had all decreased; and on measurement, their bodies were found not to be so much elongated as those of the men on the high plateau; whilst their femora had become somewhat lengthened, as had their tibiae, although in a less degree. The actual measurements may be seen by consulting Mr. Forbes's memoir. From these observations, there can, I think, be no doubt that residence during many generations at a great elevation tends, both directly and indirectly, to induce inherited modifications in the proportions of the body.[94]

Although man may not have been much modified during the latter stages of his existence through the increased or decreased use of parts, the facts now given shew that his liability in this respect has not been lost; and we positively know that the same law holds good with the lower animals. Consequently we may infer that when at a remote epoch the progenitors of man were in a transitional state, and were changing from quadrupeds into bipeds, natural selection would probably have been greatly aided by the inherited effects of the increased or diminished use of the different parts of the body.

Arrests of Development.- There is a difference between arrested development and arrested growth, for parts in the former state continue to grow whilst still retaining their early condition. Various monstrosities come under this head; and some, as a cleft palate, are known to be occasionally inherited. It will suffice for our purpose to refer to the arrested brain-development of microcephalous idiots, as described in Vogt's memoir.[95] Their skulls are smaller, and the convolutions of the brain are less complex than in normal men. The frontal sinus, or the projection over the eyebrows, is largely developed, and the jaws are prognathous to an "effrayant" degree; so that these idiots somewhat resemble the lower types of mankind. Their intelligence, and most of their mental faculties, are extremely feeble. They cannot acquire the power of speech, and are wholly incapable of prolonged attention, but are much given to imitation. They are strong and remarkably active, continually gambolling and jumping about, and making grimaces. They often ascend stairs on all-fours; and are curiously fond of climbing up furniture or trees. We are thus reminded of the delight shewn by almost all boys in climbing trees; and this again reminds us how lambs and kids, originally alpine animals, delight to frisk on any hillock, however small. Idiots also resemble the lower animals in some other respects; thus several cases are recorded of their carefully smelling every mouthful of food before eating it. One idiot is described as often using his mouth in aid of his hands, whilst hunting for lice. They are often filthy in their habits, and have no sense of decency; and several cases have been published of their bodies being remarkably hairy.[96]

Reversion.- Many of the cases to be here given, might have been introduced under the last heading. When a structure is arrested in its development, but still continues growing, until it closely resembles a corresponding structure in some lower and adult member of the same group, it may in one sense be considered as a case of reversion. The lower members in a group give us some idea how the common progenitor was probably constructed; and it is hardly credible that a complex part, arrested at an early phase of embryonic development, should go on growing so as ultimately to perform its proper function, unless it had acquired such power during some earlier state of existence, when the present exceptional or arrested structure was normal. The simple brain of a microcephalous idiot, in as far as it resembles that of an ape may in this sense be said to offer a case of reversion.[97] There are other cases which come more strictly under our present head of reversion. Certain structures, regularly occurring in the lower members of the group to which man belongs, occasionally make their appearance in him, though not found in the normal human embryo; or, if normally present in the human embryo, they become abnormally developed, although in a manner which is normal in the lower members of the group. These remarks will be rendered clearer by the following illustrations. In the above work (vol. ii., p. 12), I also attributed, though with much hesitation, the frequent cases of polydactylism in men and various animals to reversion. I was partly led to this through Prof. Owen's statement, that some of the *Ichthyopterygia* possesses more than five digits, and therefore, as I supposed, had retained a primordial condition; but Prof. Gegenbaur (*Jenaische Zeitschrift*, B. v., Heft 3, s. 341), disputes Owen's conclusion. On the other hand, according to the opinion lately advanced by Dr. Gunther, on the paddle of *Ceratodus*, which is provided with articulated bony rays on both sides of a central chain of bones, there seems no great difficulty in admitting that six or more digits on one side, or on both sides, might reappear through reversion. I am informed by Dr. Zouteveen that there is a case on record of a man having twentyfour fingers and twenty-four toes! I was chiefly led to the conclusion that the presence of supernumerary digits might be due to reversion from the fact that such digits, not only are strongly inherited, but, as I then believed, had the power of regrowth after amputation, like the normal digits of the lower Vertebrata. But I have explained in the second edition of my *Variation under Domestication* why I now place little reliance on the recorded cases of such regrowth. Nevertheless it deserves notice, inasmuch as arrested development and reversion are intimately related processes; that various structures in an embryonic or arrested condition, such as a cleft palate, bifid uterus, &c., are frequently accompanied by polydactylism. This has been strongly insisted on by Meckel and Isidore Geoffroy St-Hilaire. But at present it is the safest course to give up altogether the idea that there is any relation between the development of supernumerary digits and reversion to some lowly

organized progenitor of man.

In various mammals the uterus graduates from a double organ with two distinct orifices and two passages, as in the marsupials, into a single organ, which is in no way double except from having a slight internal fold, as in the higher apes and man. The rodents exhibit a perfect series of gradations between these two extreme states. In all mammals the uterus is developed from two simple primitive tubes, the inferior portions of which form the cornua; and it is in the words of Dr. Farre, "by the coalescence of the two cornua at their lower extremities that the body of the uterus is formed in man; while in those animals in which no middle portion or body exists, the cornua remain ununited. As the development of the uterus proceeds, the two cornua become gradually shorter, until at length they are lost, or, as it were, absorbed into the body of the uterus." The angles of the uterus are still produced into cornua, even in animals as high up in the scale as the lower apes and lemurs.

Now in women, anomalous cases are not very infrequent, in which the mature uterus is furnished with cornua, or is partially divided into two organs; and such cases, according to Owen, repeat "the grade of concentrative development," attained by certain rodents. Here perhaps we have an instance of a simple arrest of embryonic development, with subsequent growth and perfect functional development; for either side of the partially double uterus is capable of performing the proper office of gestation. In other and rarer cases, two distinct uterine cavities are formed, each having its proper orifice and passage.[98] No such stage is passed through during the ordinary development of the embryo; and it is difficult to believe, though perhaps not impossible, that the two simple, minute, primitive tubes should know how (if such an expression may be used) to grow into two distinct uteri, each with a well-constructed orifice, and passage, and each furnished with numerous muscles, nerves, glands and vessels, if they had not formerly passed through a similar course of development, as in the case of existing marsupials.

No one will pretend that so perfect a structure as the abnormal double uterus in woman could be the result of mere chance. But the principle of reversion, by which a long-lost structure is called back into existence, might serve as the guide for its full development, even after the lapse of an enormous interval of time.

Professor Canestrini, after discussing the foregoing and various analogous cases, arrives at the same conclusion as that just given. He adduces another instance, in the case of the malar bone,[99] which, in some of the Quadrumana and other mammals, normally consists of two portions. This is its condition in the human foetus when two months old; and through arrested development, it sometimes remains thus in man when adult, more especially in the lower prognathous races. Hence Canestrini concludes that some ancient progenitor of man must have had this bone normally divided into two portions, which afterwards became fused together. In man the frontal bone consists of a single piece, but in the embryo, and in children, and in almost all the lower mammals, it consists of two pieces separated by a distinct suture. This suture occasionally persists more or less distinctly in man after maturity; and more frequently in ancient than in recent crania, especially, as Canestrini has observed, in those exhumed from the Drift, and belonging to the brachycephalic type. Here again he comes to the same conclusion as in the analogous case of the malar bones. In this, and other instances presently to be given, the cause of ancient races approaching the lower animals in certain characters more frequently than do the modern races, appears to be, that the latter stand at a somewhat greater distance in the long line of descent from their early semi-human progenitors.

Various other anomalies in man, more or less analogous to the foregoing, have been advanced by different authors, as cases of reversion; but these seem not a little doubtful, for we have to descend extremely low in the mammalian series, before we find such structures normally present.[100]

In man, the canine teeth are perfectly efficient instruments for mastication. But their true canine character, as Owen [101] remarks, "is indicated by the conical form of the crown, which terminates in an obtuse point, is convex outward and flat or sub-concave within, at the base of which surface there is a feeble prominence. The conical form is best expressed in the Melanian races, especially the Australian. The canine is more deeply implanted, and by a stronger fang than the incisors." Nevertheless, this tooth no longer serves man as a special weapon for tearing his enemies or prey; it may, therefore, as far as its proper function is concerned, be considered as rudimentary. In every large collection of human skulls some may be found, as Haeckel[102] observes, with the canine teeth projecting considerably beyond the others in the same manner as in the anthropomorphous apes, but in a less degree. In these cases, open spaces between the teeth in the one jaw are left for

the reception of the canines of the opposite jaw. An inter-space of this kind in a Kaffir skull, figured by Wagner, is surprisingly wide.[103] Considering how few are the ancient skulls which have been examined, compared to recent skulls, it is an interesting fact that in at least three cases the canines project largely; and in the Naulette jaw they are spoken of as enormous.[104]

Of the anthropomorphous apes the males alone have their canines fully developed; but in the female gorilla, and in a less degree in the female orang, these teeth project considerably beyond the others; therefore the fact, of which I have been assured, that women sometimes have considerably projecting canines, is no serious objection to the belief that their occasional great development in man is a case of reversion to an ape-like progenitor. He who rejects with scorn the belief that the shape of his own canines, and their occasional great development in other men, are due to our early forefathers having been provided with these formidable weapons, will probably reveal, by sneering, the line of his descent. For though he no longer intends, nor has the power, to use these teeth as weapons, he will unconsciously retract his "snarling muscles" (thus named by Sir C. Bell),[105] so as to expose them ready for action, like a dog prepared to fight.

Many muscles are occasionally developed in man, which are proper to the Quadrumana or other mammals. Professor Vlacovich[106] examined forty male subjects, and found a muscle, called by him the ischio-pubic, in nineteen of them; in three others there was a ligament which represented this muscle; and in the remaining eighteen no trace of it. In only two out of thirty female subjects was this muscle developed on both sides, but in three others the rudimentary ligament was present. This muscle, therefore, appears to be much more common in the male than in the female sex; and on the belief in the descent of man from some lower form, the fact is intelligible; for it has been detected in several of the lower animals, and in all of these it serves exclusively to aid the male in the act of reproduction.

Mr. J. Wood, in his valuable series of papers,[107] has minutely described a vast number of muscular variations in man, which resemble normal structures in the lower animals. The muscles which closely resemble those regularly present in our nearest allies, the Quadrumans, are too numerous to be here even specified. In a single male subject, having a strong bodily frame, and well-formed skull, no less than seven muscular variations were observed, all of which plainly represented muscles proper to various kinds of apes. This man, for instance, had on both sides of his neck a true and powerful "levator claviculae," such as is found in all kinds of apes, and which is said to occur in about one out of sixty human subjects.[108] Again, this man had "a special abductor of the metatarsal bone of the fifth digit, such as Professor Huxley and Mr. Flower have shewn to exist uniformly in the higher and lower apes." I will give only two additional cases; the acromio-basilar muscle is found in all mammals below man, and seems to be correlated with a quadrupedal gait,[109] and it occurs in about one out of sixty human subjects. In the lower extremities Mr. Bradley[110] found an abductor ossis metatarsi quinti in both feet of man; this muscle had not up to that time been recorded in mankind, but is always present in the anthropomorphous apes. The muscles of the hands and arms- parts which are so eminently characteristic of man- are extremely liable to vary, so as to resemble the corresponding muscles in the lower animals.[111] Such resemblances are either perfect or imperfect; yet in the latter case they are manifestly of a transitional nature. Certain variations are more common in man, and others in woman, without our being able to assign any reason. Mr. Wood, after describing numerous variations, makes the following pregnant remark. "Notable departures from the ordinary type of muscular structures run in grooves or directions, which must be taken to indicate some unknown factor, of much importance to a comprehensive knowledge of general and scientific anatomy." [112]

That this unknown factor is reversion to a former state of existence may be admitted as in the highest degree probable.[113] It is quite incredible that a man should through mere accident abnormally resemble certain apes in no less than seven of his muscles, if there had been no genetic connection between them. On the other hand, if man is descended from some ape-like creature, no valid reason can be assigned why certain muscles should not suddenly reappear after an interval of many thousand generations, in the same manner as with horses, asses, and mules, dark-coloured stripes suddenly reappear on the legs, and shoulders, after an interval of hundreds, or more probably of thousands of generations.

These various cases of reversion are so closely related to those of rudimentary organs given in the first chapter, that many of them might have been indifferently introduced either there or here. Thus a human uterus furnished with cornua may be said to represent, in a rudimentary condition, the same

organ in its normal state in certain mammals. Some parts which are rudimentary in man, as the os coccyx in both sexes, and the mammae in the male sex, are always present; whilst others, such as the supracondyloid foramen, only occasionally appear, and therefore might have been introduced under the head of reversion. These several reversionary structures, as well as the strictly rudimentary ones, reveal the descent of man from some lower form in an unmistakable manner.

Correlated Variation.- In man, as in the lower animals, many structures are so intimately related, that when one part varies so does another, without our being able, in most cases, to assign any reason. We cannot say whether the one part governs the other, or whether both are governed by some earlier developed part. Various monstrosities, as I. Geoffroy repeatedly insists, are thus intimately connected.

Homologous structures are particularly liable to change together, as we see on the opposite sides of the body, and in the upper and lower extremities. Meckel long ago remarked, that when the muscles of the arm depart from their proper type, they almost always imitate those of the leg; and so, conversely, with the muscles of the legs. The organs of sight and hearing, the teeth and hair, the colour of the skin and of the hair, colour and constitution, are more or less correlated.[114] Professor Schaaffhausen first drew attention to the relation apparently existing between a muscular frame and the strongly-pronounced supra-orbital ridges, which are so characteristic of the lower races of man. Besides the variations which can be grouped with more or less probability under the foregoing heads, there is a large class of variations which may be provisionally called spontaneous, for to our ignorance they appear to arise without any exciting cause. It can, however, be shewn that such variations, whether consisting of slight individual differences, or of strongly-marked and abrupt deviations of structure, depend much more on the constitution of the organism than on the nature of the conditions to which it has been subjected.[115]

Rate of Increase.- Civilised populations have been known under favourable conditions, as in the United States, to double their numbers in twenty-five years; and, according to a calculation, by Euler, this might occur in a little over twelve years.[116] At the former rate, the present population of the United States (thirty millions), would in 657 years cover the whole terraqueous globe so thickly, that four men would have to stand on each square yard of surface. The primary or fundamental check to the continued increase of man is the difficulty of gaining subsistence, and of living in comfort. We may infer that this is the case from what we see, for instance, in the United States, where subsistence is easy, and there is plenty of room. If such means were suddenly doubled in Great Britain, our number would be quickly doubled. With civilised nations this primary check acts chiefly by restraining marriages. The greater death-rate of infants in the poorest classes is also very important; as well as the greater mortality, from various diseases, of the inhabitants of crowded and miserable houses, at all ages. The effects of severe epidemics and wars are soon counterbalanced, and more than counterbalanced, in nations placed under favourable conditions. Emigration also comes in aid as a temporary check, but, with the extremely poor classes, not to any great extent.

There is great reason to suspect, as Malthus has remarked, that the reproductive power is actually less in barbarous, than in civilised races. We know nothing positively on this head, for with savages no census has been taken; but from the concurrent testimony of missionaries, and of others who have long resided with such people, it appears that their families are usually small, and large ones rare. This may be partly accounted for, as it is believed, by the women suckling their infants during a long time; but it is highly probable that savages, who often suffer much hardships, and who do not obtain so much nutritious food as civilised men, would be actually less prolific. I have shewn in a former work,[117] that all our domesticated quadrupeds and birds, and all our cultivated plants, are more fertile than the corresponding species in a state of nature. It is no valid objection to this conclusion that animals suddenly supplied with an excess of food, or when grown very fat; and that most plants on sudden removal from very poor to very rich soil, are rendered more or less sterile. We might, therefore, expect that civilised men, who in one sense are highly domesticated, would be more prolific than wild men. It is also probable that the increased fertility of civilised nations would become, as with our domestic animals, an inherited character: it is at least known that with mankind a tendency to produce twins runs in families.[118]

Notwithstanding that savages appear to be less prolific than civilised people, they would no doubt rapidly increase if their numbers were not by some means rigidly kept down. The Santali, or hill-tribes of India, have recently afforded a good illustration of this fact; for, as shewn by Mr. Hunter, [119] they have increased at an extraordinary rate since vaccination has been introduced, other

pestilences mitigated, and war sternly repressed. This increase, however, would not have been possible had not these rude people spread into the adjoining districts, and worked for hire. Savages almost always marry; yet there is some prudential restraint, for they do not commonly marry at the earliest possible age. The young men are often required to shew that they can support a wife; and they generally have first to earn the price with which to purchase her from her parents. With savages the difficulty of obtaining subsistence occasionally limits their number in a much more direct manner than with civilised people, for all tribes periodically suffer from severe famines. At such times savages are forced to devour much bad food, and their health can hardly fail to be injured. Many accounts have been published of their protruding stomachs and emaciated limbs after and during famines. They are then, also, compelled to wander much, and, as I was assured in Australia, their infants perish in large numbers. As famines are periodical, depending chiefly on extreme seasons, all tribes must fluctuate in number. They cannot steadily and regularly increase, as there is no artificial increase in the supply of food. Savages, when hard pressed, encroach on each other's territories, and war is the result; but they are indeed almost always at war with their neighbours. They are liable to many accidents on land and water in their search for food; and in some countries they suffer much from the larger beasts of prey. Even in India, districts have been depopulated by the ravages of tigers.

Malthus has discussed these several checks, but he does not lay stress enough on what is probably the most important of all, namely infanticide, especially of female infants and the habit of procuring abortion. These practices now prevail in many quarters of the world; and infanticide seems formerly to have prevailed, as Mr. M'Lennan^[120] has shewn on a still more extensive scale. These practices appear to have originated in savages recognising the difficulty, or rather the impossibility of supporting all the infants that are born. Licentiousness may also be added to the foregoing checks; but this does not follow from failing means of subsistence; though there is reason to believe that in some cases (as in Japan) it has been intentionally encouraged as a means of keeping down the population.

If we look back to an extremely remote epoch, before man had arrived at the dignity of manhood, he would have been guided more by instinct and less by reason than are the lowest savages at the present time. Our early semi-human progenitors would not have practised infanticide or polyandry; for the instincts of the lower animals are never so perverted^[121] as to lead them regularly to destroy their own offspring, or to be quite devoid of jealousy. There would have been no prudential restraint from marriage, and the sexes would have freely united at an early age. Hence the progenitors of man would have tended to increase rapidly; but checks of some kind, either periodical or constant, must have kept down their numbers, even more severely than with existing savages. What the precise nature of these checks were, we cannot say, any more than with most other animals. We know that horses and cattle, which are not extremely prolific animals, when first turned loose in South America, increased at an enormous rate. The elephant, the slowest breeder of all known animals, would in a few thousand years stock the whole world. The increase of every species of monkey must be checked by some means; but not, as Brehm remarks, by the attacks of beasts of prey. No one will assume that the actual power of reproduction in the wild horses and cattle of America, was at first in any sensible degree increased; or that, as each district became fully stocked, this same power was diminished. No doubt, in this case, and in all others, many checks concur, and different checks under different circumstances; periodical dearths, depending on unfavourable seasons, being probably the most important of all. So it will have been with the early progenitors of man.

Natural Selection.- We have now seen that man is variable in body and mind; and that the variations are induced, either directly or indirectly, by the same general causes, and obey the same general laws, as with the lower animals. Man has spread widely over the face of the earth, and must have been exposed, during his incessant migration,^[122] to the most diversified conditions. The inhabitants of Tierra del Fuego, the Cape of Good Hope, and Tasmania in the one hemisphere, and of the arctic regions in the other, must have passed through many climates, and changed their habits many times, before they reached their present homes.^[123] The early progenitors of man must also have tended, like all other animals, to have increased beyond their means of subsistence; they must, therefore, occasionally have been exposed to a struggle for existence, and consequently to the rigid law of natural selection. Beneficial variations of all kinds will thus, either occasionally or habitually, have been preserved and injurious ones eliminated. I do not refer to strongly-marked deviations of structure, which occur only at long intervals of time, but to mere individual differences. We know, for instance, that the muscles of our hands and feet, which determine our powers of

movement, are liable, like those of the lower animals,[124] to incessant variability. If then the progenitors of man inhabiting any district, especially one undergoing some change in its conditions, were divided into two equal bodies, the one half which included all the individuals best adapted by their powers of movement for gaining subsistence, or for defending themselves, would on an average survive in greater numbers, and procreate more offspring than the other and less well endowed half.

Man in the rudest state in which he now exists is the most dominant animal that has ever appeared on this earth. He has spread more widely than any other highly organised form: and all others have yielded before him. He manifestly owes this immense superiority to his intellectual faculties, to his social habits, which lead him to aid and defend his fellows, and to his corporeal structure. The supreme importance of these characters has been proved by the final arbitrament of the battle for life. Through his powers of intellect, articulate language has been evolved; and on this his wonderful advancement has mainly depended. As Mr. Chauncey Wright remarks: "A psychological analysis of the faculty of language shews, that even the smallest proficiency in it might require more brain power than the greatest proficiency in any other direction." [125] He has invented and is able to use various weapons, tools, traps, &c., with which he defends himself, kills or catches prey, and otherwise obtains food. He has made rafts or canoes for fishing or crossing over to neighbouring fertile islands. He has discovered the art of making fire, by which hard and stringy roots can be rendered digestible, and poisonous roots or herbs innocuous. This discovery of fire, probably the greatest ever made by man, excepting language, dates from before the dawn of history. These several inventions, by which man in the rudest state has become so preeminent, are the direct results of the development of his powers of observation, memory, curiosity, imagination, and reason. I cannot, therefore, understand how it is that Mr. Wallace [126] maintains, that "natural selection could only have endowed the savage with a brain a little superior to that of an ape."

Although the intellectual powers and social habits of man are of paramount importance to him, we must not underrate the importance of his bodily structure, to which subject the remainder of this chapter will be devoted; the development of the intellectual and social or moral faculties being discussed in a later chapter.

Even to hammer with precision is no easy matter, as every one who has tried to learn carpentry will admit. To throw a stone with as true an aim as a Fuegian in defending himself, or in killing birds, requires the most consummate perfection in the correlated action of the muscles of the hand, arm, and shoulder, and, further, a fine sense of touch. In throwing a stone or spear, and in many other actions, a man must stand firmly on his feet; and this again demands the perfect co-adaptation of numerous muscles. To chip a flint into the rudest tool, or to form a barbed spear or hook from a bone, demands the use of a perfect hand; for, as a most capable judge, Mr. Schoolcraft, [127] remarks, the shaping fragments of stone into knives, lances, or arrow-heads, shews "extraordinary ability and long practice." This is to a great extent proved by the fact that primeval men practised a division of labour; each man did not manufacture his own flint tools or rude pottery, but certain individuals appear to have devoted themselves to such work, no doubt receiving in exchange the produce of the chase. Archaeologists are convinced that an enormous interval of time elapsed before our ancestors thought of grinding chipped flints into smooth tools. One can hardly doubt, that a man-like animal who possessed a hand and arm sufficiently perfect to throw a stone with precision, or to form a flint into a rude tool, could, with sufficient practice, as far as mechanical skill alone is concerned, make almost anything which a civilised man can make. The structure of the hand in this respect may be compared with that of the vocal organs, which in the apes are used for uttering various signalcries, or, as in one genus, musical cadences; but in man the closely similar vocal organs have become adapted through the inherited effects of use for the utterance of articulate language. Turning now to the nearest allies of men, and therefore to the best representatives of our early progenitors, we find that the hands of the *Quadrupedia* are constructed on the same general pattern as our own, but are far less perfectly adapted for diversified uses. Their hands do not serve for locomotion so well as the feet of a dog; as may be seen in such monkeys as the chimpanzee and orang, which walk on the outer margins of the palms, or on the knuckles.

128 Their hands, however, are admirably adapted for climbing trees. Monkeys seize thin branches or ropes, with the thumb on one side and the fingers and palm on the other, in the same manner as we do. They can thus also lift rather large objects, such as the neck of a bottle, to their mouths. Baboons turn over stones, and scratch up roots with their hands. They seize nuts, insects, or other small objects with the thumb in opposition to the fingers, and no doubt they thus extract eggs and

young from the nests of birds. American monkeys beat the wild oranges on the branches until the rind is cracked, and then tear it off with the fingers of the two hands. In a wild state they break open hard fruits with stones. Other monkeys open mussel-shells with the two thumbs. With their fingers they pull out thorns and burs, and hunt for each other's parasites. They roll down stones, or throw them at their enemies: nevertheless, they are clumsy in these various actions, and, as I have myself seen, are quite unable to throw a stone with precision.

It seems to me far from true that because "objects are grasped clumsily" by monkeys, "a much less specialised organ of prehension" would have served them[129] equally well with their present hands. On the contrary, I see no reason to doubt that more perfectly constructed hands would have been an advantage to them, provided that they were not thus rendered less fitted for climbing trees. We may suspect that a hand as perfect as that of man would have been disadvantageous for climbing; for the most arboreal monkeys in the world, namely, *Ateles* in America, *Colobus* in Africa, and *Hylobates* in Asia, are either thumbless, or their toes partially cohere, so that their limbs are converted into mere grasping hooks.[130]

As soon as some ancient member in the great series of the primates came to be less arboreal, owing to a change in its manner of procuring subsistence, or to some change in the surrounding conditions, its habitual manner of progression would have been modified: and thus it would have been rendered more strictly quadrupedal or bipedal. Baboons frequent hilly and rocky districts, and only from necessity climb high trees;[131] and they have acquired almost the gait of a dog. Man alone has become a biped; and we can, I think, partly see how he has come to assume his erect attitude, which forms one of his most conspicuous characters. Man could not have attained his present dominant position in the world without the use of his hands, which are so admirably adapted to act in obedience to his will. Sir C. Bell[132] insists that "the hand supplies all instruments, and by its correspondence with the intellect gives him universal dominion." But the hands and arms could hardly have become perfect enough to have manufactured weapons, or to have hurled stones and spears with a true aim, as long as they were habitually used for locomotion and for supporting the whole weight of the body, or, as before remarked, so long as they were especially fitted for climbing trees. Such rough treatment would also have blunted the sense of touch, on which their delicate use largely depends. From these causes alone it would have been an advantage to man to become a biped; but for many actions it is indispensable that the arms and whole upper part of the body should be free; and he must for this end stand firmly on his feet. To gain this great advantage, the feet have been rendered flat; and the great toe has been peculiarly modified, though this has entailed the almost complete loss of its power of prehension. It accords with the principle of the division of physiological labour, prevailing throughout the animal kingdom, that as the hands became perfected for prehension, the feet should have become perfected for support and locomotion. With some savages, however, the foot has not altogether lost its prehensile power, as shewn by their manner of climbing trees, and of using them in other ways.[134]

If it be an advantage to man to stand firmly on his feet and to have his hands and arms free, of which, from his pre-eminent success in the battle of life, there can be no doubt, then I can see no reason why it should not have been advantageous to the progenitors of man to have become more and more erect or bipedal. They would thus have been better able to defend themselves with stones or clubs, to attack their prey, or otherwise to obtain food. The best built individuals would in the long run have succeeded best, and have survived in larger numbers. If the gorilla and a few allied forms had become extinct, it might have been argued, with great force and apparent truth, that an animal could not have been gradually converted from a quadruped into a biped, as all the individuals in an intermediate condition would have been miserably ill-fitted for progression. But we know (and this is well worthy of reflection) that the anthropomorphous apes are now actually in an intermediate condition; and no one doubts that they are on the whole well adapted for their conditions of life. Thus the gorilla runs with a sidelong shambling gait, but more commonly progresses by resting on its bent hands. The long-armed apes occasionally use their arms like crutches, swinging their bodies forward between them, and some kinds of *Hylobates*, without having been taught, can walk or run upright with tolerable quickness; yet they move awkwardly, and much less securely than man. We see, in short, in existing monkeys a manner of progression intermediate between that of a quadruped and a biped; but, as an unprejudiced judge[135] insists, the anthropomorphous apes approach in structure more nearly to the bipedal than to the quadrupedal type.

As the progenitors of man became more and more erect, with their hands and arms more and more modified for prehension and other purposes, with their feet and legs at the same time transformed

for firm support and progression, endless other changes of structure would have become necessary. The pelvis would have to be broadened, the spine peculiarly curved, and the head fixed in an altered position, all which changes have been attained by man. Prof. Schaaffhausen[136] maintains that "the powerful mastoid processes of the human skull are the result of his erect position"; and these processes are absent in the orang, chimpanzee, &c., and are smaller in the gorilla than in man. Various other structures, which appear connected with man's erect position, might here have been added. It is very difficult to decide how far these correlated modifications are the result of natural selection, and how far of the inherited effects of the increased use of certain parts, or of the action of one part on another. No doubt these means of change often co-operate: thus when certain muscles, and the crests of bone to which they are attached, become enlarged by habitual use, this shews that certain actions are habitually performed and must be serviceable. Hence the individuals which performed them best, would tend to survive in greater numbers.

The free use of the arms and hands, partly the cause and partly the result of man's erect position, appears to have led in an indirect manner to other modifications of structure. The early male forefathers of man were, as previously stated, probably furnished with great canine teeth; but as they gradually acquired the habit of using stones, clubs, or other weapons, for fighting with their enemies or rivals, they would use their jaws and teeth less and less. In this case, the jaws, together with the teeth, would become reduced in size, as we may feel almost sure from innumerable analogous cases. In a future chapter we shall meet with a closely parallel case, in the reduction or complete disappearance of the canine teeth in male ruminants, apparently in relation with the development of their horns; and in horses, in relation to their habit of fighting with their incisor teeth and hoofs.

In the adult male anthropomorphous apes, as Rutimeyer,[137] and others, have insisted, it is the effect on the skull of the great development of the jaw-muscles that causes it to differ so greatly in many respects from that of man, and has given to these animals "a truly frightful physiognomy." Therefore, as the jaws and teeth in man's progenitors gradually become reduced in size, the adult skull would have come to resemble more and more that of existing man. As we shall hereafter see, a great reduction of the canine teeth in the males would almost certainly affect the teeth of the females through inheritance. As the various mental faculties gradually developed themselves the brain would almost certainly become larger. No one, I presume, doubts that the large proportion which the size of man's brain bears to his body, compared to the same proportion in the gorilla or orang, is closely connected with his higher mental powers. We meet with closely analogous facts with insects, for in ants the cerebral ganglia are of extraordinary dimensions, and in all the Hymenoptera these ganglia are many times larger than in the less intelligent orders, such as beetles.[138] On the other hand, no one supposes that the intellect of any two animals or of any two men can be accurately gauged by the cubic contents of their skulls. It is certain that there may be extraordinary mental activity with an extremely small absolute mass of nervous matter: thus the wonderfully diversified instincts, mental powers, and affections of ants are notorious, yet their cerebral ganglia are not so large as the quarter of a small pin's head. Under this point of view, the brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more so than the brain of a man.

The belief that there exists in man some close relation between the size of the brain and the development of the intellectual faculties is supported by the comparison of the skulls of savage and civilised races, of ancient and modern people, and by the analogy of the whole vertebrate series. Dr. J. Barnard Davis has proved,[139] by many careful measurements, that the mean internal capacity of the skull in Europeans is 92.3 cubic inches; in Americans 87.5; in Asiatics 87.1; and in Australians only 81.9 cubic inches. Professor Broca[140] found that the nineteenth century skulls from graves in Paris were larger than those from vaults of the twelfth century, in the proportion of 1484 to 1426; and that the increased size, as ascertained by measurements, was exclusively in the frontal part of the skull the seat of the intellectual faculties. Prichard is persuaded that the present inhabitants of Britain have "much more capacious braincases" than the ancient inhabitants. Nevertheless, it must be admitted that some skulls of very high antiquity, such as the famous one of Neanderthal, are well developed and capacious.[141] With respect to the lower animals, M. E. Lartet,[142] by comparing the crania of tertiary and recent mammals belonging to the same groups, has come to the remarkable conclusion that the brain is generally larger and the convolutions are more complex in the more recent forms. On the other hand, I have shewn[143] that the brains of domestic rabbits are considerably reduced in bulk, in comparison with those of the wild rabbit or hare; and this may be attributed to their having been closely confined during many generations, so

that they have exerted their intellect, instincts, senses and voluntary movements but little.

The gradually increasing weight of the brain and skull in man must have influenced the development of the supporting spinal column, more especially whilst he was becoming erect. As this change of position was being brought about, the internal pressure of the brain will also have influenced the form of the skull; for many facts shew how easily the skull is thus effected. Ethnologists believe that it is modified by the kind of cradle in which infants sleep. Habitual spasms of the muscles, and a cicatrix from a severe burn, have permanently modified the facial bones. In young persons whose heads have become fixed either sideways or backwards, owing to disease, one of the two eyes has changed its position, and the shape of the skull has been altered apparently by the pressure of the brain in a new direction.[144] I have shewn that with long-eared rabbits even so trifling a cause as the lopping forward of one ear drags forward almost every bone of the skull on that side; so that the bones on the opposite side no longer strictly correspond. Lastly, if any animal were to increase or diminish much in general size, without any change in its mental powers, or if the mental powers were to be much increased or diminished, without any great change in the size of the body, the shape of the skull would almost certainly be altered. I infer this from my observations on domestic rabbits, some kinds of which have become very much larger than the wild animal, whilst others have retained nearly the same size, but in both cases the brain has been much reduced relatively to the size of the body. Now I was at first much surprised on finding that in all these rabbits the skull had become elongated or dolichocephalic; for instance, of two skulls of nearly equal breadth, the one from a wild rabbit and the other from a large domestic kind, the former was 3.15 and the latter 4.3 inches in length.[145] One of the most marked distinctions in different races of men is that the skull in some is elongated, and in others rounded; and here the explanation suggested by the case of the rabbits may hold good; for Welcker finds that short "men incline more to brachycephaly, and tall men to dolichocephaly";[146] and tall men may be compared with the larger and longer-bodied rabbits, all of which have elongated skulls or are dolichocephalic.

From these several facts we can understand, to a certain extent, the means by which the great size and more or less rounded form of the skull have been acquired by man; and these are characters eminently distinctive of him in comparison with the lower animals.

Another most conspicuous difference between man and the lower animals is the nakedness of his skin. Whales and porpoises (Cetacea), dugongs (Sirenia) and the hippopotamus are naked; and this may be advantageous to them for gliding through the water; nor would it be injurious to them from the loss of warmth, as the species, which inhabit the colder regions, are protected by a thick layer of blubber, serving the same purpose as the fur of seals and otters. Elephants and rhinoceroses are almost hairless; and as certain extinct species, which formerly lived under an arctic climate, were covered with long wool or hair, it would almost appear as if the existing species of both genera had lost their hairy covering from exposure to heat. This appears the more probable, as the elephants in India which live on elevated and cool districts are more hairy[147] than those on the lowlands. May we then infer that man became divested of hair from having aboriginally inhabited some tropical land? That the hair is chiefly retained in the male sex on the chest and face, and in both sexes at the junction of all four limbs with the trunk, favours this inference- on the assumption that the hair was lost before man became erect; for the parts which now retain most hair would then have been most protected from the heat of the sun. The crown of the head, however, offers a curious exception, for at all times it must have been one of the most exposed parts, yet it is thickly clothed with hair. The fact, however, that the other members of the order of primates, to which man belongs, although inhabiting various hot regions, are well clothed with hair, generally thickest on the upper surface,[148] is opposed to the supposition that man became naked through the action of the sun. Mr. Belt believes[149] that within the tropics it is an advantage to man to be destitute of hair, as he is thus enabled to free himself of the multitude of ticks (acari) and other parasites, with which he is often infested, and which sometimes cause ulceration. But whether this evil is of sufficient magnitude to have led to the denudation of his body through natural selection, may be doubted, since none of the many quadrupeds inhabiting the tropics have, as far as I know, acquired any specialised means of relief. The view which seems to me the most probable is that man, or rather primarily woman, became divested of hair for ornamental purposes, as we shall see under Sexual Selection; and, according to this belief, it is not surprising that man should differ so greatly in hairiness from all other primates, for characters, gained through sexual selection, often differ to an extraordinary degree in closely related forms.

According to a popular impression, the absence of a tail is eminently distinctive of man; but as those

apes which come nearest to him are destitute of this organ, its disappearance does not relate exclusively to man. The tail often differs remarkably in length within the same genus: thus in some species of *Macacus* it is longer than the whole body, and is formed of twenty-four vertebrae; in others it consists of a scarcely visible stump, containing only three or four vertebrae. In some kinds of baboons there are twenty-five, whilst in the mandrill there are ten very small stunted caudal vertebrae, or, according to Cuvier,[150] sometimes only five. The tail, whether it be long or short, almost always tapers towards the end; and this, I presume, results from the atrophy of the terminal muscles, together with their arteries and nerves, through disuse, leading to the atrophy of the terminal bones. But no explanation can at present be given of the great diversity which often occurs in its length. Here, however, we are more specially concerned with the complete external disappearance of the tail. Professor Broca has recently shewn[151] that the tail in all quadrupeds consists of two portions, generally separated abruptly from each other; the basal portion consists of vertebrae, more or less perfectly channelled and furnished with apophyses like ordinary vertebrae; whereas those of the terminal portion are not channelled, are almost smooth, and scarcely resemble true vertebrae. A tail, though not externally visible, is really present in man and the anthropomorphous apes, and is constructed on exactly the same pattern in both. In the terminal portion the vertebrae, constituting the *os coccyx*, are quite rudimentary, being much reduced in size and number. In the basal portion, the vertebrae are likewise few, are united firmly together, and are arrested in development; but they have been rendered much broader and flatter than the corresponding vertebrae in the tails of other animals: they constitute what Broca calls the accessory sacral vertebrae. These are of functional importance by supporting certain internal parts and in other ways; and their modification is directly connected with the erect or semi-erect attitude of man and the anthropomorphous apes. This conclusion is the more trustworthy, as Broca formerly held a different view, which he has now abandoned. The modification, therefore, of the basal caudal vertebrae in man and the higher apes may have been effected, directly or indirectly, through natural selection.

But what are we to say about the rudimentary and variable vertebrae of the terminal portion of the tail, forming the *os coccyx*? A notion which has often been, and will no doubt again be ridiculed, namely, that friction has had something to do with the disappearance of the external portion of the tail, is not so ridiculous as it at first appears. Dr. Anderson[152] states that the extremely short tail of *Macacus brunneus* is formed of eleven vertebrae, including the imbedded basal ones. The extremity is tendinous and contains no vertebrae; this is succeeded by five rudimentary ones, so minute that together they are only one line and a half in length, and these are permanently bent to one side in the shape of a hook. The free part of the tail, only a little above an inch in length, includes only four more small vertebrae. This short tail is carried erect; but about a quarter of its total length is doubled on to itself to the left; and this terminal part, which includes the hook-like portion, serves "to fill up the interspace between the upper divergent portion of the callosities"; so that the animal sits on it, and thus renders it rough and callous. Dr. Anderson thus sums up his observations: "These facts seem to me to have only one explanation; this tail, from its short size, is in the monkey's way when it sits down, and frequently becomes placed under the animal while it is in this attitude; and from the circumstance that it does not extend beyond the extremity of the ischial tuberosities, it seems as if the tail originally had been bent round by the will of the animal, into the interspace between the callosities, to escape being pressed between them and the ground, and that in time the curvature became permanent, fitting in of itself when the organ happens to be sat upon." Under these circumstances it is not surprising that the surface of the tail should have been roughened and rendered callous, and Dr. Murie,[153] who carefully observed this species in the Zoological Gardens, as well as three other closely allied forms with slightly longer tails, says that when the animal sits down, the tail "is necessarily thrust to one side of the buttocks; and whether long or short its root is consequently liable to be rubbed or chafed." As we now have evidence that mutilations occasionally produce an inherited effect,[154] it is not very improbable that in short-tailed monkeys, the projecting part of the tail, being functionally useless, should after many generations have become rudimentary and distorted, from being continually rubbed and chafed. We see the projecting part in this condition in the *Macacus brunneus*, and absolutely aborted in the *M. ecaudatus* and in several of the higher apes. Finally, then, as far as we can judge, the tail has disappeared in man and the anthropomorphous apes, owing to the terminal portion having been injured by friction during a long lapse of time; the basal and embedded portion having been reduced and modified, so as to become suitable to the erect or semi-erect position.

I have now endeavoured to shew that some of the most distinctive characters of man have in all probability been acquired, either directly, or more commonly indirectly, through natural selection. We

should bear in mind that modifications in structure or constitution which do not serve to adapt an organism to its habits of life, to the food which it consumes, or passively to the surrounding conditions, cannot have been thus acquired. We must not, however, be too confident in deciding what modifications are of service to each being: we should remember how little we know about the use of many parts, or what changes in the blood or tissues may serve to fit an organism for a new climate or new kinds of food. Nor must we forget the principle of correlation, by which, as Isidore Geoffroy has shewn in the case of man, many strange deviations of structure are tied together. Independently of correlation, a change in one part often leads, through the increased or decreased use of other parts, to other changes of a quite unexpected nature. It is also well to reflect on such facts, as the wonderful growth of galls on plants caused by the poison of an insect, and on the remarkable changes of colour in the plumage of parrots when fed on certain fishes, or inoculated with the poison of toads;[155] for we can thus see that the fluids of the system, if altered for some special purpose, might induce other changes. We should especially bear in mind that modifications acquired and continually used during past ages for some useful purpose, would probably become firmly fixed, and might be long inherited.

Thus a large yet undefined extension may safely be given to the direct and indirect results of natural selection; but I now admit, after reading the essay by Nageli on plants, and the remarks by various authors with respect to animals, more especially those recently made by Professor Broca, that in the earlier editions of my *Origin of Species* I perhaps attributed too much to the action of natural selection or the survival of the fittest. I have altered the fifth edition of the *Origin* so as to confine my remarks to adaptive changes of structure; but I am convinced, from the light gained during even the last few years, that very many structures which now appear to us useless, will hereafter be proved to be useful, and will therefore come within the range of natural selection. Nevertheless, I did not formerly consider sufficiently the existence of structures, which, as far as we can at present judge, are neither beneficial nor injurious; and this I believe to be one of the greatest oversights as yet detected in my work. I may be permitted to say, as some excuse, that I had two distinct objects in view; firstly, to shew that species had not been separately created, and secondly, that natural selection had been the chief agent of change, though largely aided by the inherited effects of habit, and slightly by the direct action of the surrounding conditions. I was not, however, able to annul the influence of my former belief, then almost universal, that each species had been purposely created; and this led to my tacit assumption that every detail of structure, excepting rudiments, was of some special, though unrecognised, service. Any one with this assumption in his mind would naturally extend too far the action of natural selection, either during past or present times. Some of those who admit the principle of evolution, but reject natural selection, seem to forget, when criticising my book, that I had the above two objects in view; hence if I have erred in giving to natural selection great power, which I am very far from admitting, or in having exaggerated its power, which is in itself probable, I have at least, as I hope, done good service in aiding to overthrow the dogma of separate creations.

It is, as I can now see, probable that all organic beings, including man, possess peculiarities of structure, which neither are now, nor were formerly of any service to them, and which, therefore, are of no physiological importance. We know not what produces the numberless slight differences between the individuals of each species, for reversion only carries the problem a few steps backwards, but each peculiarity must have had its efficient cause. If these causes, whatever they may be, were to act more uniformly and energetically during a lengthened period (and against this no reason can be assigned), the result would probably be not a mere slight individual difference, but a well-marked and constant modification, though one of no physiological importance. Changed structures, which are in no way beneficial, cannot be kept uniform through natural selection, though the injurious will be thus eliminated. Uniformity of character would, however, naturally follow from the assumed uniformity of the exciting causes, and likewise from the free intercrossing of many individuals. During successive periods, the same organism might in this manner acquire successive modifications, which would be transmitted in a nearly uniform state as long as the exciting causes remained the same and there was free intercrossing. With respect to the exciting causes we can only say, as when speaking of so-called spontaneous variations, that they relate much more closely to the constitution of the varying organism, than to the nature of the conditions to which it has been subjected.

Conclusion.- In this chapter we have seen that as man at the present day is liable, like every other animal, to multiform individual differences or slight variations, so no doubt were the early progenitors of man; the variations being formerly induced by the same general causes, and governed by the

same general and complex laws as at present. As all animals tend to multiply beyond their means of subsistence, so it must have been with the progenitors of man; and this would inevitably lead to a struggle for existence and to natural selection. The latter process would be greatly aided by the inherited effects of the increased use of parts, and these two processes would incessantly react on each other. It appears, also, as we shall hereafter see, that various unimportant characters have been acquired by man through sexual selection. An unexplained residuum of change must be left to the assumed uniform action of those unknown agencies, which occasionally induce strongly marked and abrupt deviations of structure in our domestic productions.

Judging from the habits of savages and of the greater number of the *Quadrumania*, primeval men, and even their ape-like progenitors, probably lived in society. With strictly social animals, natural selection sometimes acts on the individual, through the preservation of variations which are beneficial to the community. A community which includes a large number of well-endowed individuals increases in number, and is victorious over other less favoured ones; even although each separate member gains no advantage over the others of the same community. Associated insects have thus acquired many remarkable structures, which are of little or no service to the individual, such as the pollen-collecting apparatus, or the sting of the worker-bee, or the great jaws of soldier-ants. With the higher social animals, I am not aware that any structure has been modified solely for the good of the community, though some are of secondary service to it. For instance, the horns of ruminants and the great canine teeth of baboons appear to have been acquired by the males as weapons for sexual strife, but they are used in defence of the herd or troop. In regard to certain mental powers the case, as we shall see in the fifth chapter, is wholly different; for these faculties have been chiefly, or even exclusively, gained for the benefit of the community, and the individuals thereof have at the same time gained an advantage indirectly.

It has often been objected to such views as the foregoing, that man is one of the most helpless and defenceless creatures in the world; and that during his early and less well-developed condition, he would have been still more helpless. The Duke of Argyll, for instance, insists^[156] that "the human frame has diverged from the structure of brutes, in the direction of greater physical helplessness and weakness. That is to say, it is a divergence which of all others it is most impossible to ascribe to mere natural selection." He adduces the naked and unprotected state of the body, the absence of great teeth or claws for defence, the small strength and speed of man, and his slight power of discovering food or of avoiding danger by smell. To these deficiencies there might be added one still more serious, namely, that he cannot climb quickly, and so escape from enemies. The loss of hair would not have been a great injury to the inhabitants of a warm country. For we know that the unclothed Fuegians can exist under a wretched climate. When we compare the defenceless state of man with that of apes, we must remember that the great canine teeth with which the latter are provided, are possessed in their full development by the males alone, and are chiefly used by them for fighting with their rivals; yet the females, which are not thus provided, manage to survive.

In regard to bodily size or strength, we do not know whether man is descended from some small species, like the chimpanzee, or from one as powerful as the gorilla; and, therefore, we cannot say whether man has become larger and stronger, or smaller and weaker, than his ancestors. We should, however, bear in mind that an animal possessing great size, strength, and ferocity, and which, like the gorilla, could defend itself from all enemies, would not perhaps have become social: and this would most effectually have checked the acquirement of the higher mental qualities, such as sympathy and the love of his fellows. Hence it might have been an immense advantage to man to have sprung from some comparatively weak creature.

The small strength and speed of man, his want of natural weapons, &c., are more than counterbalanced, firstly, by his intellectual powers, through which he has formed for himself weapons, tools, &c., though still remaining in a barbarous state, and, secondly, by his social qualities which lead him to give and receive aid from his fellow-men. No country in the world abounds in a greater degree with dangerous beasts than southern Africa; no country presents more fearful physical hardships than the arctic regions; yet one of the puniest of races, that of the bushmen, maintains itself in southern Africa, as do the dwarfed Esquimaux in the arctic regions. The ancestors of man were, no doubt, inferior in intellect, and probably in social disposition, to the lowest existing savages; but it is quite conceivable that they might have existed, or even flourished, if they had advanced in intellect, whilst gradually losing their brute-like powers such as that of climbing trees, &c. But these ancestors would not have been exposed to any special danger, even if far more helpless and defenceless than any existing savages, had they inhabited some warm continent or

large island, such as Australia, New Guinea, or Borneo, which is now the home of the orang. And natural selection arising from the competition of tribe with tribe, in some such large area as one of these, together with the inherited effects of habit, would, under favourable conditions, have sufficed to raise man to his present high position in the organic scale.

(go on to chapter 3)

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Footnotes

[60] Investigations in the Military and Anthropological Statistics of American Soldiers, by B. A. Gould, 1869, p. 256

[61] With respect to the "Cranial forms of the American aborigines," see Dr. Aitken Meigs in Proc. Acad. Nat. Sci. Philadelphia, May, 1868. On the Australians, see Huxley, in Lyell's Antiquity of Man, 1863, p. 87. On the Sandwich Islanders, Prof. J. Wyman, Observations on Crania, Boston, 1868, p. 18

[62] Anatomy of the Arteries, by R. Quain. Preface, vol. i., 1844

[63] Transactions of the Royal Society of Edinburgh, vol. xxiv., pp. 175, 189

[64] Proceedings Royal Society, 1867, p. 544; also 1868, pp. 483, 524. There is a previous paper, 1866, p. 229

[65] Proc. R. Irish Academy, vol. x., 1868, p. 141.

[66] Act. Acad. St. Petersburg, 1778, part ii., p. 217.

[67] Brehm, Illustriertes Thierleben, B. i., ss. 58, 87. Rengger, Saugethiere von Paraguay, s. 57.

[68] Variation of Animals and Plants under Domestication, vol. ii., chap. xii

[69] Hereditary Genius: an Inquiry into its Laws and Consequences, 1869.

[70] Mr. Bates remarks (The Naturalist on the Amazons, 1863, vol. ii p. 159), with respect to the Indians of the same South American tribe, "no two of them were at all similar in the shape of the head; one man had an oval visage with fine features, and another was quite Mongolian in breadth and prominence of cheek, spread of nostrils, and obliquity of eyes.

[71] Blumenbach, Treatises on Anthropology., Eng. translat., 1865, p. 205

[72] Mitford's History of Greece, vol. i., p. 282. It appears from a passage in Xenophon's Memorabilia, B. ii. 4 (to which my attention has been called by the Rev. J. N. Hoare), that it was a well recognised principle with the Greeks, that men ought to select their wives with a view to the health and vigour of their children. The Grecian poet, Theognis, who lived 550 B. C., clearly saw how important selection, if carefully applied, would be for the improvement of mankind. He saw, likewise, that wealth often checks the proper action of sexual selection. He thus writes:

[73] Godron, De l'Espece, 1859, tom. ii., livre 3. Quatrefages, Unite de l'Espece Humaine, 1861. Also Lectures on Anthropology, given in the Revue des Cours Scientifiques, 1866-1868

[74] Hist. Gen. et Part. des Anomalies de l'Organisation, tom. i., 1832

[75] I have fully discussed these laws in my Variation of Animals and Plants under Domestication, vol. ii., chaps. xxii. and xxiii. M. J. P. Durand has lately (1868) published a valuable essay, De l'Influence des Milieux, &c. He lays much stress, in the case of plants, on the nature of the soil.

[76] Investigations in Military and Anthropol. Statistics, &c., 1869, by B. A. Gould, pp. 93, 107, 126, 131, 134

[77] For the Polynesians, see Prichard's Physical History of Mankind, vol. v., 1847, pp. 145, 283. Also Godron, De l'Espece, tom. ii., p. 289. There is also a remarkable difference in appearance between the closely-allied Hindoos inhabiting the Upper Ganges and Bengal; see Elphinstone's History of India, vol. i., p. 324

[78] Memoirs, Anthropological Society, vol. iii., 1867-69, pp. 561, 565, 567.

[79] Dr. Brakenridge, "Theory of Diathesis," Medical Times, June 19 and July 17, 1869.

[80] I have given authorities for these several statements in my Variation of Animals and Plants under Domestication, vol. ii., pp. 297-300. Dr. Jaeger, "Uber das Langenwachsthum der Knochen," Jenaische Zeitschrift, B. v., Heft. i

[81] Investigations, &c., by B. A. Gould, 1869, p. 288.

[82] Saugethiere von Paraguay, 1830, s. 4

[83] History of Greenland, Eng. translat., 1767, vol. i., p. 23

[84] Intermarriage, by Alex. Walker, 1838, p. 377

[85] The Variation of Animals and Plants under Domestication, vol. i., p. 173

[86] Principles of Biology, vol. i., p. 455

[87] Paget, Lectures on Surgical Pathology, vol. ii, 1853, p. 209.

[88] It is a singular and unexpected fact that sailors are inferior to landmen in their mean distance of distinct vision. Dr. B. A. Gould (Sanitary Memoirs of the War of the Rebellion, 1869 p. 530), has proved this to be the case; and he accounts for it by the ordinary range of vision in sailors being "restricted to the length of the vessel and the height of the masts.

[89] The Variation of Animal and Plants under Domestication, vol. i., p. 8

[90] Saugethiere von Paraguay, s. 8, 10. I have had good opportunities for observing the extraordinary power of eyesight in the Fuegians. See also Lawrence (Lectures on Physiology, &c., 1822, p. 404) on this same subject. M. Giraud-Teulon has recently collected (Revue des Cours Scientifiques, 1870, p. 625) a large and valuable body of evidence proving that the cause of short-sight, "C'est le travail assidu, de pres.

[91] Prichard, Physical History of Mankind, on the authority of Blumenbach, vol. i., 1841, p. 311; for the statement by Pallas, vol. iv., 1844, p. 407.

[92] Quoted by Prichard, Researches into the Physical History of Mankind, vol. v., p. 463

[93] Mr. Forbes' valuable paper is now published in the Journal of the Ethnological Society of London, new series, vol. ii., 1870, p. 193.

[94] Dr. Wilckens (Landwirthschaft. Wochenblatt, No. 10, 1869) has lately published an interesting essay shewing how domestic animals, which live in mountainous regions, have their frames modified.

[95] Memoires sur les Microcephales, 1867, pp. 50, 125, 169, 171, 184-198

[96] Prof. Laycock sums up the character of brute-like idiots by calling them theroid; Journal of Mental Science,, July, 1863. Dr. Scott (The Deaf and Dumb, 2nd ed., 1870, p. 10) has often observed the imbeciles smelling their food. See, on this same subject, and on the hairiness of idiots, Dr. Maudsley, Body and Mind, 1870, pp. 46-51. Pinel has also given a striking case of hairiness in an idiot.

[97] In my *Variation of Animals under Domestication* (vol. ii., p. 57), I attributed the not very rare cases of supernumerary mammae in women to reversion. I was led to this as a probable conclusion, by the additional mammae being generally placed symmetrically on the breast; and more especially from one case, in which a single efficient mamma occurred in the inguinal region of a woman, the daughter of another woman with supernumerary mammae. But I now find (see, for instance, Prof. Preyer, *Der Kampf um das Dasein*, 1869, s. 45) that mammae erratae, occur in other situations, as on the back, in the armpit, and on the thigh; the mammae in this latter instance having given so much milk that the child was thus nourished. The probability that the additional mammae are due to reversion is thus much weakened; nevertheless, it still seems to me probable, because two pairs are often found symmetrically on the breast; and of this I myself have received information in several cases. It is well known that some lemurs normally have two pairs of mammae on the breast. Five cases have been recorded of the presence of more than a pair of mammae (of course rudimentary) in the male sex of mankind; see *Journal of Anat. and Physiology*, 1872, p. 56, for a case given by Dr. Handyside in which two brothers exhibited this peculiarity; see also a paper by Dr. Bartels, in *Reichert's and du Bois-Reymond's Archiv.*, 1872, p. 304. In one of the cases alluded to by Dr. Bartels, a man bore five mammae, one being medial and placed above the navel; Meckel von Hemsbach thinks that this latter case is illustrated by a medial mamma occurring in certain Cheiroptera. On the whole, we may well doubt if additional mammae would ever have been developed in both sexes of mankind, had not his early progenitors been provided with more than a single pair.

[98] See Dr. A. Farre's well-known article in the *Cyclopaedia of Anatomy and Physiology*, vol. v., 1859, p. 642. Owen, *Anatomy of Vertebrates*, vol. iii., 1868, p. 687. Professor Turner, in *Edinburgh Medical Journal*, February, 1865.

[99] *Annuario della Soc. dei Naturalisti*, Modena, 1867, p. 83. Prof. Canestrini gives extracts on this subject from various authorities. Laurillard remarks, that as he has found a complete similarity in the form, proportions, and connection of the two malar bones in several human subjects and in certain apes, he cannot consider this disposition of the parts as simply accidental. Another paper on this same anomaly has been published by Dr. Saviotti in the *Gazzetta delle Cliniche*, Turin, 1871, where he says that traces of the division may be detected in about two per cent of adult skulls; he also remarks that it more frequently occurs in prognathous skulls, not of the Aryan race, than in others. See also G. Delorenzi on the same subject; "Tre nuovi casi d'anomalia dell' osso malare," Torino, 1872. Also, E. Morselli, "Sopra una rara anomalia dell' osso malare," Modena, 1872. Still more recently Gruber has written a pamphlet on the division of this bone. I give these references because a reviewer, without any grounds or scruples, has thrown doubts on my statements.

[100] A whole series of cases is given by Isidore Geoffroy St-Hilaire, *Hist. des Anomalies*, tom. iii, p. 437. A reviewer (*Journal of Anatomy and Physiology*, 1871, p. 366) blames me much for not having discussed the numerous cases, which have been recorded, of various parts arrested in their development. He says that, according to my theory, "every transient condition of an organ, during its development, is not only a means to an end, but once was an end in itself." This does not seem to me necessarily to hold good. Why should not variations occur during an early period of development, having no relation to reversion; yet such variations might be preserved and accumulated, if in any way serviceable, for instance, in shortening and simplifying the course of development? And again, why should not injurious abnormalities, such as atrophied or hypertrophied parts, which have no relation to a former state of existence, occur at an early period, as well as during maturity?

[101] *Anatomy of Vertebrates*, vol. iii., 1868, p. 323

[102] *Generelle Morphologie*, 1866, B. ii., s. clv

[103] Carl Vogt's *Lectures on Man*, Eng. transl., 1864, p. 151

[104] C. Carter Blake, on a jaw from La Naulette, *Anthropological Review*, 1867, p. 295. Schaaffhausen, *ibid.*, 1868, p. 426.

[105] *The Anatomy of Expression*, 1844, pp. 110, 131.

[106] Quoted by Prof. Canestrini in the *Annuario, della Soc. dei Naturalisti*, 1867, p. 90.

[107] These papers deserve careful study by any one who desires to learn how frequently our muscles vary, and in varying come to resemble those of the *Quadrumana*. The following references relate to the few points touched on in my text: *Proc. Royal Soc.*, vol. xiv., 1865, pp. 379-384; vol. xv., 1866, pp. 241, 242; vol. xv., 1867, p. 544; vol. xvi., 1868, p. 524. I may here add that Dr. Murie and Mr. St. George Mivart have shewn in their *Memoir on the Lemuroidea* (*Transactions, Zoological Society*, vol. vii., 1869, p. 96), how extraordinarily variable some of the muscles are in these animals, the lowest members of the primates. Gradations, also, in the muscles leading to structures found in animals still lower in the scale, are numerous in the *Lemuroidea*

[108] See also Prof. Macalister in *Proceedings, Royal Irish Academy*, vol. x., 1868, p. 124

[109] Mr. Champneys in *Journal of Anatomy and Physiology*, Nov., 1871, p. 178

[110] *Ibid.*, May, 1872, p. 421

[111] Prof. Macalister (*ibid.*, p. 121) has tabulated his observations, and finds that muscular abnormalities are most frequent in the fore-arms, secondly, in the face, thirdly, in the foot, &c

[112] The Rev. Dr. Haughton, after giving (*Proc. R. Irish Academy*, June 27, 1864, p. 715) a remarkable case of variation in the human flexor pollicis longus, adds, "This remarkable example shows that man may sometimes possess the arrangement of tendons of thumb and fingers characteristic of the macaque; but whether such a case should be regarded as a macaque passing upwards into a man, or a man passing downwards into a macaque, or as a congenital freak of nature, I cannot undertake to say." It is satisfactory to hear so capable an anatomist, and so embittered an opponent of evolutionism, admitting even the possibility of either of his first propositions. Prof. Macalister has also described (*Proceedings Royal Irish Academy*, vol.

x., 1864, p. 138) variations in the flexor pollicis longus, remarkable from their relations to the same muscle in the *Quadrumana*.

[113] Since the first edition of this book appeared, Mr. Wood has published another memoir in the *Philosophical Transactions*, 1870, p. 83, on the varieties of the muscles of the human neck, shoulder, and chest. He here shows how extremely variable these muscles are, and how often and how closely the variations resemble the normal muscles of the lower animals. He sums up by remarking, "It will be enough for my purpose if I have succeeded in shewing the more important forms which, when occurring as varieties in the human subject, tend to exhibit in a sufficiently marked manner what may be considered as proofs and examples of the Darwinian principle of reversion, or law of inheritance, in this department of anatomical science."

[114] The authorities for these several statements are given in my *Variation of Animals and Plants under Domestication*, vol. ii., pp. 320-335.

[115] This whole subject has been discussed in chap. xxiii., vol. ii. of my *Variation of Animals and Plants under Domestication*.

[116] See the ever memorable *Essay on the Principle of Population*, by the Rev. T. Malthus, vol. i. 1826. pp. 6, 517.

[117] *Variation of Animals and Plants under Domestication*, vol ii., pp. 111-113, 163

[118] Mr. Sedgwick, *British and Foreign Medico-Chirurgical Review*, July, 1863, p. 170.

[119] *The Animals of Rural Bengal*, by W. W. Hunter, 1868, p. 259.

[120] *Primitive Marriage*, 1865.

[121] A writer in the *Spectator* (March 12, 1871, p. 320) comments as follows on this passage:- "Mr. Darwin finds himself compelled to reintroduce a new doctrine of the fall of man. He shews that the instincts of the higher animals are far nobler than the habits of savage races of men, and he finds himself, therefore, compelled to re-introduce,- in a form of the substantial orthodoxy of which he

appears to be quite unconscious,- and to introduce as a scientific hypothesis the doctrine that man's gain of knowledge was the cause of a temporary but long-enduring moral deterioration as indicated by the many foul customs, especially as to marriage, of savage tribes. What does the Jewish tradition of the moral degeneration of man through his snatching at a knowledge forbidden him by his highest instinct assert beyond this?"

[122] See some good remarks to this effect by W. Stanley Jevons, "A Deduction from Darwin's Theory," *Nature* 1869, p. 231

[123] Latham, *Man and his Migrations*, 1851, p. 135

[124] Messrs. Murie and Mivart in their "Anatomy of the Lemuroidea" (*Transact. Zoolog. Soc.*, vol. vii., 1869, pp. 96-98) say, "some muscles are so irregular in their distribution that they cannot be well classed in any of the above groups." These muscles differ even on the opposite sides of the same individual.

[125] "Limits of Natural Selection," *North American Review*, Oct., 1870, p. 295

[126] *Quarterly Review*, April, 1869, p. 392. This subject is more fully discussed in Mr. Wallace's *Contributions to the Theory of Natural Selection*, 1870, in which all the essays referred to in this work are re-published. The "Essay on Man," has been ably criticised by Prof. Claparede, one of the most distinguished zoologists in Europe, in an article published in the *Bibliothèque Universelle*, June, 1870. The remark quoted in my text will surprise every one who has read Mr. Wallace's celebrated paper on "The Origin of Human Races Deduced from the Theory of Natural Selection," originally published in the *Anthropological Review*, May, 1864, p. clviii. I cannot here resist quoting a most just remark by Sir J. Lubbock (*Prehistoric Times*, 1865, p. 479) in reference to this paper, namely, that Mr. Wallace, "with characteristic unselfishness, ascribes it (i. e. the idea of natural selection) unreservedly to Mr. Darwin, although, as is well known, he struck out the idea independently, and published it, though not with the same elaboration, at the same time."

[127] Quoted by Mr. Lawson Tait in his "Law of Natural Selection," *Dublin Quarterly Journal of Medical Science*, Feb., 1869. Dr. Keller is likewise quoted to the same effect.

[128] Owen, *Anatomy of Vertebrates*, vol. iii., p. 71.

[129] *Quarterly Review*, April, 1869, p. 392

[130] In *Hylobates syndactylus*, as the name expresses, two of the toes regularly cohere; and this, as Mr. Blyth informs me, is occasionally the case with the toes of *H. agilis*, *lar*, and *leuciscus*. *Colobus* is strictly arboreal and extraordinarily active (Brehm, *Illustriertes Thierleben*, B. i., s. 50), but whether a better climber than the species of the allied genera, I do not know. It deserves notice that the feet of the sloths, the most arboreal animals in the world, are wonderfully hooklike.

[131] Brehm, *Illustriertes Thierleben*, B. i., s. 80

[132] "The Hand," &c., *Bridgewater Treatise*, 1833, p. 38

[No footnote 133 in original text -- Classics editor]

[134] Haeckel has an excellent discussion on the steps by which man became a biped: *Natürliche Schöpfungsgeschichte*, 1868, s. 507. Dr. Buchner (*Conferences sur la Théorie Darwinienne*, 1869, p. 135) has given good cases of the use of the foot as a prehensile organ by man; and has also written on the manner of progression of the higher apes, to which I allude in the following paragraph: see also Owen (*Anatomy of Vertebrates*, vol. iii., p. 71) on this latter subject.

[135] Prof. Broca, "La Constitution des vertèbres caudales"; *La Revue d'Anthropologie*, 1872, p. 26, (separate copy).

[136] "On the Primitive Form of the Skull," translated in *Anthropological Review*, Oct., 1868, p. 428. Owen (*Anatomy of Vertebrates*, vol. ii., 1866, p. 551) on the mastoid processes in the higher apes.

[137] Die Grenzen der Thierwelt, eine Betrachtung zu Darwin's Lehre, 1868, s. 51.

[138] Dujardin, Annales des Sciences Nat., 3rd series, Zoolog., tom. xiv., 1850, p. 203. See also Mr. Lowne, Anatomy and Phys. of the Musca vomitoria, 1870, p. 14. My son, Mr. F. Darwin, dissected for me the cerebral ganglia of the Formica rufa.

[139] Philosophical Transactions, 1869, p. 513

[140] "Les Selections," M. P. Broca, Revue d'Anthropologie,, 1873; see also, as quoted in C. Vogt's Lectures on Man, Engl. transl., 1864, pp. 88, 90. Prichard, Physical History of Mankind, vol. i., 1838, p. 305

[141] In the interesting article just referred to, Prof. Broca has well remarked, that in civilised nations, the average capacity of the skull must be lowered by the preservation of a considerable number of individuals, weak in mind and body, who would have been promptly eliminated in the savage state. On the other hand, with savages, the average includes only the more capable individuals, who have been able to survive under extremely hard conditions of life. Broca thus explains the otherwise inexplicable fact, that the mean capacity of the skull of the ancient troglodytes of Lozere is greater than that of modern Frenchmen

[142] Comptes-rendus des Sciences, &c., June 1, 1868

[143] The Variation of Animals and Plants under Domestication, vol. i., pp. 124-129.

[144] Schaaffhausen gives from Blumenbach and Busch, the cases of the spasms and cicatrix in Anthropological Review, Oct., 1868, p. 420. Dr. Jarrold (Anthropologia, 1808, pp. 115, 116) adduces from Camper and from his own observations, cases of the modification of the skull from the head being fixed in an unnatural position. He believes that in certain trades, such as that of a shoemaker, where the head is habitually held forward, the forehead becomes more rounded and prominent

[145] Variation of Animals and Plants under Domestication, vol. i., p. 117, on the elongation of the skull; p. 119, on the effect of the lopping of one ear

[146] Quoted by Schaaffhausen, in Anthropological Review, Oct., 1868, p. 419.

[147] Owen, Anatomy of Vertebrates, vol. iii., p. 619

[148] Isidore Geoffroy St-Hilaire remarks (Histoire Nat. Generale, tom. ii., 1859, pp. 215-217) on the head of man being covered with long hair; also on the upper surfaces of monkeys and of other mammals being more thickly clothed than the lower surfaces. This has likewise been observed by various authors. Prof. P. Gervais (Histoire Nat. des Mammiferes, tom. i., 1854, p. 28), however, states that in the gorilla the hair is thinner on the back, where it is partly rubbed off, than on the lower surface

[149] The Naturalist in Nicaragua, 1874, p. 209. As some confirmation of Mr. Belt's view, I may quote the following passage from Sir W. Denison (Varieties of Vice-Regal Life, vol. i., 1870, p. 440): "It is said to be a practice with the Australians, when the vermin get troublesome, to singe themselves."

[150] Mr. St. George Mivart, Proc. Zoolog. Soc., 1865, pp. 562, 583. Dr. J. E. Gray, Cat. Brit. Mus: "Skeletons." Owen, Anatomy of Vertebrates, vol. ii., p. 517. Isidore Geoffroy, Hist. Nat. Gen., tom. ii., p. 244

[151] Revue d'Anthropologie, 1872; "La Constitution des vertebres caudales."

[152] Proceedings Zoological Society, 1872, p. 210

[153] Proceedings Zoological Society, 1872, p. 786

[154] I allude to Dr. Brown-Sequard's observations on the transmitted effect of an operation causing epilepsy in guinea-pigs, and likewise more recently on the analogous effects of cutting the

sympathetic nerve in the neck. I shall hereafter have occasion to refer to Mr. Salvin's interesting case of the apparently inherited effects of motmots biting off the barbs of their own tail-feathers. See also on the general subject *Variation of Animals and Plants under Domestication*, vol. ii., pp. 22-24.

[155] *The Variation of Animals and Plants under Domestication*, vol. ii., pp. 280, 282.

[156] *Primeval Man*, 1869, p. 66.

Chapter III

COMPARISON OF THE MENTAL POWERS OF MAN AND THE LOWER ANIMALS.

We have seen in the last two chapters that man bears in his bodily structure clear traces of his descent from some lower form; but it may be urged that, as man differs so greatly in his mental power from all other animals, there must be some error in this conclusion. No doubt the difference in this respect is enormous, even if we compare the mind of one of the lowest savages, who has no words to express any number higher than four, and who uses hardly any abstract terms for common objects or for the affections,[157] with that of the most highly organised ape. The difference would, no doubt, still remain immense, even if one of the higher apes had been improved or civilised as much as a dog has been in comparison with its parent-form, the wolf or jackal. The Fuegians rank amongst the lowest barbarians; but I was continually struck with surprise how closely the three natives on board *H. M. S. Beagle*, who had lived some years in England, and could talk a little English, resembled us in disposition and in most of our mental faculties. If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that our high faculties had been gradually developed. But it can be shewn that there is no fundamental difference of this kind. We must also admit that there is a much wider interval in mental power between one of the lowest fishes, as a lamprey or lancelet, and one of the higher apes, than between an ape and man; yet this interval is filled up by numberless gradations.

Nor is the difference slight in moral disposition between a barbarian, such as the man described by the old navigator Byron, who dashed his child on the rocks for dropping a basket of sea-urchins, and a Howard or Clarkson; and in intellect, between a savage who uses hardly any abstract terms, and a Newton or Shakespeare. Differences of this kind between the highest men of the highest races and the lowest savages, are connected by the finest gradations. Therefore it is possible that they might pass and be developed into each other.

My object in this chapter is to shew that there is no fundamental difference between man and the higher mammals in their mental faculties. Each division of the subject might have been extended into a separate essay, but must here be treated briefly. As no classification of the mental powers has been universally accepted, I shall arrange my remarks in the order most convenient for my purpose; and will select those facts which have struck me most, with the hope that they may produce some effect on the reader.

With respect to animals very low in the scale, I shall give some additional facts under Sexual Selection, shewing that their mental powers are much higher than might have been expected. The variability of the faculties in the individuals of the same species is an important point for us, and some few illustrations will here be given. But it would be superfluous to enter into many details on this head, for I have found on frequent enquiry, that it is the unanimous opinion of all those who have long attended to animals of many kinds, including birds, that the individuals differ greatly in every mental characteristic. In what manner the mental powers were first developed in the lowest organisms, is as hopeless an enquiry as how life itself first originated. These are problems for the distant future, if they are ever to be solved by man.

As man possesses the same senses as the lower animals, his fundamental intuitions must be the same. Man has also some few instincts in common, as that of self-preservation, sexual love, the love of the mother for her new-born offspring, the desire possessed by the latter to suck, and so forth. But man, perhaps, has somewhat fewer instincts than those possessed by the animals which come next to him in the series. The orang in the Eastern islands, and the chimpanzee in Africa,

build platforms on which they sleep; and, as both species follow the same habit, it might be argued that this was due to instinct, but we cannot feel sure that it is not the result of both animals having similar wants, and possessing similar powers of reasoning. These apes, as we may assume, avoid the many poisonous fruits of the tropics, and man has no such knowledge: but as our domestic animals, when taken to foreign lands, and when first turned out in the spring, often eat poisonous herbs, which they afterwards avoid, we cannot feel sure that the apes do not learn from their own experience or from that of their parents what fruits to select. It is, however, certain, as we shall presently see, that apes have an instinctive dread of serpents, and probably of other dangerous animals.

The fewness and the comparative simplicity of the instincts in the higher animals are remarkable in contrast with those of the lower animals. Cuvier maintained that instinct and intelligence stand in an inverse ratio to each other; and some have thought that the intellectual faculties of the higher animals have been gradually developed from their instincts. But Pouchet, in an interesting essay, [158] has shewn that no such inverse ratio really exists. Those insects which possess the most wonderful instincts are certainly the most intelligent. In the vertebrate series, the least intelligent members, namely fishes and amphibians, do not possess complex instincts; and amongst mammals the animal most remarkable for its instincts, namely the beaver, is highly intelligent, as will be admitted by every one who has read Mr. Morgan's excellent work.[159]

Although the first dawnings of intelligence, according to Mr. Herbert Spencer,[160] have been developed through the multiplication and coordination of reflex actions, and although many of the simpler instincts graduate into reflex actions, and can hardly be distinguished from them, as in the case of young animals sucking, yet the more complex instincts seem to have originated independently of intelligence. I am, however, very far from wishing to deny that instinctive actions may lose their fixed and untaught character, and be replaced by others performed by the aid of the free will. On the other hand, some intelligent actions, after being performed during several generations, become converted into instincts and are inherited, as when birds on oceanic islands learn to avoid man. These actions may then be said to be degraded in character, for they are no longer performed through reason or from experience. But the greater number of the more complex instincts appear to have been gained in a wholly different manner, through the natural selection of variations of simpler instinctive actions. Such variations appear to arise from the same unknown causes acting on the cerebral organisation, which induce slight variations or individual differences in other parts of the body; and these variations, owing to our ignorance, are often said to arise spontaneously. We can, I think, come to no other conclusion with respect to the origin of the more complex instincts, when we reflect on the marvellous instincts of sterile worker-ants and bees, which leave no offspring to inherit the effects of experience and of modified habits.

Although, as we learn from the above-mentioned insects and the beaver, a high degree of intelligence is certainly compatible with complex instincts, and although actions, at first learnt voluntarily can soon through habit be performed with the quickness and certainty of a reflex action, yet it is not improbable that there is a certain amount of interference between the development of free intelligence and of instinct,- which latter implies some inherited modification of the brain. Little is known about the functions of the brain, but we can perceive that as the intellectual powers become highly developed, the various parts of the brain must be connected by very intricate channels of the freest intercommunication; and as a consequence each separate part would perhaps tend to be less well fitted to answer to particular sensations or associations in a definite and inherited- that is instinctive- manner. There seems even to exist some relation between a low degree of intelligence and a strong tendency to the formation of fixed, though not inherited habits; for as a sagacious physician remarked to me, persons who are slightly imbecile tend to act in everything by routine or habit; and they are rendered much happier if this is encouraged.

I have thought this digression worth giving, because we may easily underrate the mental powers of the higher animals, and especially of man, when we compare their actions founded on the memory of past events, on foresight, reason, and imagination, with exactly similar actions instinctively performed by the lower animals; in this latter case the capacity of performing such actions has been gained, step by step, through the variability of the mental organs and natural selection, without any conscious intelligence on the part of the animal during each successive generation. No doubt, as Mr. Wallace has argued,[161] much of the intelligent work done by man is due to imitation and not to reason; but there is this great difference between his actions and many of those performed by the lower animals, namely, that man cannot, on his first trial, make, for instance, a stone hatchet or a

canoe, through his power of imitation. He has to learn his work by practice; a beaver, on the other hand, can make its dam or canal, and a bird its nest, as well, or nearly as well, and a spider its wonderful web, quite as well,[162] the first time it tries as when old and experienced.

To return to our immediate subject: the lower animals, like man, manifestly feel pleasure and pain, happiness and misery. Happiness is never better exhibited than by young animals, such as puppies, kittens, lambs, &c., when playing together, like our own children. Even insects play together, as has been described by that excellent observer, P. Huber,[163] who saw ants chasing and pretending to bite each other, like so many puppies.

The fact that the lower animals are excited by the same emotions as ourselves is so well established, that it will not be necessary to weary the reader by many details. Terror acts in the same manner on them as on us, causing the muscles to tremble, the heart to palpitate, the sphincters to be relaxed, and the hair to stand on end. Suspicion, the offspring of fear, is eminently characteristic of most wild animals. It is, I think, impossible to read the account given by Sir E. Tennent, of the behaviour of the female elephants, used as decoys, without admitting that they intentionally practise deceit, and well know what they are about. Courage and timidity are extremely variable qualities in the individuals of the same species, as is plainly seen in our dogs. Some dogs and horses are ill-tempered, and easily turn sulky; others are good-tempered; and these qualities are certainly inherited. Every one knows how liable animals are to furious rage, and how plainly they shew it. Many, and probably true, anecdotes have been published on the long-delayed and artful revenge of various animals. The accurate Rengger, and Brehm[164] state that the American and African monkeys which they kept tame, certainly revenged themselves. Sir Andrew Smith, a zoologist whose scrupulous accuracy was known to many persons, told me the following story of which he was himself an eye-witness; at the Cape of Good Hope an officer had often plagued a certain baboon, and the animal, seeing him approaching one Sunday for parade, poured water into a hole and hastily made some thick mud, which he skilfully dashed over the officer as he passed by, to the amusement of many by-standers. For long afterwards the baboon rejoiced and triumphed whenever he saw his victim.

The love of a dog for his master is notorious; as an old writer quaintly says,[165] "A dog is the only thing on this earth that luvs you more than he luvs himself."

In the agony of death a dog has been known to caress his master, and every one has heard of the dog suffering under vivisection, who licked the hand of the operator; this man, unless the operation was fully justified by an increase of our knowledge, or unless he had a heart of stone, must have felt remorse to the last hour of his life.

As Whewell[166] has well asked, "Who that reads the touching instances of maternal affection, related so often of the women of all nations, and of the females of all animals, can doubt that the principle of action is the same in the two cases?" We see maternal affection exhibited in the most trifling details; thus Rengger observed an American monkey (a *Cebus*) carefully driving away the flies which plagued her infant; and Duvaucel saw a *Hylobates* washing the faces of her young ones in a stream. So intense is the grief of female monkeys for the loss of their young, that it invariably caused the death of certain kinds kept under confinement by Brehm in N. Africa. Orphan monkeys were always adopted and carefully guarded by the other monkeys, both males and females. One female baboon had so capacious a heart that she not only adopted young monkeys of other species, but stole young dogs and cats, which she continually carried about. Her kindness, however, did not go so far as to share her food with her adopted offspring, at which Brehm was surprised, as his monkeys always divided everything quite fairly with their own young ones. An adopted kitten scratched this affectionate baboon, who certainly had a fine intellect, for she was much astonished at being scratched, and immediately examined the kitten's feet, and without more ado bit off the claws.[167] In the Zoological Gardens, I heard from the keeper that an old baboon (*C. chacma*) had adopted a Rhesus monkey; but when a young drill and mandrill were placed in the cage, she seemed to perceive that these monkeys, though distinct species, were her nearer relatives, for she at once rejected the Rhesus and adopted both of them. The young Rhesus, as I saw, was greatly discontented at being thus rejected, and it would, like a naughty child, annoy and attack the young drill and mandrill whenever it could do so with safety; this conduct exciting great indignation in the old baboon. Monkeys will also, according to Brehm, defend their master when attacked by any one, as well as dogs to whom they are attached, from the attacks of other dogs. But we here trench on the subjects of sympathy and fidelity, to which I shall recur. Some of Brehm's monkeys took much

delight in teasing a certain old dog whom they disliked, as well as other animals, in various ingenious ways.

Most of the more complex emotions are common to the higher animals and ourselves. Every one has seen how jealous a dog is of his master's affection, if lavished on any other creature; and I have observed the same fact with monkeys. This shews that animals not only love, but have desire to be loved. Animals manifestly feel emulation. They love approbation or praise; and a dog carrying a basket for his master exhibits in a high degree self-complacency or pride. There can, I think, be no doubt that a dog feels shame, as distinct from fear, and something very like modesty when begging too often for food. A great dog scorns the snarling of a little dog, and this may be called magnanimity. Several observers have stated that monkeys certainly dislike being laughed at; and they sometimes invent imaginary offences. In the Zoological Gardens I saw a baboon who always got into a furious rage when his keeper took out a letter or book and read it aloud to him; and his rage was so violent that, as I witnessed on one occasion, he bit his own leg till the blood flowed. Dogs shew what may be fairly called a sense of humour, as distinct from mere play; if a bit of stick or other such object be thrown to one, he will often carry it away for a short distance; and then squatting down with it on the ground close before him, will wait until his master comes quite close to take it away. The dog will then seize it and rush away in triumph, repeating the same manoeuvre, and evidently enjoying the practical joke.

We will now turn to the more intellectual emotions and faculties, which are very important, as forming the basis for the development of the higher mental powers. Animals manifestly enjoy excitement, and suffer from ennui, as may be seen with dogs, and, according to Rengger, with monkeys. All animals feel Wonder, and many exhibit Curiosity. They sometimes suffer from this latter quality, as when the hunter plays antics and thus attracts them; I have witnessed this with deer, and so it is with the wary chamois, and with some kinds of wild-ducks. Brehm gives a curious account of the instinctive dread, which his monkeys exhibited, for snakes; but their curiosity was so great that they could not desist from occasionally satiating their horror in a most human fashion, by lifting up the lid of the box in which the snakes were kept. I was so much surprised at this account, that I took a stuffed and coiled-up snake into the monkey-house at the Zoological Gardens, and the excitement thus caused was one of the most curious spectacles which I ever beheld. Three species of *Cercopithecus* were the most alarmed; they dashed about their cages, and uttered sharp signal cries of danger, which were understood by the other monkeys. A few young monkeys and one old Anubis baboon alone took no notice of the snake. I then placed the stuffed specimen on the ground in one of the larger compartments. After a time all the monkeys collected round it in a large circle, and staring intently, presented a most ludicrous appearance. They became extremely nervous; so that when a wooden ball, with which they were familiar as a plaything, was accidentally moved in the straw, under which it was partly hidden, they all instantly started away. These monkeys behaved very differently when a dead fish, a mouse,[168] a living turtle, and other new objects were placed in their cages; for though at first frightened, they soon approached, handled and examined them. I then placed a live snake in a paper bag, with the mouth loosely closed, in one of the larger compartments. One of the monkeys immediately approached, cautiously opened the bag a little, peeped in, and instantly dashed away. Then I witnessed what Brehm has described, for monkey after monkey, with head raised high and turned on one side, could not resist taking a momentary peep into the upright bag, at the dreadful object lying quietly at the bottom. It would almost appear as if monkeys had some notion of zoological affinities, for those kept by Brehm exhibited a strange, though mistaken, instinctive dread of innocent lizards and frogs. An orang, also, has been known to be much alarmed at the first sight of a turtle.[169]

The principle of Imitation is strong in man, and especially, as I have myself observed, with savages. In certain morbid states of the brain this tendency is exaggerated to an extraordinary degree: some hemiplegic patients and others, at the commencement of inflammatory softening of the brain, unconsciously imitate every word which is uttered, whether in their own or in a foreign language, and every gesture or action which is performed near them.[170] Desor[171] has remarked that no animal voluntarily imitates an action performed by man, until in the ascending scale we come to monkeys, which are well known to be ridiculous mockers. Animals, however, sometimes imitate each other's actions: thus two species of wolves, which had been reared by dogs, learned to bark, as does sometimes the jackal,[172] but whether this can be called voluntary imitation is another question. Birds imitate the songs of their parents, and sometimes of other birds; and parrots are notorious imitators of any sound which they often hear. Dureau de la Malle gives an account[173] of a dog reared by a cat, who learnt to imitate the well-known action of a cat licking her paws, and thus

washing her ears and face; this was also witnessed by the celebrated naturalist Audouin. I have received several confirmatory accounts; in one of these, a dog had not been suckled by a cat, but had been brought up with one, together with kittens, and had thus acquired the above habit, which he ever afterwards practised during his life of thirteen years. Dureau de la Malle's dog likewise learnt from the kittens to play with a ball by rolling it about with his fore paws, and springing on it. A correspondent assures me that a cat in his house used to put her paws into jugs of milk having too narrow a mouth for her head. A kitten of this cat soon learned the same trick, and practised it ever afterwards, whenever there was an opportunity.

The parents of many animals, trusting to the principle of imitation in their young, and more especially to their instinctive or inherited tendencies, may be said to educate them. We see this when a cat brings a live mouse to her kittens; and Dureau de la Malle has given a curious account (in the paper above quoted) of his observations on hawks which taught their young dexterity, as well as judgment of distances, by first dropping through the air dead mice and sparrows, which the young generally failed to catch, and then bringing them live birds and letting them loose.

Hardly any faculty is more important for the intellectual progress of man than Attention. Animals clearly manifest this power, as when a cat watches by a hole and prepares to spring on its prey. Wild animals sometimes become so absorbed when thus engaged, that they may be easily approached. Mr. Bartlett has given me a curious proof how variable this faculty is in monkeys. A man who trains monkeys to act in plays, used to purchase common kinds from the Zoological Society at the price of five pounds for each; but he offered to give double the price, if he might keep three or four of them for a few days, in order to select one. When asked how he could possibly learn so soon, whether a particular monkey would turn out a good actor, he answered that it all depended on their power of attention. If when he was talking and explaining anything to a monkey, its attention was easily distracted, as by a fly on the wall or other trifling object, the case was hopeless. If he tried by punishment to make an inattentive monkey act, it turned sulky. On the other hand, a monkey which carefully attended to him could always be trained.

It is almost superfluous to state that animals have excellent Memories for persons and places. A baboon at the Cape of Good Hope, as I have been informed by Sir Andrew Smith, recognised him with joy after an absence of nine months. I had a dog who was savage and averse to all strangers, and I purposely tried his memory after an absence of five years and two days. I went near the stable where he lived, and shouted to him in my old manner; he shewed no joy, but instantly followed me out walking, and obeyed me, exactly as if I had parted with him only half an hour before. A train of old associations, dormant during five years, had thus been instantaneously awakened in his mind. Even ants, as P. Huber[174] has clearly shewn, recognised their fellow-ants belonging to the same community after a separation of four months. Animals can certainly by some means judge of the intervals of time between recurrent events.

The Imagination is one of the highest prerogatives of man. By this faculty he unites former images and ideas, independently of the will, and thus creates brilliant and novel results. A poet, as Jean Paul Richter remarks,[175] "who must reflect whether he shall make a character say yes or no- to the devil with him; he is only a stupid corpse." Dreaming gives us the best notion of this power; as Jean Paul again says, "The dream is an involuntary art of poetry." The value of the products of our imagination depends of course on the number, accuracy, and clearness of our impressions, on our judgment and taste in selecting or rejecting the involuntary combinations, and to a certain extent on our power of voluntarily combining them. As dogs, cats, horses, and probably all the higher animals, even birds[176] have vivid dreams, and this is shewn by their movements and the sounds uttered, we must admit that they possess some power of imagination. There must be something special, which causes dogs to howl in the night, and especially during moonlight, in that remarkable and melancholy manner called baying. All dogs do not do so; and, according to Houzeau,[177] they do not then look at the moon, but at some fixed point near the horizon. Houzeau thinks that their imaginations are disturbed by the vague outlines of the surrounding objects, and conjure up before them fantastic images: if this be so, their feelings may almost be called superstitious.

Of all the faculties of the human mind, it will, I presume, be admitted that Reason stands at the summit. Only a few persons now dispute that animals possess some power of reasoning. Animals may constantly be seen to pause, deliberate, and resolve. It is a significant fact, that the more the habits of any particular animal are studied by a naturalist, the more he attributes to reason and the less to unlearned instincts.[178] In future chapters we shall see that some animals extremely low in

the scale apparently display a certain amount of reason. No doubt it is often difficult to distinguish between the power of reason and that of instinct. For instance. Dr. Hayes, in his work on The Open Polar Sea, repeatedly remarks that his dogs, instead of continuing to draw the sledges in a compact body, diverged and separated when they came to thin ice, so that their weight might be more evenly distributed. This was often the first warning which the travellers received that the ice was becoming thin and dangerous. Now, did the dogs act thus from the experience of each individual, or from the example of the older and wiser dogs, or from an inherited habit, that is from instinct? This instinct, may possibly have arisen since the time, long ago, when dogs were first employed by the natives in drawing their sledges; or the arctic wolves, the parent-stock of the Esquimaux dog, may have acquired an instinct impelling them not to attack their prey in a close pack, when on thin ice.

We can only judge by the circumstances under which actions are performed, whether they are due to instinct, or to reason, or to the mere association of ideas: this latter principle, however, is intimately connected with reason. A curious case has been given by Prof. Mobius,[179] of a pike, separated by a plate of glass from an adjoining aquarium stocked with fish, and who often dashed himself with such violence against the glass in trying to catch the other fishes, that he was sometimes completely stunned. The pike went on thus for three months, but at last learnt caution, and ceased to do so. The plate of glass was then removed, but the pike would not attack these particular fishes, though he would devour others which were afterwards introduced; so strongly was the idea of a violent shock associated in his feeble mind with the attempt on his former neighbours. If a savage, who had never seen a large plate-glass window, were to dash himself even once against it, he would for a long time afterwards associate a shock with a window-frame; but very differently from the pike, he would probably reflect on the nature of the impediment, and be cautious under analogous circumstances. Now with monkeys, as we shall presently see, a painful or merely a disagreeable impression, from an action once performed, is sometimes sufficient to prevent the animal from repeating it. If we attribute this difference between the monkey and the pike solely to the association of ideas being so much stronger and more persistent in the one than the other, though the pike often received much the more severe injury, can we maintain in the case of man that a similar difference implies the possession of a fundamentally different mind?

Houzeau relates[180] that, whilst crossing a wide and arid plain in Texas, his two dogs suffered greatly from thirst, and that between thirty and forty times they rushed down the hollows to search for water. These hollows were not valleys, and there were no trees in them, or any other difference in the vegetation, and as they were absolutely dry there could have been no smell of damp earth. The dogs behaved as if they knew that a dip in the ground offered them the best chance of finding water, and Houzeau has often witnessed the same behaviour in other animals.

I have seen, as I daresay have others, that when a small object is thrown on the ground beyond the reach of one of the elephants in the Zoological Gardens, he blows through his trunk on the ground beyond the object, so that the current reflected on all sides may drive the object within his reach. Again a well-known ethnologist, Mr. Westropp, informs me that he observed in Vienna a bear deliberately making with his paw a current in some water, which was close to the bars of his cage, so as to draw a piece of floating bread within his reach. These actions of the elephant and bear can hardly be attributed to instinct or inherited habit, as they would be of little use to an animal in a state of nature. Now, what is the difference between such actions, when performed by an uncultivated man, and by one of the higher animals?

The savage and the dog have often found water at a low level, and the coincidence under such circumstances has become associated in their minds. A cultivated man would perhaps make some general proposition on the subject; but from all that we know of savages it is extremely doubtful whether they would do so, and a dog certainly would not. But a savage, as well as a dog, would search in the same way, though frequently disappointed; and in both it seems to be equally an act of reason, whether or not any general proposition on the subject is consciously placed before the mind. [181] The same would apply to the elephant and the bear making currents in the air or water. The savage would certainly neither know nor care by what law the desired movements were effected; yet his act would be guided by a rude process of reasoning, as surely as would a philosopher in his longest chain of deductions. There would no doubt be this difference between him and one of the higher animals, that he would take notice of much slighter circumstances and conditions, and would observe any connection between them after much less experience, and this would be of paramount importance. I kept a daily record of the actions of one of my infants, and when he was about eleven months old, and before he could speak a single word, I was continually struck with the greater

quickness, with which all sorts of objects and sounds were associated together in his mind, compared with that of the most intelligent dogs I ever knew. But the higher animals differ in exactly the same way in this power of association from those low in the scale, such as the pike, as well as in that of drawing inferences and of observation.

The promptings of reason, after very short experience, are well shewn by the following actions of American monkeys, which stand low in their order. Rengger, a most careful observer, states that when he first gave eggs to his monkeys in Paraguay, they smashed them, and thus lost much of their contents; afterwards they gently hit one end against some hard body, and picked off the bits of shell with their fingers. After cutting themselves only once with any sharp tool, they would not touch it again, or would handle it with the greatest caution. Lumps of sugar were often given them wrapped up in paper; and Rengger sometimes put a live wasp in the paper, so that in hastily unfolding it they got stung; after this had once happened, they always first held the packet to their ears to detect any movement within.[182]

The following cases relate to dogs. Mr. Colquhoun[183] winged two wildducks, which fell on the further side of a stream; his retriever tried to bring over both at once, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird. Col. Hutchinson relates that two partridges were shot at once, one being killed, the other wounded; the latter ran away, and was caught by the retriever, who on her return came across the dead bird; "she stopped, evidently greatly puzzled, and after one or two trials, finding she could not take it up without permitting the escape of the winged bird, she considered a moment, then deliberately murdered it by giving it a severe crunch, and afterwards brought away both together. This was the only known instance of her ever having wilfully injured any game." Here we have reason though not quite perfect, for the retriever might have brought the wounded bird first and then returned for the dead one, as in the case of the two wild-ducks. I give the above cases, as resting on the evidence of two independent witnesses, and because in both instances the retrievers, after deliberation, broke through a habit which is inherited by them (that of not killing the game retrieved), and because they shew how strong their reasoning faculty must have been to overcome a fixed habit.

I will conclude by quoting a remark by the illustrious Humboldt.[184] "The muleteers in S. America say, 'I will not give you the mule whose step is easiest, but la mas racional,- the one that reasons best'; and, as, he adds, "this popular expression, dictated by long experience, combats the system of animated machines, better perhaps than all the arguments of speculative philosophy." Nevertheless some writers even yet deny that the higher animals possess a trace of reason; and they endeavor to explain away, by what appears to be mere verbiage,[185] all such facts as those above given.

It has, I think, now been shewn that man and the higher animals, especially the primates, have some few instincts in common. All have the same senses, intuitions, and sensations,- similar passions, affections, and emotions, even the more complex ones, such as jealousy, suspicion, emulation, gratitude, and magnanimity; they practise deceit and are revengeful; they are sometimes susceptible to ridicule, and even have a sense of humour; they feel wonder and curiosity; they possess the same faculties of imitation, attention, deliberation, choice, memory, imagination, the association of ideas, and reason, though in very different degrees. The individuals of the same species graduate in intellect from absolute imbecility to high excellence. They are also liable to insanity, though far less often than in the case of man.[186] Nevertheless, many authors have insisted that man is divided by an insuperable barrier from all the lower animals in in [sic -- Classics editor] his mental faculties. I formerly made a collection of above a score of such aphorisms, but they are almost worthless, as their wide difference and number prove the difficulty, if not the impossibility, of the attempt. It has been asserted that man alone is capable of progressive improvement; that he alone makes use of tools or fire, domesticates other animals, or possesses property; that no animal has the power of abstraction, or of forming general concepts, is self-conscious and comprehends itself; that no animal employs language; that man alone has a sense of beauty, is liable to caprice, has the feeling of gratitude, mystery, &c.; believes in God, or is endowed with a conscience. I will hazard a few remarks on the more important and interesting of these points.

Archbishop Sumner formerly maintained[187] that man alone is capable of progressive improvement. That he is capable of incomparably greater and more rapid improvement than is any other animal, admits of no dispute; and this is mainly due to his power of speaking and handing

down his acquired knowledge. With animals, looking first to the individual, every one who has had any experience in setting traps, knows that young animals can be caught much more easily than old ones; and they can be much more easily approached by an enemy. Even with respect to old animals, it is impossible to catch many in the same place and in the same kind of trap, or to destroy them by the same kind of poison; yet it is improbable that all should have partaken of the poison, and impossible that all should have been caught in a trap. They must learn caution by seeing their brethren caught or poisoned. In North America, where the fur-bearing animals have long been pursued, they exhibit, according to the unanimous testimony of all observers, an almost incredible amount of sagacity, caution and cunning; but trapping has been there so long carried on, that inheritance may possibly have come into play. I have received several accounts that when telegraphs are first set up in any district, many birds kill themselves by flying against the wires, but that in the course of a very few years they learn to avoid this danger, by seeing, as it would appear, their comrades killed.[188]

If we look to successive generations, or to the race, there is no doubt that birds and other animals gradually both acquire and lose caution in relation to man or other enemies;[189] and this caution is certainly in chief part an inherited habit or instinct, but in part the result of individual experience. A good observer, Leroy,[190] states, that in districts where foxes are much hunted, the young, on first leaving their burrows, are incontestably much more wary than the old ones in districts where they are not much disturbed.

Our domestic dogs are descended from wolves and jackals,[191] and though they may not have gained in cunning, and may have lost in wariness and suspicion, yet they have progressed in certain moral qualities, such as in affection, trust-worthiness, temper, and probably in general intelligence. The common rat has conquered and beaten several other species throughout Europe, in parts of North America, New Zealand, and recently in Formosa, as well as on the mainland of China. Mr. Swinhoe,[192] who describes these two latter cases, attributes the victory of the common rat over the large *Mus coninga* to its superior cunning; and this latter quality may probably be attributed to the habitual exercise of all its faculties in avoiding extirpation by man, as well as to nearly all the less cunning or weak-minded rats having been continuously destroyed by him. It is, however, possible that the success of the common rat may be due to its having possessed greater cunning than its fellow-species, before it became associated with man. To maintain, independently of any direct evidence, that no animal during the course of ages has progressed in intellect or other mental faculties, is to beg the question of the evolution of species. We have seen that, according to Lartet, existing mammals belonging to several orders have larger brains than their ancient tertiary prototypes.

It has often been said that no animal uses any tool; but the chimpanzee in a state of nature cracks a native fruit, somewhat like a walnut, with a stone.[193] Rengger[194] easily taught an American monkey thus to break open hard palm-nuts; and afterwards of its own accord, it used stones to open other kinds of nuts, as well as boxes. It thus also removed the soft rind of fruit that had a disagreeable flavour. Another monkey was taught to open the lid of a large box with a stick, and afterwards it used the stick as a lever to move heavy bodies; and I have myself seen a young orang put a stick into a crevice, slip his hand to the other end, and use it in the proper manner as a lever. The tamed elephants in India are well known to break off branches of trees and use them to drive away the flies; and this same act has been observed in an elephant in a state of nature.[195] I have seen a young orang, when she thought she was going to be whipped, cover and protect herself with a blanket or straw. In these several cases stones and sticks were employed as implements; but they are likewise used as weapons. Brehm[196] states, on the authority of the well-known traveller Schimper, that in Abyssinia when the baboons belonging to one species (*C. gelada*) descend in troops from the mountains to plunder the fields, they sometimes encounter troops of another species (*C. hamadryas*), and then a fight ensues. The *Geladas* roll down great stones, which the *Hamadryas* try to avoid, and then both species, making a great uproar, rush furiously against each other. Brehm, when accompanying the Duke of Coburg-Gotha, aided in an attack with fire-arms on a troop of baboons in the pass of Mensa in Abyssinia. The baboons in return rolled so many stones down the mountain, some as large as a man's head, that the attackers had to beat a hasty retreat; and the pass was actually closed for a time against the caravan. It deserves notice that these baboons thus acted in concert. Mr. Wallace[197] on three occasions saw female orangs, accompanied by their young, "breaking off branches and the great spiny fruit of the Durian tree, with every appearance of rage; causing such a shower of missiles as effectually kept us from approaching too near the tree." As I have repeatedly seen, a chimpanzee will throw any object at

hand at a person who offends him; and the before-mentioned baboon at the Cape of Good Hope prepared mud for the purpose.

In the Zoological Gardens, a monkey, which had weak teeth, used to break open nuts with a stone; and I was assured by the keepers that after using the stone, he hid it in the straw, and would not let any other monkey touch it. Here, then, we have the idea of property; but this idea is common to every dog with a bone, and to most or all birds with their nests.

The Duke of Argyll[198] remarks, that the fashioning of an implement for a special purpose is absolutely peculiar to man; and he considers that this forms an immeasurable gulf between him and the brutes. This is no doubt a very important distinction; but there appears to me much truth in Sir J. Lubbock's suggestion,[199] that when primeval man first used flint-stones for any purpose, he would have accidentally splintered them, and would then have used the sharp fragments. From this step it would be a small one to break the flints on purpose, and not a very wide step to fashion them rudely. This latter advance, however, may have taken long ages, if we may judge by the immense interval of time which elapsed before the men of the neolithic period took to grinding and polishing their stone tools. In breaking the flints, as Sir J. Lubbock likewise remarks, sparks would have been emitted, and in grinding them heat would have been evolved: thus the two usual methods of "obtaining fire may have originated." The nature of fire would have been known in the many volcanic regions where lava occasionally flows through forests. The anthropomorphous apes, guided probably by instinct, build for themselves temporary platforms; but as many instincts are largely controlled by reason, the simpler ones, such as this of building a platform, might readily pass into a voluntary and conscious act. The orang is known to cover itself at night with the leaves of the pandanus; and Brehm states that one of his baboons used to protect itself from the heat of the sun by throwing a straw-mat over its head. In these several habits, we probably see the first steps towards some of the simpler arts, such as rude architecture and dress, as they arose amongst the early progenitors of man.

Abstraction, General Conceptions, Self-consciousness, Mental Individuality. It would be very difficult for any one with even much more knowledge than I possess, to determine how far animals exhibit any traces of these high mental powers. This difficulty arises from the impossibility of judging what passes through the mind of an animal; and again, the fact that writers differ to a great extent in the meaning which they attribute to the above terms, causes a further difficulty. If one may judge from various articles which have been published lately, the greatest stress seems to be laid on the supposed entire absence in animals of the power of abstraction, or of forming general concepts. But when a dog sees another dog at a distance, it is often clear that he perceives that it is a dog in the abstract; for when he gets nearer his whole manner suddenly changes if the other dog be a friend. A recent writer remarks, that in all such cases it is a pure assumption to assert that the mental act is not essentially of the same nature in the animal as in man. If either refers what he perceives with his senses to a mental concept, then so do both.[200] When I say to my terrier, in an eager voice (and I have made the trial many times), "Hi, hi, where is it?" she at once takes it as a sign that something is to be hunted, and generally first looks quickly all around, and then rushes into the nearest thicket, to scent for any game, but finding nothing, she looks up into any neighbouring tree for a squirrel. Now do not these actions clearly shew that she had in her mind a general idea or concept that some animal is to be discovered and hunted?

It may be freely admitted that no animal is self-conscious, if by this term it is implied, that he reflects on such points, as whence he comes or whither he will go, or what is life and death, and so forth. But how can we feel sure that an old dog with an excellent memory and some power of imagination, as shewn by his dreams, never reflects on his past pleasures or pains in the chase? And this would be a form of self-consciousness. On the other hand, as Buchner[201] has remarked, how little can the hard worked wife of a degraded Australian savage, who uses very few abstract words, and cannot count above four, exert her selfconsciousness, or reflect on the nature of her own existence. It is generally admitted, that the higher animals possess memory, attention, association, and even some imagination and reason. If these powers, which differ much in different animals, are capable of improvement, there seems no great improbability in more complex faculties, such as the higher forms of abstraction, and self-consciousness, &c., having been evolved through the development and combination of the simpler ones. It has been urged against the views here maintained that it is impossible to say at what point in the ascending scale animals become capable of abstraction, &c.; but who can say at what age this occurs in our young children? We see at least that such powers are developed in children by imperceptible degrees.

That animals retain their mental individuality is unquestionable. When my voice awakened a train of old associations in the mind of the before-mentioned dog, he must have retained his mental individuality, although every atom of his brain had probably undergone change more than once during the interval of five years. This dog might have brought forward the argument lately advanced to crush all evolutionists, and said, "I abide amid all mental moods and all material changes.... The teaching that atoms leave their impressions as legacies to other atoms falling into the places they have vacated is contradictory of the utterance of consciousness, and is therefore false; but it is the teaching necessitated by evolutionism, consequently the hypothesis is a false one." [202]

Language.- This faculty has justly been considered as one of the chief distinctions between man and the lower animals. But man, as a highly competent judge, Archbishop Whately remarks, "is not the only animal that can make use of language to express what is passing in his mind, and can understand, more or less, what is so expressed by another." [203] In Paraguay the *Cebus azarae* when excited utters at least six distinct sounds, which excite in other monkeys similar emotions. [204] The movements of the features and gestures of monkeys are understood by us, and they partly understand ours, as Rengger and others declare. It is a more remarkable fact that the dog, since being domesticated, has learnt to bark [205] in at least four or five distinct tones. Although barking is a new art, no doubt the wild parent-species of the dog expressed their feelings by cries of various kinds. With the domesticated dog we have the bark of eagerness, as in the chase; that of anger, as well as growling; the yelp or howl of despair, as when shut up; the baying at night; the bark of joy, as when starting on a walk with his master; and the very distinct one of demand or supplication, as when wishing for a door or window to be opened. According to Houzeau, who paid particular attention to the subject, the domestic fowl utters at least a dozen significant sounds. [206]

The habitual use of articulate language is, however, peculiar to man; but he uses, in common with the lower animals, inarticulate cries to express his meaning, aided by gestures and the movements of the muscles of the face. [207] This especially holds good with the more simple and vivid feelings, which are but little connected with our higher intelligence. Our cries of pain, fear, surprise, anger, together with their appropriate actions, and the murmur of a mother to her beloved child are more expressive than any words. That which distinguishes man from the lower animals is not the understanding of articulate sounds, for, as every one knows, dogs understand many words and sentences. In this respect they are at the same stage of development as infants, between the ages of ten and twelve months, who understand many words and short sentences, but cannot yet utter a single word. It is not the mere articulation which is our distinguishing character, for parrots and other birds possess this power. Nor is it the mere capacity of connecting definite sounds with definite ideas; for it is certain that some parrots, which have been taught to speak, connect unerringly words with things, and persons with events. [208] The lower animals differ from man solely in his almost infinitely larger power of associating together the most diversified sounds and ideas; and this obviously depends on the high development of his mental powers.

As Horne Tooke, one of the founders of the noble science of philology, observes, language is an art, like brewing or baking; but writing would have been a better simile. It certainly is not a true instinct, for every language has to be learnt. It differs, however, widely from all ordinary arts, for man has an instinctive tendency to speak, as we see in the babble of our young children; whilst no child has an instinctive tendency to brew, bake, or write. Moreover, no philologist now supposes that any language has been deliberately invented; it has been slowly and unconsciously developed by many steps. [209] The sounds uttered by birds offer in several respects the nearest analogy to language, for all the members of the same species utter the same instinctive cries expressive of their emotions; and all the kinds which sing, exert their power instinctively; but the actual song, and even the call-notes, are learnt from their parents or foster-parents. These sounds, as Daines Barrington [210] has proved, "are no more innate than language is in man." The first attempts to sing "may be compared to the imperfect endeavour in a child to babble." The young males continue practising, or as the bird-catchers say, "recording," for ten or eleven months. Their first essays show hardly a rudiment of the future song; but as they grow older we can perceive what they are aiming at; and at last they are said "to sing their song round." Nestlings which have learnt the song of a distinct species, as with the canary-birds educated in the Tyrol, teach and transmit their new song to their offspring. The slight natural differences of song in the same species inhabiting different districts may be appositely compared, as Barrington remarks, "to provincial dialects"; and the songs of allied, though distinct species may be compared with the languages of distinct races of man. I have given the foregoing details to shew that an instinctive tendency to acquire an art is not peculiar to man.

With respect to the origin of articulate language, after having read on the one side the highly interesting works of Mr. Hensleigh Wedgwood, the Rev. F. Farrar, and Prof. Schleicher,[211] and the celebrated lectures of Prof. Max Muller on the other side, I cannot doubt that language owes its origin to the imitation and modification of various natural sounds, the voices of other animals, and man's own instinctive cries, aided by signs and gestures. When we treat of sexual selection we shall see that primeval man, or rather some early progenitor of man, probably first used his voice in producing true musical cadences, that is in singing, as do some of the gibbon-apes at the present day; and we may conclude from a widelyspread analogy, that this power would have been especially exerted during the courtship of the sexes,- would have expressed various emotions, such as love, jealousy, triumph,- and would have served as a challenge to rivals. It is, therefore, probable that the imitation of musical cries by articulate sounds may have given rise to words expressive of various complex emotions. The strong tendency in our nearest allies, the monkeys, in microcephalous idiots,[212] and in the barbarous races of mankind, to imitate whatever they hear deserves notice, as bearing on the subject of imitation. Since monkeys certainly understand much that is said to them by man, and when wild, utter signal-cries of danger to their fellows;[213] and since fowls give distinct warnings for danger on the ground, or in the sky from hawks (both, as well as a third cry, intelligible to dogs),[214] may not some unusually wise apelike animal have imitated the growl of a beast of prey, and thus told his fellow-monkeys the nature of the expected danger? This would have been a first step in the formation of a language.

As the voice was used more and more, the vocal organs would have been strengthened and perfected through the principle of the inherited effects of use; and this would have reacted on the power of speech. But the relation between the continued use of language and the development of the brain, has no doubt been far more important. The mental powers in some early progenitor of man must have been more highly developed than in any existing ape, before even the most imperfect form of speech could have come into use; but we may confidently believe that the continued use and advancement of this power would have reacted on the mind itself, by enabling and encouraging it to carry on long trains of thought. A complex train of thought can no more be carried on without the aid of words, whether spoken or silent, than a long calculation without the use of figures or algebra. It appears, also, that even an ordinary train of thought almost requires, or is greatly facilitated by some form of language, for the dumb, deaf, and blind girl, Laura Bridgman, was observed to use her fingers whilst dreaming.[215] Nevertheless, a long succession of vivid and connected ideas may pass through the mind without the aid of any form of language, as we may infer from the movements of dogs during their dreams. We have, also, seen that animals are able to reason to a certain extent, manifestly without the aid of language. The intimate connection between the brain, as it is now developed in us, and the faculty of speech, is well shewn by those curious cases of brain-disease in which speech is specially affected, as when the power to remember substantives is lost, whilst other words can be correctly used, or where substantives of a certain class, or all except the initial letters of substantives and proper names are forgotten.[216] There is no more improbability in the continued use of the mental and vocal organs leading to inherited changes in their structure and functions, than in the case of hand-writing, which depends partly on the form of the hand and partly on the disposition of the mind; and handwriting is certainly inherited. [217]

Several writers, more especially Prof. Max Muller,[218] have lately insisted that the use of language implies the power of forming general concepts; and that as no animals are supposed to possess this power, an impassable barrier is formed between them and man.[219] With respect to animals, I have already endeavoured to shew that they have this power, at least in a rude and incipient degree. As far as concerns infants of from ten to eleven months old, and deaf-mutes, it seems to me incredible, that they should be able to connect certain sounds with certain general ideas as quickly as they do, unless such ideas were already formed in their minds. The same remark may be extended to the more intelligent animals; as Mr. Leslie Stephen observes,[220] "A dog frames a general concept of cats or sheep, and knows the corresponding words as well as a philosopher. And the capacity to understand is as good a proof of vocal intelligence, though in an inferior degree, as the capacity to speak."

Why the organs now used for speech should have been originally perfected for this purpose, rather than any other organs, it is not difficult to see. Ants have considerable powers of inter-communication by means of their antennae, as shewn by Huber, who devotes a whole chapter to their language. We might have used our fingers as efficient instruments, for a person with practice

can report to a deaf man every word of a speech rapidly delivered at a public meeting; but the loss of our hands, whilst thus employed, would have been a serious inconvenience. As all the higher mammals possess vocal organs, constructed on the same general plan as ours, and used as a means of communication, it was obviously probable that these same organs would be still further developed if the power of communication had to be improved; and this has been effected by the aid of adjoining and well adapted parts, namely the tongue and lips.[221] The fact of the higher apes not using their vocal organs for speech, no doubt depends on their intelligence not having been sufficiently advanced. The possession by them of organs, which with long-continued practice might have been used for speech, although not thus used, is paralleled by the case of many birds which possess organs fitted for singing, though they never sing. Thus, the nightingale and crow have vocal organs similarly constructed, these being used by the former for diversified song, and by the latter only for croaking.[222] If it be asked why apes have not had their intellects developed to the same degree as that of man, general causes only can be assigned in answer, and it is unreasonable to expect any thing more definite, considering our ignorance with respect to the successive stages of development through which each creature has passed.

The formation of different languages and of distinct species, and the proofs that both have been developed through a gradual process, are curiously parallel.[223] But we can trace the formation of many words further back than that of species, for we can perceive how they actually arose from the imitation of various sounds. We find in distinct languages striking homologies due to community of descent, and analogies due to a similar process of formation. The manner in which certain letters or sounds change when others change is very like correlated growth. We have in both cases the re-duplication of parts, the effects of long-continued use, and so forth. The frequent presence of rudiments, both in languages and in species, is still more remarkable. The letter m in the word am, means I; so that in the expression I am, a superfluous and useless rudiment has been retained. In the spelling also of words, letters often remain as the rudiments of ancient forms of pronunciation. Languages, like organic beings, can be classed in groups under groups; and they can be classed either naturally according to descent, or artificially by other characters. Dominant languages and dialects spread widely, and lead to the gradual extinction of other tongues. A language, like a species, when once extinct, never, as Sir C. Lyell remarks, reappears. The same language never has two birth-places. Distinct languages may be crossed or blended together.[224] We see variability in every tongue, and new words are continually cropping up; but as there is a limit to the powers of the memory, single words, like whole languages, gradually become extinct. As Max Muller[225] has well remarked:- "A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue." To these more important causes of the survival of certain words, mere novelty and fashion may be added; for there is in the mind of man a strong love for slight changes in all things. The survival or preservation of certain favoured words in the struggle for existence is natural selection.

The perfectly regular and wonderfully complex construction of the languages of many barbarous nations has often been advanced as a proof, either of the divine origin of these languages, or of the high art and former civilisation of their founders. Thus F. von Schlegel writes: "In those languages which appear to be at the lowest grade of intellectual culture, we frequently observe a very high and elaborate degree of art in their grammatical structure. This is especially the case with the Basque and the Lapponian, and many of the American languages." [226]

But it is assuredly an error to speak of any language as an art, in the sense of its having been elaborately and methodically formed. Philologists now admit that conjugations, declensions, &c., originally existed as distinct words, since joined together; and as such words express the most obvious relations between objects and persons, it is not surprising that they should have been used by the men of most races during the earliest ages. With respect to perfection, the following illustration will best shew how easily we may err: a crinoid sometimes consists of no less than 150,000 pieces of shell,[227] all arranged with perfect symmetry in radiating lines; but a naturalist does not consider an animal of this kind as more perfect than a bilateral one with comparatively few parts, and with none of these parts alike, excepting on the opposite sides of the body. He justly considers the differentiation and specialisation of organs as the test of perfection. So with languages: the most symmetrical and complex ought not to be ranked above irregular, abbreviated, and bastardised languages, which have borrowed expressive words and useful forms of construction from various conquering, conquered, or immigrant races.

From these few and imperfect remarks I conclude that the extremely complex and regular construction of many barbarous languages, is no proof that they owe their origin to a special act of creation.[228] Nor, as we have seen, does the faculty of articulate speech in itself offer any insuperable objection to the belief that man has been developed from some lower form.

Sense of Beauty.- This sense has been declared to be peculiar to man. I refer here only to the pleasure given by certain colours, forms, and sounds, and which may fairly be called a sense of the beautiful; with cultivated men such sensations are, however, intimately associated with complex ideas and trains of thought. When we behold a male bird elaborately displaying his graceful plumes or splendid colours before the female, whilst other birds, not thus decorated, make no such display, it is impossible to doubt that she admires the beauty of her male partner. As women everywhere deck themselves with these plumes, the beauty of such ornaments cannot be disputed. As we shall see later, the nests of hummingbirds, and the playing passages of bower-birds are tastefully ornamented with gaily-coloured objects; and this shews that they must receive some kind of pleasure from the sight of such things. With the great majority of animals, however, the taste for the beautiful is confined, as far as we can judge, to the attractions of the opposite sex. The sweet strains poured forth by many male birds during the season of love, are certainly admired by the females, of which fact evidence will hereafter be given. If female birds had been incapable of appreciating the beautiful colours, the ornaments, and voices of their male partners, all the labour and anxiety exhibited by the latter in displaying their charms before the females would have been thrown away; and this it is impossible to admit. Why certain bright colours should excite pleasure cannot, I presume, be explained, any more than why certain flavours and scents are agreeable; but habit has something to do with the result, for that which is at first unpleasant to our senses, ultimately becomes pleasant, and habits are inherited. With respect to sounds, Helmholtz has explained to a certain extent on physiological principles, why harmonies and certain cadences are agreeable. But besides this, sounds frequently recurring at irregular intervals are highly disagreeable, as every one will admit who has listened at night to the irregular flapping of a rope on board ship. The same principle seems to come into play with vision, as the eye prefers symmetry or figures with some regular recurrence. Patterns of this kind are employed by even the lowest savages as ornaments; and they have been developed through sexual selection for the adornment of some male animals. Whether we can or not give any reason for the pleasure thus derived from vision and hearing, yet man and many of the lower animals are alike pleased by the same colours, graceful shading and forms, and the same sounds.

The taste for the beautiful, at least as far as female beauty is concerned, is not of a special nature in the human mind; for it differs widely in the different races of man, and is not quite the same even in the different nations of the same race. Judging from the hideous ornaments, and the equally hideous music admired by most savages, it might be urged that their Aesthetic faculty was not so highly developed as in certain animals, for instance, as in birds. Obviously no animal would be capable of admiring such scenes as the heavens at night, a beautiful landscape, or refined music; but such high tastes are acquired through culture, and depend on complex associations; they are not enjoyed by barbarians or by uneducated persons.

Many of the faculties, which have been of inestimable service to man for his progressive advancement, such as the powers of the imagination, wonder, curiosity, an undefined sense of beauty, a tendency to imitation, and the love of excitement or novelty, could hardly fail to lead to capricious changes of customs and fashions. I have alluded to this point, because a recent writer [229] has oddly fixed on Caprice "as one of the most remarkable and typical differences between savages and brutes." But not only can we partially understand how it is that man is from various conflicting influences rendered capricious, but that the lower animals are, as we shall hereafter see, likewise capricious in their affections, aversions, and sense of beauty. There is also reason to suspect that they love novelty, for its own sake.

Belief in God- Religion.- There is no evidence that man was aboriginally endowed with the ennobling belief in the existence of an Omnipotent God. On the contrary there is ample evidence, derived not from hasty travellers, but from men who have long resided with savages, that numerous races have existed, and still exist, who have no idea of one or more gods, and who have no words in their languages to express such an idea.[230] The question is of course wholly distinct from that higher one, whether there exists a Creator and Ruler of the universe; and this has been answered in the affirmative by some of the highest intellects that have ever existed.

If, however, we include under the term "religion" the belief in unseen or spiritual agencies the case is wholly different; for this belief seems to be universal with the less civilised races. Nor is it difficult to comprehend how it arose. As soon as the important faculties of the imagination, wonder, and curiosity, together with some power of reasoning, had become partially developed, man would naturally crave to understand what was passing around him, and would have vaguely speculated on his own existence. As Mr. M'Lennan[231] has remarked, "Some explanation of the phenomena of life, a man must feign for himself, and to judge from the universality of it, the simplest hypothesis, and the first to occur to men, seems to have been that natural phenomena are ascribable to the presence in animals, plants, and things, and in the forces of nature, of such spirits prompting to action as men are conscious they themselves possess." It is also probable, as Mr. Tylor has shewn, that dreams may have first given rise to the notion of spirits; for savages do not readily distinguish between subjective and objective impressions. When a savage dreams, the figures which appear before him are believed to have come from a distance, and to stand over him; or "the soul of the dreamer goes out on its travels, and comes home with a remembrance of what it has seen." [232] But until the faculties of imagination, curiosity, reason, &c., had been fairly well developed in the mind of man, his dreams would not have led him to believe in spirits, any more than in the case of a dog.

The tendency in savages to imagine that natural objects and agencies are animated by spiritual or living essences, is perhaps illustrated by a little fact which I once noticed: my dog, a full-grown and very sensible animal, was lying on the lawn during a hot and still day; but at a little distance a slight breeze occasionally moved an open parasol, which would have been wholly disregarded by the dog, had any one stood near it. As it was, every time that the parasol slightly moved, the dog growled fiercely and barked. He must, I think, have reasoned to himself in a rapid and unconscious manner, that movement without any apparent cause indicated the presence of some strange living agent, and that no stranger had a right to be on his territory.

The belief in spiritual agencies would easily pass into the belief in the existence of one or more gods. For savages would naturally attribute to spirits the same passions, the same love of vengeance or simplest form of justice, and the same affections which they themselves feel. The Fuegians appear to be in this respect in an intermediate condition, for when the surgeon on board the Beagle shot some young ducklings as specimens, York Minster declared in the most solemn manner, "Oh, Mr. Bynoe, much rain, much snow, blow much"; and this was evidently a retributive punishment for wasting human food. So again he related how, when his brother killed a "wild man," storms long raged, much rain and snow fell. Yet we could never discover that the Fuegians believed in what we should call a God, or practised any religious rites; and Jemmy Button, with justifiable pride, stoutly maintained that there was no devil in his land. This latter assertion is the more remarkable, as with savages the belief in bad spirits is far more common than that in good ones.

The feeling of religious devotion is a highly complex one, consisting of love, complete submission to an exalted and mysterious superior, a strong sense of dependence, [233] fear, reverence, gratitude, hope for the future, and perhaps other elements. No being could experience so complex an emotion until advanced in his intellectual and moral faculties to at least a moderately high level. Nevertheless, we see some distant approach to this state of mind in the deep love of a dog for his master, associated with complete submission, some fear, and perhaps other feelings. The behaviour of a dog when returning to his master after an absence, and, as I may add, of a monkey to his beloved keeper, is widely different from that towards their fellows. In the latter case the transports of joy appear to be somewhat less, and the sense of equality is shewn in every action. Professor Braubach goes so far as to maintain that a dog looks on his master as on a god. [234]

The same high mental faculties which first led man to believe in unseen spiritual agencies, then in fetishism, polytheism, and ultimately in monotheism, would infallibly lead him, as long as his reasoning powers remained poorly developed, to various strange superstitions and customs. Many of these are terrible to think of- such as the sacrifice of human beings to a blood-loving god; the trial of innocent persons by the ordeal of poison or fire; witchcraft, &c.- yet it is well occasionally to reflect on these superstitions, for they shew us what an infinite debt of gratitude we owe to the improvement of our reason, to science, and to our accumulated knowledge. As Sir J. Lubbock [235] has well observed, "it is not too much to say that the horrible dread of unknown evil hangs like a thick cloud over savage life, and embitters every pleasure." These miserable and indirect consequences of our highest faculties may be compared with the incidental and occasional mistakes of the instincts of the lower animals.

(go on to chapter 4)

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Footnotes

[157] See the evidence on those points, as given by Lubbock, *Prehistoric Times*, p. 354, &c.

[158] "L'Instinct chez les insectes," *Revue des Deux Mondes*, Feb., 1870, p. 690

[159] *The American Beaver and His Works*, 1868.

[160] *The Principles of Psychology*, 2nd ed., 1870, pp. 418-443.

[161] *Contributions to the Theory of Natural Selection*, 1870, p. 212

[162] For the evidence on this head, see Mr. J. Traherne Moggridge's most interesting work, *Harvesting Ants and Trap-Door Spiders*, 1873, pp. 126, 128.

[163] *Recherches sur les Moeurs des Fourmis*, 1810, p. 173.

[164] All the following statements, given on the authority of these two naturalists, are taken from Rengger's *Naturgesch. der Saugethiere von Paraguay*, 1830, ss. 41-57, and from Brehm's *Thierleben*, B. i., ss. 10-87.

[165] Quoted by Dr. Lauder Lindsay, in his "Physiology of Mind in the Lower Animals," *Journal of Mental Science*, April, 1871, p. 38.

[166] *Bridgewater Treatise*, p. 263

[167] A critic, without any grounds (*Quarterly Review*, July, 1871, p. 72), disputes the possibility of this act as described by Brehm, for the sake of discrediting my work. Therefore I tried, and found that I could readily seize with my own teeth the sharp little claws of a kitten nearly five weeks old.

[168] I have given a short account of their behaviour on this occasion in my *Expression of the Emotions in Man and Animals*, p. 43

[169] W. C. L. Martin, *Natural History of Mammalia*, 1841, p. 405.

[170] Dr. Bateman, *On Aphasia*, 1870, p. 110

[171] Quoted by Vogt, *Memoire sur les Microcephales*, 1867, p. 168

[172] *The Variation of Animals and Plants under Domestication*, vol. i., p. 27

[173] *Annales des Sciences Nat.*, (1st series), tom, xxii., p. 397.

[174] *Les Moeurs des Fourmis*, 1810, p. 150.

[175] Quoted in Dr. Maudsley's *Physiology and Pathology of Mind*, 1868, pp. 19, 220

[176] Dr. Jerdon, *Birds of India*, vol. i., 1862, p. xxi. Houzeau says that his parakeets and canary-birds dreamt: *Etudes sur les Facultes Mentales des Animaux*, tom. ii., p. 136

[177] *ibid.*, 1872, tom. ii., p. 181.

[178] Mr. L. H. Morgan's work on *The American Beaver*, 1868, offers a good illustration of this remark. I cannot help thinking, however, that he goes too far in undertaking the power of instinct.

[179] *Die Bewegungen der Thiere*, &c., 1873, p. 11.

[180] Etudes sur les Facultes Mentales des Animaux, 1872, tom. ii., p. 265.

[181] Prof. Huxley has analysed with admirable clearness the mental steps by which a man, as well as a dog, arrives at a conclusion in a case analogous to that given in my text. See his article, "Mr. Darwin's Critics," in the Contemporary Review, Nov., 1871, p. 462, and in his Critiques and Essays, 1873, p. 279.

[182] Mr. Belt, in his most interesting work, The Naturalist in Nicaragua, 1874, p. 119, likewise describes various actions of a tamed Cebus, which, I think, clearly shew that this animal possessed some reasoning power.

[183] The Moor and the Loch, p. 45. Col. Hutchinson on Dog Breaking, 1850, p. 46.

[184] Personal Narrative, Eng. transl., vol. iii., p. 106

[185] I am glad to find that so acute a reasoner as Mr. Leslie Stephen ("Darwinism and Divinity," Essays on Free Thinking, 1873, p. 80), in speaking of the supposed impassable barrier between the minds of man and the lower animals, says, "The distinctions, indeed, which have been drawn, seem to us to rest upon no better foundation than a great many other metaphysical distinctions; that is, the assumption that because you can give two things different names, they must therefore have different natures. It is difficult to understand how anybody who has ever kept a dog, or seen an elephant, can have any doubt as to an animal's power of performing the essential processes of reasoning."

[186] See "Madness in Animals," by Dr. W. Lauder Lindsay, in Journal of Mental Science, July, 1871.

[187] Quoted by Sir C. Lyell, Antiquity of Man, p. 497

[188] For additional evidence, with details, see M. Houzeau, Etudes sur les Facultes Mentales des Animaux, tom. ii., 1872, p. 147.

[189] See, with respect to birds on oceanic islands, my Journal of Researches during the Voyage of the "Beagle," 1845, p. 398. Also, Origin of Species.(OOS

[190] Lettres Phil. sur l'Intelligence des Animaux, nouvelle edit., 1802, p. 86.

[191] See the evidence on this head in chap. i., vol. i., On the Variation of Animals and Plants under Domestication

[192] Proceedings Zoological Society, 1864, p. 186.

[193] Savage and Wyman in Boston Journal of Natural History, vol. iv., 1843-44, p. 383

[194] Saugethiere von Paraguay, 1830, ss. 51-56

[195] The Indian Field, March 4, 1871

[196] Illustriertes Thierleben, B. i., s. 79, 82

[197] The Malay Archipelago, vol. i., 1869, p. 87.

[198] Primeval Man, 1869, pp. 145, 147

[199] Prehistoric Times, 1865, p. 473, &c.

[200] Mr. Hookham, in a letter to Prof. Max Muller, in the Birmingham News, May, 1873.

[201] Conferences sur la Theorie Darwinienne, French transl., 1869, p. 132.

[202] The Rev. Dr. J. M'Cann, *Anti-Darwinism*, 1869, p. 13.

[203] Quoted in *Anthropological Review*, 1864, p. 158

[204] Rengger, *ibid.*, s. 45

[205] See my *Variation of Animals and Plants under Domestication*, vol. i., p. 27

[206] *Facultes Mentales des Animaux*, tom. ii., 1872, p. 346-349.

[207] See a discussion on this subject in Mr. E. B. Tylor's very interesting work, *Researches into the Early History of Mankind*, 1865, chaps. ii. to iv

[208] I have received several detailed accounts to this effect. Admiral Sir. B. J. Sullivan, whom I know to be a careful observer, assures me that an African parrot, long kept in his father's house, invariably called certain persons of the household, as well as visitors, by their names. He said "good morning" to every one at breakfast, and "good night" to each as they left the room at night, and never reversed these salutations. To Sir B. J. Sullivan's father, he used to add to the "good morning" a short sentence, which was never once repeated after his father's death. He scolded violently a strange dog which came into the room through the open window; and he scolded another parrot (saying "you naughty polly") which had got out of its cage, and was eating apples on the kitchen table. See also, to the same effect, Houzeau on parrots, *Facultes Mentales*, tom. ii., p. 309. Dr. A. Moschkau informs me that he knew a starling which never made a mistake in saying in German "good morning" to persons arriving, and "good bye, old fellow," to those departing. I could add several other such cases.

[209] See some good remarks on this head by Prof. Whitney, in his *Oriental and Linguistic Studies*, 1873, p. 354. He observes that the desire of communication between man is the living force, which, in the development of language, "works both consciously and unconsciously; consciously as regards the immediate end to be attained; unconsciously as regards the further consequences of the act.

[210] Hon. Daines Barrington in *Philosoph. Transactions*, 1773, p. 262. See also Dureau de la Malle, in *Ann. des. Sc. Nat.*, 3rd series, *Zoolog.*, tom. x., p. 119.

[211] *On the Origin of Language*, by H. Wedgwood, 1866. *Chapters on Language*, by the Rev. F. W. Farrar, 1865. These works are most interesting. See also *De la Phys. et de Parole*, par Albert Lemoine, 1865, p. 190. The work on this subject, by the late Prof. Aug. Schleicher, has been translated by Dr. Bickers into English, under the title of *Darwinism tested by the Science of Language*, 1869

[212] Vogt, *Memoire sur les Microcephales*, 1867, p. 169. With respect to savages, I have given some facts in my *Journal of Researches*, &c., 1845, p. 206

[213] See clear evidence on this head in the two works so often quoted, by Brehm and Rengger

[214] Houzeau gives a very curious account of his observations on this subject in his *Facultes Mentales des Animaux*, tom. ii., p. 348.

[215] See remarks on this head by Dr. Maudsley, *The Physiology and Pathology of Mind*, 2nd ed., 1868, p. 199

[216] Many curious cases have been recorded. See, for instance, Dr. Bateman *On Aphasia*, 1870, pp. 27, 31, 53, 100, &c. Also, *Inquiries Concerning the Intellectual Powers*, by Dr. Abercrombie, 1838, p. 150

[217] *The Variation of Animals and Plants under Domestication*, vol. ii., p. 6.

[218] *Lectures on Mr. Darwin's Philosophy of Language*, 1873

[219] The judgment of a distinguished philologist, such as Prof. Whitney, will have far more weight

on this point than anything that I can say. He remarks (*Oriental and Linguistic Studies*, 1873, p. 297), in speaking of Bleek's views: "Because on the grand scale language is the necessary auxiliary of thought, indispensable to the development of the power of thinking, to the distinctness and variety and complexity of cognitions, to the full mastery of consciousness; therefore he would fain make thought absolutely impossible without speech, identifying the faculty with its instrument. He might just as reasonably assert that the human hand cannot act without a tool. With such a doctrine to start from, he cannot stop short of Max Muller's worst paradoxes, that an infant (in fact, not speaking) is not a human being, and that deaf-mutes do not become possessed of reason until they learn to twist their fingers into imitation of spoken words." Max Muller gives in italics (*Lectures on Mr. Darwin's Philosophy of Language*, 1873, third lecture) this aphorism: "There is no thought without words, as little as there are words without thought." What a strange definition must here be given to the word thought

[220] *Essays on Free Thinking, &c.*, 1873, p. 82.

[221] See some good remarks to this effect by Dr. Maudsley, *The Physiology and Pathology of Mind*, 1868, p. 199

[222] Macgillivray, *Hist. of British Birds*, vol. ii., 1839, p. 29. An excellent observer, Mr. Blackwall remarks that the magpie learns to pronounce single words, and even short sentences, more readily than almost any other British bird; yet, as he adds, after long and closely investigating its habits, he has never known it, in a state of nature, display any unusual capacity for imitation. *Researches in Zoology*, 1834, p. 158.

[223] See the very interesting parallelism between the development of species and languages, given by Sir C. Lyell in *The Geological Evidences of the Antiquity of Man*, 1863, chap. xxiii

[224] See remarks to this effect by the Rev. F. W. Farrar, in an interesting article, entitled *Philology and Darwinism*," in *Nature*, March 24, 1870, p. 528

[225] *Nature*, January 6, 1870, p. 257.

[226] Quoted by C. S. Wake, *Chapters on Man*, 1868, p. 101

[227] Buckland, *Bridgewater Treatise*, p. 411.

[228] See some good remarks on the simplification of languages, by Sir J. Lubbock, *Origin of Civilisation*, 1870, p. 278.

[229] *The Spectator*, Dec. 4. 1869, p. 1430.

[230] See an excellent article on this subject by the Rev. F. W. Farrar, in the *Anthropological Review*, Aug., 1864, p. cccvii. For further facts see Sir J. Lubbock, *Prehistoric Times*, 2nd ed., 1869, p. 564; and especially the chapters on Religion in his *Origin of Civilisation*, 1870.

[231] "The Worship of Animals and Plants," in the *Fortnightly Review*, Oct. 1, 1869, p. 422

[232] Tylor, *Early History of Mankind*, 1865, p. 6. See also the three striking chapters on the "Development of Religion," in Lubbock's *Origin of Civilisation*, 1870. In a like manner Mr. Herbert Spencer, in his ingenious essay in the *Fortnightly Review* (May 1, 1870, p. 535), accounts for the earliest forms of religious belief throughout the world, by man being led through dreams, shadows, and other causes, to look at himself as a double essence, corporeal and spiritual. As the spiritual being is supposed to exist after death and to be powerful, it is propitiated by various gifts and ceremonies, and its aid invoked. He then further shews that names or nicknames given from some animal or other object, to the early progenitors or founders of a tribe, are supposed after a long interval to represent the real progenitor of the tribe; and such animal or object is then naturally believed still to exist as a spirit, is held sacred, and worshipped as a god. Nevertheless I cannot but suspect that there is a still earlier and ruder stage, when anything which manifests power or movement is thought to be endowed with some form of life, and with mental faculties analogous to our own.

[233] See an able article on the "Physical Elements of Religion," by Mr. L. Owen Pike, in *Anthropological Review*, April, 1870, p. lxiii

[234] *Religion, Moral, &c., der Darwin'schen Art-Lehre*, 1869, s. 53. It is said (Dr. W. Lauder Lindsay, *Journal of Mental Science*, 1871, p. 43), that Bacon long ago, and the poet Burns, held the same notion.

[235] *Prehistoric Times*, 2nd ed., p. 571. In this work (p. 571) there will be found an excellent account of the many strange and capricious customs of savages.

Chapter IV

COMPARISON OF THE MENTAL POWERS OF MAN AND THE LOWER ANIMALS (Continued).

I fully subscribe to the judgment of those writers[236] who maintain that of all the differences between man and the lower animals, the moral sense or conscience is by far the most important. This sense, as Mackintosh[237] remarks, "has a rightful supremacy over every other principle of human action"; it is summed up in that short but imperious word ought, so full of high significance. It is the most noble of all the attributes of man, leading him without a moment's hesitation to risk his life for that of a fellow-creature; or after due deliberation, impelled simply by the deep feeling of right or duty, to sacrifice it in some great cause. Immanuel Kant exclaims, "Duty! Wondrous thought, that worst neither by fond insinuation, flattery, nor by any threat, but merely by holding up thy naked law in the soul, and so extorting for thyself always reverence, if not always obedience; before whom all appetites are dumb, however secretly they rebel; whence thy original?"[238]

This great question has been discussed by many writers[239] of consummate ability; and my sole excuse for touching on it, is the impossibility of here passing it over; and because, as far as I know, no one has approached it exclusively from the side of natural history. The investigation possesses, also, some independent interest, as an attempt to see how far the study of the lower animals throws light on one of the highest psychical faculties of man. The following proposition seems to me in a high degree probable- namely, that any animal whatever, endowed with well-marked social instincts, [240] the parental and filial affections being here included, would inevitably acquire a moral sense or conscience, as soon as its intellectual powers had become as well, or nearly as well developed, as in man. For, firstly, the social instincts lead an animal to take pleasure in the society of its fellows, to feel a certain amount of sympathy with them, and to perform various services for them. The services may be of a definite and evidently instinctive nature; or there may be only a wish and readiness, as with most of the higher social animals, to aid their fellows in certain general ways. But these feelings and services are by no means extended to all the individuals of the same species, only to those of the same association. Secondly, as soon as the mental faculties had become highly developed, images of all past actions and motives would be incessantly passing through the brain of each individual: and that feeling of dissatisfaction, or even misery, which invariably results, as we shall hereafter see, from any unsatisfied instinct, would arise, as often as it was perceived that the enduring and always present social instinct had yielded to some other instinct, at the time stronger, but neither enduring in its nature, nor leaving behind it a very vivid impression. It is clear that many instinctive desires, such as that of hunger, are in their nature of short duration; and after being satisfied, are not readily or vividly recalled. Thirdly, after the power of language had been acquired, and the wishes of the community could be expressed, the common opinion how each member ought to act for the public good, would naturally become in a paramount degree the guide to action. But it should be borne in mind that however great weight we may attribute to public opinion, our regard for the approbation and disapprobation of our fellows depends on sympathy, which, as we shall see, forms an essential part of the social instinct, and is indeed its foundation-stone. Lastly, habit in the individual would ultimately play a very important part in guiding the conduct of each member; for the social instinct, together with sympathy, is, like any other instinct, greatly strengthened by habit, and so consequently would be obedience to the wishes and judgment of the community. These several subordinate propositions must now be discussed, and some of them at considerable length.

It may be well first to premise that I do not wish to maintain that any strictly social animal, if its intellectual faculties were to become as active and as highly developed as in man, would acquire

exactly the same moral sense as ours. In the same manner as various animals have some sense of beauty, though they admire widely-different objects, so they might have a sense of right and wrong, though led by it to follow widely different lines of conduct. If, for instance, to take an extreme case, men were reared under precisely the same conditions as hive-bees, there can hardly be a doubt that our unmarried females would, like the workerbees, think it a sacred duty to kill their brothers, and mothers would strive to kill their fertile daughters; and no one would think of interfering.[241] Nevertheless, the bee, or any other social animal, would gain in our supposed case, as it appears to me, some feeling of right or wrong, or a conscience. For each individual would have an inward sense of possessing certain stronger or more enduring instincts, and others less strong or enduring; so that there would often be a struggle as to which impulse should be followed; and satisfaction, dissatisfaction, or even misery would be felt, as past impressions were compared during their incessant passage through the mind. In this case an inward monitor would tell the animal that it would have been better to have followed the one impulse rather than the other. The one course ought to have been followed, and the other ought not; the one would have been right and the other wrong; but to these terms I shall recur.

Mr. H. Sidgwick remarks, in an able discussion on this subject (the Academy, June 15, 1872, p. 231), "A superior bee, we may feel sure, would aspire to a milder solution of the popular question." Judging, however, from the habits of many or most savages, man solves the problem by female infanticide, polyandry and promiscuous intercourse; therefore it may well be doubted whether it would be by a milder method. Miss Cobbe, in commenting ("Darwinism in Morals," Theological Review, April, 1872, pp. 188-191) on the same illustration, says, the principles of social duty would be thus reversed; and by this, I presume, she means that the fulfillment of a social duty would tend to the injury of individuals; but she overlooks the fact, which she would doubtless admit, that the instincts of the bee have been acquired for the good of the community. She goes so far as to say that if the theory of ethics advocated in this chapter were ever generally accepted, "I cannot but believe that in the hour of their triumph would be sounded the knell of the virtue of mankind!" It is to be hoped that the belief in the permanence of virtue on this earth is not held by many persons on so weak a tenure.

Sociability.- Animals of many kinds are social; we find even distinct species living together; for example, some American monkeys; and united flocks of rooks, jackdaws, and starlings. Man shews the same feeling in his strong love for the dog, which the dog returns with interest. Every one must have noticed how miserable horses, dogs, sheep, &c., are when separated from their companions, and what strong mutual affection the two former kinds, at least, shew on their reunion. It is curious to speculate on the feelings of a dog, who will rest peacefully for hours in a room with his master or any of the family, without the least notice being taken of him; but if left for a short time by himself, barks or howls dismally. We will confine our attention to the higher social animals; and pass over insects, although some of these are social, and aid one another in many important ways. The most common mutual service in the higher animals is to warn one another of danger by means of the united senses of all. Every sportsman knows, as Dr. Jaeger remarks,[242] how difficult it is to approach animals in a herd or troop. Wild horses and cattle do not, I believe, make any danger-signal; but the attitude of any one of them who first discovers an enemy, warns the others. Rabbits stamp loudly on the ground with their hindfeet as a signal: sheep and chamois do the same with their forefeet, uttering likewise a whistle. Many birds, and some mammals, post sentinels, which in the case of seals are said[243] generally to be the females. The leader of a troop of monkeys acts as the sentinel, and utters cries expressive both of danger and of safety.[244] Social animals perform many little services for each other: horses nibble, and cows lick each other, on any spot which itches: monkeys search each other for external parasites; and Brehm states that after a troop of the *Cercopithecus griseoviridis* has rushed through a thorny brake, each monkey stretches itself on a branch, and another monkey sitting by, "conscientiously" examines its fur, and extracts every thorn or burr.

Animals also render more important services to one another: thus wolves and some other beasts of prey hunt in packs, and aid one another in attacking their victims. Pelicans fish in concert. The Hamadryas baboons turn over stones to find insects, &c.; and when they come to a large one, as many as can stand round, turn it over together and share the booty. Social animals mutually defend each other. Bull bison in N. America, when there is danger, drive the cows and calves into the middle of the herd, whilst they defend the outside. I shall also in a future chapter give an account of two young wild bulls at Chillingham attacking an old one in concert, and of two stallions together trying to drive away a third stallion from a troop of mares. In Abyssinia, Brehm encountered a great

troop of baboons who were crossing a valley; some had already ascended the opposite mountain, and some were still in the valley; the latter were attacked by the dogs, but the old males immediately hurried down from the rocks, and with mouths widely opened, roared so fearfully, that the dogs quickly drew back. They were again encouraged to the attack; but by this time all the baboons had reascended the heights, excepting a young one, about six months old, who, loudly calling for aid, climbed on a block of rock, and was surrounded. Now one of the largest males, a true hero, came down again from the mountain, slowly went to the young one, coaxed him, and triumphantly led him away- the dogs being too much astonished to make an attack. I cannot resist giving another scene which was witnessed by this same naturalist; an eagle seized a young *Cercopithecus*, which, by clinging to a branch, was not at once carried off; it cried loudly for assistance, upon which the other members of the troop, with much uproar, rushed to the rescue, surrounded the eagle, and pulled out so many feathers, that he no longer thought of his prey, but only how to escape. This eagle, as Brehm remarks, assuredly would never again attack a single monkey of a troop.[245]

It is certain that associated animals have a feeling of love for each other, which is not felt by non-social adult animals. How far in most cases they actually sympathise in the pains and pleasures of others, is more doubtful, especially with respect to pleasures. Mr. Buxton, however, who had excellent means of observation,[246] states that his macaws, which lived free in Norfolk, took "an extravagant interest" in a pair with a nest; and whenever the female left it, she was surrounded by a troop "screaming horrible acclamations in her honour." It is often difficult to judge whether animals have any feeling for the sufferings of others of their kind. Who can say what cows feel, when they surround and stare intently on a dying or dead companion; apparently, however, as Houzeau remarks, they feel no pity. That animals sometimes are far from feeling any sympathy is too certain; for they will expel a wounded animal from the herd, or gore or worry it to death. This is almost the blackest fact in natural history, unless, indeed, the explanation which has been suggested is true, that their instinct or reason leads them to expel an injured companion, lest beasts of prey, including man, should be tempted to follow the troop. In this case their conduct is not much worse than that of the North American Indians, who leave their feeble comrades to perish on the plains; or the Fijians, who, when their parents get old, or fall ill, bury them alive.[247]

Many animals, however, certainly sympathise with each other's distress or danger. This is the case even with birds. Captain Stansbury[248] found on a salt lake in Utah an old and completely blind pelican, which was very fat, and must have been well fed for a long time by his companions. Mr. Blyth, as he informs me, saw Indian crows feeding two or three of their companions which were blind; and I have heard of an analogous case with the domestic cock. We may, if we choose, call these actions instinctive; but such cases are much too rare for the development of any special instinct.[249] I have myself seen a dog, who never passed a cat who lay sick in a basket, and was a great friend of his, without giving her a few licks with his tongue, the surest sign of kind feeling in a dog.

It must be called sympathy that leads a courageous dog to fly at any one who strikes his master, as he certainly will. I saw a person pretending to beat a lady, who had a very timid little dog on her lap, and the trial had never been made before; the little creature instantly jumped away, but after the pretended beating was over, it was really pathetic to see how perseveringly he tried to lick his mistress's face, and comfort her. Brehm[250] states that when a baboon in confinement was pursued to be punished, the others tried to protect him. It must have been sympathy in the cases above given which led the baboons and *Cercopithecus* to defend their young comrades from the dogs and the eagle. I will give only one other instance of sympathetic and heroic conduct, in the case of a little American monkey. Several years ago a keeper at the Zoological Gardens showed me some deep and scarcely healed wounds on the nape of his own neck, inflicted on him, whilst kneeling on the floor, by a fierce baboon. The little American monkey, who was a warm friend of this keeper, lived in the same compartment, and was dreadfully afraid of the great baboon. Nevertheless, as soon as he saw his friend in peril, he rushed to the rescue, and by screams and bites so distracted the baboon that the man was able to escape, after, as the surgeon thought, running great risk of his life.

Besides love and sympathy, animals exhibit other qualities connected with the social instincts, which in us would be called moral; and I agree with Agassiz[251] that dogs possess something very like a conscience. Dogs possess some power of self-command, and this does not appear to be wholly the result of fear. As Braubach[252] remarks, they will refrain from stealing food in the absence of their master. They have long been accepted as the very type of fidelity and obedience. But the elephant

is likewise very faithful to his driver or keeper, and probably considers him as the leader of the herd. Dr. Hooker informs me that an elephant, which he was riding in India, became so deeply bogged that he remained stuck fast until the next day, when he was extricated by men with ropes. Under such circumstances elephants will seize with their trunks any object, dead or alive, to place under their knees, to prevent their sinking deeper in the mud; and the driver was dreadfully afraid lest the animal should have seized Dr. Hooker and crushed him to death. But the driver himself, as Dr. Hooker was assured, ran no risk. This forbearance under an emergency so dreadful for a heavy animal, is a wonderful proof of noble fidelity.[253]

All animals living in a body, which defend themselves or attack their enemies in concert, must indeed be in some degree faithful to one another; and those that follow a leader must be in some degree obedient. When the baboons in Abyssinia[254] plunder a garden, they silently follow their leader; and if an imprudent young animal makes a noise, he receives a slap from the others to teach him silence and obedience. Mr. Galton, who has had excellent opportunities for observing the half-wild cattle in S. Africa, says,[255] that they cannot endure even a momentary separation from the herd. They are essentially slavish, and accept the common determination, seeking no better lot than to be led by any one ox who has enough self-reliance to accept the position. The men who break in these animals for harness, watch assiduously for those who, by grazing apart, shew a self-reliant disposition, and these they train as fore-oxen. Mr. Galton adds that such animals are rare and valuable; and if many were born they would soon be eliminated, as lions are always on the look-out for the individuals which wander from the herd.

With respect to the impulse which leads certain animals to associate together, and to aid one another in many ways, we may infer that in most cases they are impelled by the same sense of satisfaction or pleasure which they experience in performing other instinctive actions; or by the same sense of dissatisfaction as when other instinctive actions are checked. We see this in innumerable instances, and it is illustrated in a striking manner by the acquired instincts of our domesticated animals; thus a young shepherd-dog delights in driving and running round a flock of sheep, but not in worrying them; a young fox-hound delights in hunting a fox, whilst some other kinds of dogs, as I have witnessed, utterly disregard foxes. What a strong feeling of inward satisfaction must impel a bird, so full of activity, to brood day after day over her eggs. Migratory birds are quite miserable if stopped from migrating; perhaps they enjoy starting on their long flight; but it is hard to believe that the poor pinioned goose, described by Audubon, which started on foot at the proper time for its journey of probably more than a thousand miles, could have felt any joy in doing so. Some instincts are determined solely by painful feelings, as by fear, which leads to self-preservation, and is in some cases directed towards special enemies. No one, I presume, can analyse the sensations of pleasure or pain. In many instances, however, it is probable that instincts are persistently followed from the mere force of inheritance, without the stimulus of either pleasure or pain. A young pointer, when it first scents game, apparently cannot help pointing. A squirrel in a cage who pats the nuts which it cannot eat, as if to bury them in the ground, can hardly be thought to act thus, either from pleasure or pain. Hence the common assumption that men must be impelled to every action by experiencing some pleasure or pain may be erroneous. Although a habit may be blindly and implicitly followed, independently of any pleasure or pain felt at the moment, yet if it be forcibly and abruptly checked, a vague sense of dissatisfaction is generally experienced.

It has often been assumed that animals were in the first place rendered social, and that they feel as a consequence uncomfortable when separated from each other, and comfortable whilst together; but it is a more probable view that these sensations were first developed, in order that those animals which would profit by living in society, should be induced to live together, in the same manner as the sense of hunger and the pleasure of eating were, no doubt, first acquired in order to induce animals to eat. The feeling of pleasure from society is probably an extension of the parental or filial affections, since the social instinct seems to be developed by the young remaining for a long time with their parents; and this extension may be attributed in part to habit, but chiefly to natural selection. With those animals which were benefited by living in close association, the individuals which took the greatest pleasure in society would best escape various dangers, whilst those that cared least for their comrades, and lived solitary, would perish in greater numbers. With respect to the origin of the parental and filial affections, which apparently lie at the base of the social instincts, we know not the steps by which they have been gained; but we may infer that it has been to a large extent through natural selection. So it has almost certainly been with the unusual and opposite feeling of hatred between the nearest relations, as with the worker-bees which kill their brother drones, and with the queen-bees which kill their daughterqueens; the desire to destroy their nearest

relations having been in this case of service to the community. Parental affection, or some feeling which replaces it, has been developed in certain animals extremely low in the scale, for example, in star-fishes and spiders. It is also occasionally present in a few members alone in a whole group of animals, as in the genus *Forficula*, or earwigs.

The all-important emotion of sympathy is distinct from that of love. A mother may passionately love her sleeping and passive infant, but she can hardly at such times be said to feel sympathy for it. The love of a man for his dog is distinct from sympathy, and so is that of a dog for his master. Adam Smith formerly argued, as has Mr. Bain recently, that the basis of sympathy lies in our strong retentiveness of former states of pain or pleasure. Hence, "the sight of another person enduring hunger, cold, fatigue, revives in us some recollection of these states, which are painful even in idea." We are thus impelled to relieve the sufferings of another, in order that our own painful feelings may be at the same time relieved. In like manner we are led to participate in the pleasures of others. [256] But I cannot see how this view explains the fact that sympathy is excited, in an immeasurably stronger degree, by a beloved, than by an indifferent person. The mere sight of suffering, independently of love, would suffice to call up in us vivid recollections and associations. The explanation may lie in the fact that, with all animals, sympathy is directed solely towards the members of the same community, and therefore towards known, and more or less beloved members, but not to all the individuals of the same species. This fact is not more surprising than that the fears of many animals should be directed against special enemies. Species which are not social, such as lions and tigers, no doubt feel sympathy for the suffering of their own young, but not for that of any other animal. With mankind, selfishness, experience, and imitation, probably add, as Mr. Bain has shown, to the power of sympathy; for we are led by the hope of receiving good in return to perform acts of sympathetic kindness to others; and sympathy is much strengthened by habit. In however complex a manner this feeling may have originated, as it is one of high importance to all those animals which aid and defend one another, it will have been increased through natural selection; for those communities, which included the greatest number of the most sympathetic members, would flourish best, and rear the greatest number of offspring.

It is, however, impossible to decide in many cases whether certain social instincts have been acquired through natural selection, or are the indirect result of other instincts and faculties, such as sympathy, reason, experience, and a tendency to imitation; or again, whether they are simply the result of long-continued habit. So remarkable an instinct as the placing sentinels to warn the community of danger, can hardly have been the indirect result of any of these faculties; it must, therefore, have been directly acquired. On the other hand, the habit followed by the males of some social animals of defending the community, and of attacking their enemies or their prey in concert, may perhaps have originated from mutual sympathy; but courage, and in most cases strength, must have been previously acquired, probably through natural selection.

Of the various instincts and habits, some are much stronger than others; that is, some either give more pleasure in their performance, and more distress in their prevention, than others; or, which is probably quite as important, they are, through inheritance, more persistently followed, without exciting any special feeling of pleasure or pain. We are ourselves conscious that some habits are much more difficult to cure or change than others. Hence a struggle may often be observed in animals between different instincts, or between an instinct and some habitual disposition; as when a dog rushes after a hare, is rebuked, pauses, hesitates, pursues again, or returns ashamed to his master; or as between the love of a female dog for her young puppies and for her master, - for she may be seen to slink away to them, as if half ashamed of not accompanying her master. But the most curious instance known to me of one instinct getting the better of another, is the migratory instinct conquering the maternal instinct. The former is wonderfully strong; a confined bird will at the proper season beat her breast against the wires of her cage, until it is bare and bloody. It causes young salmon to leap out of the fresh water, in which they could continue to exist, and thus unintentionally to commit suicide. Every one knows how strong the maternal instinct is, leading even timid birds to face great danger, though with hesitation, and in opposition to the instinct of self-preservation. Nevertheless, the migratory instinct is so powerful, that late in the autumn swallows, house-martins, and swifts frequently desert their tender young, leaving them to perish miserably in their nests. [257]

We can perceive that an instinctive impulse, if it be in any way more beneficial to a species than some other or opposed instinct, would be rendered the more potent of the two through natural selection; for the individuals which had it most strongly developed would survive in larger numbers.

Whether this is the case with the migratory in comparison with the maternal instinct, may be doubted. The great persistence, or steady action of the former at certain seasons of the year during the whole day, may give it for a time paramount force.

Man a social animal.- Every one will admit that man is a social being. We see this in his dislike of solitude, and in his wish for society beyond that of his own family. Solitary confinement is one of the severest punishments which can be inflicted. Some authors suppose that man primevally lived in single families; but at the present day, though single families, or only two or three together, roam the solitudes of some savage lands, they always, as far as I can discover, hold friendly relations with other families inhabiting the same district. Such families occasionally meet in council, and unite for their common defence. It is no argument against savage man being a social animal, that the tribes inhabiting adjacent districts are almost always at war with each other; for the social instincts never extend to all the individuals of the same species. Judging from the analogy of the majority of the Quadrumana, it is probable that the early ape-like progenitors of man were likewise social; but this is not of much importance for us. Although man, as he now exists, has few special instincts, having lost any which his early progenitors may have possessed, this is no reason why he should not have retained from an extremely remote period some degree of instinctive love and sympathy for his fellows. We are indeed all conscious that we do possess such sympathetic feelings;[258] but our consciousness does not tell us whether they are instinctive, having originated long ago in the same manner as with the lower animals, or whether they have been acquired by each of us during our early years. As man is a social animal, it is almost certain that he would inherit a tendency to be faithful to his comrades, and obedient to the leader of his tribe; for these qualities are common to most social animals. He would consequently possess some capacity for self-command. He would from an inherited tendency be willing to defend, in concert with others, his fellow-men; and would be ready to aid them in any way, which did not too greatly interfere with his own welfare or his own strong desires.

The social animals which stand at the bottom of the scale are guided almost exclusively, and those which stand higher in the scale are largely guided, by special instincts in the aid which they give to the members of the same community; but they are likewise in part impelled by mutual love and sympathy, assisted apparently by some amount of reason. Although man, as just remarked, has no special instincts to tell him how to aid his fellow-men, he still has the impulse, and with his improved intellectual faculties would naturally be much guided in this respect by reason and experience. Instinctive sympathy would also cause him to value highly the approbation of his fellows; for, as Mr. Bain has clearly shewn,[259] the love of praise and the strong feeling of glory, and the still stronger horror of scorn and infamy, "are due to the workings of sympathy." Consequently man would be influenced in the highest degree by the wishes, approbation, and blame of his fellow-men, as expressed by their gestures and language. Thus the social instincts, which must have been acquired by man in a very rude state, and probably even by his early ape-like progenitors, still give the impulse to some of his best actions; but his actions are in a higher degree determined by the expressed wishes and judgment of his fellow-men, and unfortunately very often by his own strong selfish desires. But as love, sympathy and self-command become strengthened by habit, and as the power of reasoning becomes clearer, so that man can value justly the judgments of his fellows, he will feel himself impelled, apart from any transitory pleasure or pain, to certain lines of conduct. He might then declare- not that any barbarian or uncultivated man could thus think- I am the supreme judge of my own conduct, and in the words of Kant, I will not in my own person violate the dignity of humanity.

The more enduring Social Instincts conquer the less persistent Instincts.- We have not, however, as yet considered the main point, on which, from our present point of view, the whole question of the moral sense turns. Why should a man feel that he ought to obey one instinctive desire rather than another? Why is he bitterly regretful, if he has yielded to a strong sense of self-preservation, and has not risked his life to save that of a fellow-creature? Or why does he regret having stolen food from hunger?

It is evident in the first place, that with mankind the instinctive impulses have different degrees of strength; a savage will risk his own life to save that of a member of the same community, but will be wholly indifferent about a stranger: a young and timid mother urged by the maternal instinct will, without a moment's hesitation, run the greatest danger for her own infant, but not for a mere fellow creature. Nevertheless many a civilized man, or even boy, who never before risked his life for another, but full of courage and sympathy, has disregarded the instinct of self-preservation, and

plunged at once into a torrent to save a drowning man, though a stranger. In this case man is impelled by the same instinctive motive, which made the heroic little American monkey, formerly described, save his keeper, by attacking the great and dreaded baboon. Such actions as the above appear to be the simple result of the greater strength of the social or maternal instincts rather than that of any other instinct or motive; for they are performed too instantaneously for reflection, or for pleasure or pain to be felt at the time; though, if prevented by any cause, distress or even misery might be felt. In a timid man, on the other hand, the instinct of self-preservation, might be so strong, that he would be unable to force himself to run any such risk, perhaps not even for his own child.

I am aware that some persons maintain that actions performed impulsively, as in the above cases, do not come under the dominion of the moral sense, and cannot be called moral. They confine this term to actions done deliberately, after a victory over opposing desires, or when prompted by some exalted motive. But it appears scarcely possible to draw any clear line of distinction of this kind.[260] As far as exalted motives are concerned, many instances have been recorded of savages, destitute of any feeling of general benevolence towards mankind, and not guided by any religious motive, who have deliberately sacrificed their lives as prisoners,[261] rather than betray their comrades; and surely their conduct ought to be considered as moral. As far as deliberation, and the victory over opposing motives are concerned, animals may be seen doubting between opposed instincts, in rescuing their offspring or comrades from danger; yet their actions, though done for the good of others, are not called moral. Moreover, anything performed very often by us, will at last be done without deliberation or hesitation, and can then hardly be distinguished from an instinct; yet surely no one will pretend that such an action ceases to be moral. On the contrary, we all feel that an act cannot be considered as perfect, or as performed in the most noble manner, unless it be done impulsively, without deliberation or effort, in the same manner as by a man in whom the requisite qualities are innate. He who is forced to overcome his fear or want of sympathy before he acts, deserves, however, in one way higher credit than the man whose innate disposition leads him to a good act without effort. As we cannot distinguish between motives, we rank all actions of a certain class as moral, if performed by a moral being. A moral being is one who is capable of comparing his past and future actions or motives, and of approving or disapproving of them. We have no reason to suppose that any of the lower animals have this capacity; therefore, when a Newfoundland dog drags a child out of the water, or a monkey faces danger to rescue its comrade, or takes charge of an orphan monkey, we do not call its conduct moral. But in the case of man, who alone can with certainty be ranked as a moral being, actions of a certain class are called moral, whether performed deliberately, after a struggle with opposing motives, or impulsively through instinct, or from the effects of slowly-gained habit.

But to return to our more immediate subject. Although some instincts are more powerful than others, and thus lead to corresponding actions, yet it is untenable, that in man the social instincts (including the love of praise and fear of blame) possess greater strength, or have, through long habit, acquired greater strength than the instincts of self-preservation, hunger, lust, vengeance, &c. Why then does man regret, even though trying to banish such regret, that he has followed the one natural impulse rather than the other; and why does he further feel that he ought to regret his conduct? Man in this respect differs profoundly from the lower animals. Nevertheless we can, I think, see with some degree of clearness the reason of this difference.

Man, from the activity of his mental faculties, cannot avoid reflection: past impressions and images are incessantly and clearly passing through his mind. Now with those animals which live permanently in a body, the social instincts are ever present and persistent. Such animals are always ready to utter the danger-signal, to defend the community, and to give aid to their fellows in accordance with their habits; they feel at all times, without the stimulus of any special passion or desire, some degree of love and sympathy for them; they are unhappy if long separated from them, and always happy to be again in their company. So it is with ourselves. Even when we are quite alone, how often do we think with pleasure or pain of what others think of us,- of their imagined approbation or disapprobation; and this all follows from sympathy, a fundamental element of the social instincts. A man who possessed no trace of such instincts would be an unnatural monster. On the other hand, the desire to satisfy hunger, or any passion such as vengeance, is in its nature temporary, and can for a time be fully satisfied. Nor is it easy, perhaps hardly possible, to call up with complete vividness the feeling, for instance, of hunger; nor indeed, as has often been remarked, of any suffering. The instinct of self-preservation is not felt except in the presence of danger; and many a coward has thought himself brave until he has met his enemy face to face. The wish for another man's property is perhaps as persistent a desire as any that can be named; but

even in this case the satisfaction of actual possession is generally a weaker feeling than the desire: many a thief, if not an habitual one, after success has wondered why he stole some article. [262]

A man cannot prevent past impressions often repassing through his mind; he will thus be driven to make a comparison between the impressions of past hunger, vengeance satisfied, or danger shunned at other men's cost, with the almost ever-present instinct of sympathy, and with his early knowledge of what others consider as praiseworthy or blameable. This knowledge cannot be banished from his mind, and from instinctive sympathy is esteemed of great moment. He will then feel as if he had been balked in following a present instinct or habit, and this with all animals causes dissatisfaction, or even misery.

The above case of the swallow affords an illustration, though of a reversed nature, of a temporary though for the time strongly persistent instinct conquering another instinct, which is usually dominant over all others. At the proper season these birds seem all day long to be impressed with the desire to migrate; their habits change; they become restless, are noisy and congregate in flocks. Whilst the mother-bird is feeding, or brooding over her nestlings, the maternal instinct is probably stronger than the migratory; but the instinct which is the more persistent gains the victory, and at last, at a moment when her young ones are not in sight, she takes flight and deserts them. When arrived at the end of her long journey, and the migratory instinct has ceased to act, what an agony of remorse the bird would feel, if, from being endowed with great mental activity, she could not prevent the image constantly passing through her mind, of her young ones perishing in the bleak north from cold and hunger.

At the moment of action, man will no doubt be apt to follow the stronger impulse; and though this may occasionally prompt him to the noblest deeds, it will more commonly lead him to gratify his own desires at the expense of other men. But after their gratification when past and weaker impressions are judged by the ever-enduring social instinct, and by his deep regard for the good opinion of his fellows, retribution will surely come. He will then feel remorse, repentance, regret, or shame; this latter feeling, however, relates almost exclusively to the judgment of others. He will consequently resolve more or less firmly to act differently for the future; and this is conscience; for conscience looks backwards, and serves as a guide for the future.

The nature and strength of the feelings which we call regret, shame, repentance or remorse, depend apparently not only on the strength of the violated instinct, but partly on the strength of the temptation, and often still more on the judgment of our fellows. How far each man values the appreciation of others, depends on the strength of his innate or acquired feeling of sympathy; and on his own capacity for reasoning out the remote consequences of his acts. Another element is most important, although not necessary, the reverence or fear of the Gods, or Spirits believed in by each man: and this applies especially in cases of remorse. Several critics have objected that though some slight regret or repentance may be explained by the view advocated in this chapter, it is impossible thus to account for the soul-shaking feeling of remorse. But I can see little force in this objection. My critics do not define what they mean by remorse, and I can find no definition implying more than an overwhelming sense of repentance. Remorse seems to bear the same relation to repentance, as rage does to anger, or agony to pain. It is far from strange that an instinct so strong and so generally admired, as maternal love, should, if disobeyed, lead to the deepest misery, as soon as the impression of the past cause of disobedience is weakened. Even when an action is opposed to no special instinct, merely to know that our friends and equals despise us for it is enough to cause great misery. Who can doubt that the refusal to fight a duel through fear has caused many men an agony of shame? Many a Hindoo, it is said, has been stirred to the bottom of his soul by having partaken of unclean food. Here is another case of what must, I think, be called remorse. Dr. Landor acted as a magistrate in West Australia, and relates[263] that a native on his farm, after losing one of his wives from disease, came and said that, "He was going to a distant tribe to spear a woman, to satisfy his sense of duty to his wife. I told him that if he did so, I would send him to prison for life. He remained about the farm for some months, but got exceedingly thin, and complained that he could not rest or eat, that his wife's spirit was haunting him, because he had not taken a life for hers. I was inexorable, and assured him that nothing should save him if he did." Nevertheless the man disappeared for more than a year, and then returned in high condition; and his other wife told Dr. Landor that her husband had taken the life of a woman belonging to a distant tribe; but it was impossible to obtain legal evidence of the act. The breach of a rule held sacred by the tribe, will thus, as it seems, give rise to the deepest feelings, and this quite apart from the social instincts, excepting in so far as the rule is grounded on the judgment of the community. How so

many strange superstitions have arisen throughout the world we know not; nor can we tell how some real and great crimes, such as incest, have come to be held in an abhorrence (which is not however quite universal) by the lowest savages. It is even doubtful whether in some tribes incest would be looked on with greater horror, than would the marriage of a man with a woman bearing the same name, though not a relation. "To violate this law is a crime which the Australians hold in the greatest abhorrence, in this agreeing exactly with certain tribes of North America. When the question is put in either district, is it worse to kill a girl of a foreign tribe, or to marry a girl of one's own, an answer just opposite to ours would be given without hesitation." [264] We may, therefore, reject the belief, lately insisted on by some writers, that the abhorrence of incest is due to our possessing a special God-implanted conscience. On the whole it is intelligible, that a man urged by so powerful a sentiment as remorse, though arising as above explained, should be led to act in a manner, which he has been taught to believe serves as an expiation, such as delivering himself up to justice.

Man prompted by his conscience, will through long habit acquire such perfect self-command, that his desires and passions will at last yield instantly and without a struggle to his social sympathies and instincts, including his feeling for the judgment of his fellows. The still hungry, or the still revengeful man will not think of stealing food, or of wreaking his vengeance. It is possible, or as we shall hereafter see, even probable, that the habit of self-command may, like other habits, be inherited. Thus at last man comes to feel, through acquired and perhaps inherited habit, that it is best for him to obey his more persistent impulses. The imperious word ought seems merely to imply the consciousness of the existence of a rule of conduct, however it may have originated. Formerly it must have been often vehemently urged that an insulted gentleman ought to fight a duel. We even say that a pointer ought to point, and a retriever to retrieve game. If they fail to do so, they fail in their duty and act wrongly.

If any desire or instinct leading to an action opposed to the good of others still appears, when recalled to mind, as strong as, or stronger than, the social instinct, a man will feel no keen regret at having followed it; but he will be conscious that if his conduct were known to his fellows, it would meet with their disapprobation; and few are so destitute of sympathy as not to feel discomfort when this is realised. If he has no such sympathy, and if his desires leading to bad actions are at the time strong, and when recalled are not over-mastered by the persistent social instincts, and the judgment of others, then he is essentially a bad man; [265] and the sole restraining motive left is the fear of punishment, and the conviction that in the long run it would be best for his own selfish interests to regard the good of others rather than his own.

It is obvious that every one may with an easy conscience gratify his own desires, if they do not interfere with his social instincts, that is with the good of others; but in order to be quite free from self-reproach, or at least of anxiety, it is almost necessary for him to avoid the disapprobation, whether reasonable or not, of his fellow-men. Nor must he break through the fixed habits of his life, especially if these are supported by reason; for if he does, he will assuredly feel dissatisfaction. He must likewise avoid the reprobation of the one God or gods in whom, according to his knowledge or superstition, he may believe; but in this case the additional fear of divine punishment often supervenes.

The strictly Social Virtues at first alone regarded.- The above view of the origin and nature of the moral sense, which tells us what we ought to do, and of the conscience which reproves us if we disobey it, accords well with what we see of the early and undeveloped condition of this faculty in mankind. The virtues which must be practised, at least generally, by rude men, so that they may associate in a body, are those which are still recognised as the most important. But they are practised almost exclusively in relation to the men of the same tribe; and their opposites are not regarded as crimes in relation to the men of other tribes. No tribe could hold together if murder, robbery, treachery, &c., were common; consequently such crimes within the limits of the same tribe "are branded with everlasting infamy"; [266] but excite no such sentiment beyond these limits. A North-American Indian is well pleased with himself, and is honoured by others, when he scalps a man of another tribe; and a Dyak cuts off the head of an unoffending person, and dries it as a trophy. The murder of infants has prevailed on the largest scale throughout the world, [267] and has met with no reproach; but infanticide, especially of females, has been thought to be good for the tribe, or at least not injurious. Suicide during former times was not generally considered as a crime, [268] but rather, from the courage displayed, as an honourable act; and it is still practised by some semi-civilised and savage nations without reproach, for it does not obviously concern others of the

tribe. It has been recorded that an Indian Thug conscientiously regretted that he had not robbed and strangled as many travellers as did his father before him. In a rude state of civilisation the robbery of strangers is, indeed, generally considered as honourable.

Slavery, although in some ways beneficial during ancient times,[269] is a great crime; yet it was not so regarded until quite recently, even by the most civilised nations. And this was especially the case, because the slaves belonged in general to a race different from that of their masters. As barbarians do not regard the opinion of their women, wives are commonly treated like slaves. Most savages are utterly indifferent to the sufferings of strangers, or even delight in witnessing them.

It is well known that the women and children of the North American Indians aided in torturing their enemies. Some savages take a horrid pleasure in cruelty to animals,[270] and humanity is an unknown virtue. Nevertheless, besides the family affections, kindness is common, especially during sickness, between the members of the same tribe, and is sometimes extended beyond these limits. Mungo Park's touching account of the kindness of the negro women of the interior to him is well known. Many instances could be given of the noble fidelity of savages towards each other, but not to strangers; common experience justifies the maxim of the Spaniard, "Never, never trust an Indian." There cannot be fidelity without truth; and this fundamental virtue is not rare between the members of the same tribe: thus Mungo Park heard the negro women teaching their young children to love the truth. This, again, is one of the virtues which becomes so deeply rooted in the mind, that it is sometimes practised by savages, even at a high cost, towards strangers; but to lie to your enemy has rarely been thought a sin, as the history of modern diplomacy too plainly shews. As soon as a tribe has a recognised leader, disobedience becomes a crime, and even abject submission is looked at as a sacred virtue.

As during rude times no man can be useful or faithful to his tribe without courage, this quality has universally been placed in the highest rank; and although in civilised countries a good yet timid man may be far more useful to the community than a brave one, we cannot help instinctively honouring the latter above a coward, however benevolent. Prudence, on the other hand, which does not concern the welfare of others, though a very useful virtue, has never been highly esteemed. As no man can practise the virtues necessary for the welfare of his tribe without self-sacrifice, self-command, and the power of endurance, these qualities have been at all times highly and most justly valued. The American savage voluntarily submits to the most horrid tortures without a groan, to prove and strengthen his fortitude and courage; and we cannot help admiring him, or even an Indian Fakir, who, from a foolish religious motive, swings suspended by a hook buried in his flesh.

The other so-called self-regarding virtues, which do not obviously, though they may really, affect the welfare of the tribe, have never been esteemed by savages, though now highly appreciated by civilised nations. The greatest intemperance is no reproach with savages. Utter licentiousness, and unnatural crimes, prevail to an astounding extent.[271] As soon, however, as marriage, whether polygamous, or monogamous, becomes common, jealousy will lead to the inculcation of female virtue; and this, being honoured, will tend to spread to the unmarried females. How slowly it spreads to the male sex, we see at the present day. Chastity eminently requires self-command; therefore, it has been honoured from a very early period in the moral history of civilised man. As a consequence of this, the senseless practice of celibacy has been ranked from a remote period as a virtue.[272] The hatred of indecency, which appears to us so natural as to be thought innate, and which is so valuable an aid to chastity, is a modern virtue, appertaining exclusively, as Sir G. Staunton remarks, [273] to civilised life. This is shewn by the ancient religious rites of various nations, by the drawings on the walls of Pompeii, and by the practices of many savages.

We have now seen that actions are regarded by savages, and were probably so regarded by primeval man, as good or bad, solely as they obviously affect the welfare of the tribe,- not that of the species, nor that of an individual member of the tribe. This conclusion agrees well with the belief that the so-called moral sense is aboriginally derived from the social instincts, for both relate at first exclusively to the community.

The chief causes of the low morality of savages, as judged by our standard, are, firstly, the confinement of sympathy to the same tribe. Secondly, powers of reasoning insufficient to recognise the bearing of many virtues, especially of the self-regarding virtues, on the general welfare of the tribe. Savages, for instance, fail to trace the multiplied evils consequent on a want of temperance, chastity, &c. And, thirdly, weak power of self-command; for this power has not been strengthened

through long-continued, perhaps inherited, habit, instruction and religion.

I have entered into the above details on the immorality of savages,[274] because some authors have recently taken a high view of their moral nature, or have attributed most of their crimes to mistaken benevolence.[275] These authors appear to rest their conclusion on savages possessing those virtues which are serviceable, or even necessary, for the existence of the family and of the tribe,- qualities which they undoubtedly do possess, and often in a high degree.

Concluding Remarks.- It was assumed formerly by philosophers of the derivative[276] school of morals that the foundation of morality lay in a form of Selfishness; but more recently the "Greatest happiness principle" has been brought prominently forward. It is, however, more correct to speak of the latter principle as the standard, and not as the motive of conduct. Nevertheless, all the authors whose works I have consulted, with a few exceptions,[277] write as if there must be a distinct motive for every action, and that this must be associated with some pleasure or displeasure. But man seems often to act impulsively, that is from instinct or long habit, without any consciousness of pleasure, in the same manner as does probably a bee or ant, when it blindly follows its instincts. Under circumstances of extreme peril, as during a fire, when a man endeavours to save a fellow-creature without a moment's hesitation, he can hardly feel pleasure; and still less has he time to reflect on the dissatisfaction which he might subsequently experience if he did not make the attempt. Should he afterwards reflect over his own conduct, he would feel that there lies within him an impulsive power widely different from a search after pleasure or happiness; and this seems to be the deeply planted social instinct.

In the case of the lower animals it seems much more appropriate to speak of their social instincts, as having been developed for the general good rather than for the general happiness of the species. The term, general good, may be defined as the rearing of the greatest number of individuals in full vigour and health, with all their faculties perfect, under the conditions to which they are subjected. As the social instincts both of man and the lower animals have no doubt been developed by nearly the same steps, it would be advisable, if found practicable, to use the same definition in both cases, and to take as the standard of morality, the general good or welfare of the community, rather than the general happiness; but this definition would perhaps require some limitation on account of political ethics.

When a man risks his life to save that of a fellow-creature, it seems also more correct to say that he acts for the general good, rather than for the general happiness of mankind. No doubt the welfare and the happiness of the individual usually coincide; and a contented, happy tribe will flourish better than one that is discontented and unhappy. We have seen that even at an early period in the history of man, the expressed wishes of the community will have naturally influenced to a large extent the conduct of each member; and as all wish for happiness, the "greatest happiness principle" will have become a most important secondary guide and object; the social instinct, however, together with sympathy (which leads to our regarding the approbation and disapprobation of others), having served as the primary impulse and guide. Thus the reproach is removed of laying the foundation of the noblest part of our nature in the base principle of selfishness; unless, indeed, the satisfaction which every animal feels, when it follows its proper instincts, and the dissatisfaction felt when prevented, be called selfish.

The wishes and opinions of the members of the same community, expressed at first orally, but later by writing also, either form the sole guides of our conduct, or greatly reinforce the social instincts; such opinions, however, have sometimes a tendency directly opposed to these instincts. This latter fact is well exemplified by the Law of Honour, that is, the law of the opinion of our equals, and not of all our countrymen. The breach of this law, even when the breach is known to be strictly accordant with true morality, has caused many a man more agony than a real crime. We recognise the same influence in the burning sense of shame which most of us have felt, even after the interval of years, when calling to mind some accidental breach of a trifling, though fixed, rule of etiquette. The judgment of the community will generally be guided by some rude experience of what is best in the long run for all the members; but this judgment will not rarely err from ignorance and weak powers of reasoning. Hence the strangest customs and superstitions, in complete opposition to the true welfare and happiness of mankind, have become all-powerful throughout the world. We see this in the horror felt by a Hindoo who breaks his caste, and in many other such cases. It would be difficult to distinguish between the remorse felt by a Hindoo who has yielded to the temptation of eating unclean food, from that felt after committing a theft; but the former would probably be the more

severe.

How so many absurd rules of conduct, as well as so many absurd religious beliefs, have originated, we do not know; nor how it is that they have become, in all quarters of the world, so deeply impressed on the mind of men; but it is worthy of remark that a belief constantly inculcated during the early years of life, whilst the brain is impressible, appears to acquire almost the nature of an instinct; and the very essence of an instinct is that it is followed independently of reason. Neither can we say why certain admirable virtues, such as the love of truth, are much more highly appreciated by some savage tribes than by others;[278] nor, again, why similar differences prevail even amongst highly civilised nations. Knowing how firmly fixed many strange customs and superstitions have become, we need feel no surprise that the self-regarding virtues, supported as they are by reason, should now appear to us so natural as to be thought innate, although they were not valued by man in his early condition.

Notwithstanding many sources of doubt, man can generally and readily distinguish between the higher and lower moral rules. The higher are founded on the social instincts, and relate to the welfare of others. They are supported by the approbation of our fellow-men and by reason. The lower rules, though some of them when implying self-sacrifice hardly deserve to be called lower, relate chiefly to self, and arise from public opinion, matured by experience and cultivation; for they are not practised by rude tribes.

As man advances in civilisation, and small tribes are united into larger communities, the simplest reason would tell each individual that he ought to extend his social instincts and sympathies to all the members of the same nation, though personally unknown to him. This point being once reached, there is only an artificial barrier to prevent his sympathies extending to the men of all nations and races. If, indeed, such men are separated from him by great differences in appearance or habits, experience unfortunately shews us how long it is, before we look at them as our fellow-creatures. Sympathy beyond the confines of man, that is, humanity to the lower animals, seems to be one of the latest moral acquisitions. It is apparently unfelt by savages, except towards their pets. How little the old Romans knew of it is shewn by their abhorrent gladiatorial exhibitions. The very idea of humanity, as far as I could observe, was new to most of the Gauchos of the Pampas. This virtue, one of the noblest with which man is endowed, seems to arise incidentally from our sympathies becoming more tender and more widely diffused, until they are extended to all sentient beings. As soon as this virtue is honoured and practised by some few men, it spreads through instruction and example to the young, and eventually becomes incorporated in public opinion.

The highest possible stage in moral culture is when we recognise that we ought to control our thoughts, and "not even in inmost thought to think again the sins that made the past so pleasant to us." [279] Whatever makes any bad action familiar to the mind, renders its performance by so much the easier. As Marcus Aurelius long ago said, "Such as are thy habitual thoughts, such also will be the character of thy mind; for the soul is dyed by the thoughts." [280]

Our great philosopher, Herbert Spencer, has recently explained his views on the moral sense. He says, "I believe that the experiences of utility organised and consolidated through all past generations of the human race, have been producing corresponding modifications, which, by continued transmission and accumulation, have become in us certain faculties of moral intuition—certain emotions responding to right and wrong conduct, which have no apparent basis in the individual experiences of utility." [281] There is not the least inherent improbability, as it seems to me, in virtuous tendencies being more or less strongly inherited; for, not to mention the various dispositions and habits transmitted by many of our domestic animals to their offspring, I have heard of authentic cases in which a desire to steal and a tendency to lie appeared to run in families of the upper ranks; and as stealing is a rare crime in the wealthy classes, we can hardly account by accidental coincidence for the tendency occurring in two or three members of the same family. If bad tendencies are transmitted, it is probable that good ones are likewise transmitted. That the state of the body by affecting the brain, has great influence on the moral tendencies is known to most of those who have suffered from chronic derangements of the digestion or liver. The same fact is likewise shewn by the "perversion or destruction of the moral sense being often one of the earliest symptoms of mental derangement"; [282] and insanity is notoriously often inherited. Except through the principle of the transmission of moral tendencies, we cannot understand the differences believed to exist in this respect between the various races of mankind.

Even the partial transmission of virtuous tendencies would be an immense assistance to the primary impulse derived directly and indirectly from the social instincts. Admitting for a moment that virtuous tendencies are inherited, it appears probable, at least in such cases as chastity, temperance, humanity to animals, &c., that they become first impressed on the mental organization through habit, instruction and example, continued during several generations in the same family, and in a quite subordinate degree, or not at all, by the individuals possessing such virtues having succeeded best in the struggle for life. My chief source of doubt with respect to any such inheritance, is that senseless customs, superstitions, and tastes, such as the horror of a Hindoo for unclean food, ought on the same principle to be transmitted. I have not met with any evidence in support of the transmission of superstitious customs or senseless habits, although in itself it is perhaps not less probable than that animals should acquire inherited tastes for certain kinds of food or fear of certain foes.

Finally the social instincts, which no doubt were acquired by man as by the lower animals for the good of the community, will from the first have given to him some wish to aid his fellows, some feeling of sympathy, and have compelled him to regard their approbation and disapprobation. Such impulses will have served him at a very early period as a rude rule of right and wrong. But as man gradually advanced in intellectual power, and was enabled to trace the more remote consequences of his actions; as he acquired sufficient knowledge to reject baneful customs and superstitions; as he regarded more and more, not only the welfare, but the happiness of his fellow-men; as from habit, following on beneficial experience, instruction and example, his sympathies became more tender and widely diffused, extending to men of all races, to the imbecile, maimed, and other useless members of society, and finally to the lower animals,- so would the standard of his morality rise higher and higher. And it is admitted by moralists of the derivative school and by some intuitionists, that the standard of morality has risen since an early period in the history of man.[283]

As a struggle may sometimes be seen going on between the various instincts of the lower animals, it is not surprising that there should be a struggle in man between his social instincts, with their derived virtues, and his lower, though momentarily stronger impulses or desires. This, as Mr. Galton [284] has remarked, is all the less surprising, as man has emerged from a state of barbarism within a comparatively recent period. After having yielded to some temptation we feel a sense of dissatisfaction, shame, repentance, or remorse, analogous to the feelings caused by other powerful instincts or desires, when left unsatisfied or balked. We compare the weakened impression of a past temptation with the ever present social instincts, or with habits, gained in early youth and strengthened during our whole lives, until they have become almost as strong as instincts. If with the temptation still before us we do not yield, it is because either the social instinct or some custom is at the moment predominant, or because we have learnt that it will appear to us hereafter the stronger, when compared with the weakened impression of the temptation, and we realise that its violation would cause us suffering. Looking to future generations, there is no cause to fear that the social instincts will grow weaker, and we may expect that virtuous habits will grow stronger, becoming perhaps fixed by inheritance. In this case the struggle between our higher and lower impulses will be less severe, and virtue will be triumphant.

Summary of the last two Chapters.- There can be no doubt that the difference between the mind of the lowest man and that of the highest animal is immense. An anthropomorphous ape, if he could take a dispassionate view of his own case, would admit that though he could form an artful plan to plunder a garden- though he could use stones for fighting or for breaking open nuts, yet that the thought of fashioning a stone into a tool was quite beyond his scope. Still less, as he would admit, could he follow out a train of metaphysical reasoning, or solve a mathematical problem, or reflect on God, or admire a grand natural scene. Some apes, however, would probably declare that they could and did admire the beauty of the coloured skin and fur of their partners in marriage. They would admit, that though they could make other apes understand by cries some of their perceptions and simpler wants, the notion of expressing definite ideas by definite sounds had never crossed their minds. They might insist that they were ready to aid their fellow-apes of the same troop in many ways, to risk their lives for them, and to take charge of their orphans; but they would be forced to acknowledge that disinterested love for all living creatures, the most noble attribute of man, was quite beyond their comprehension.

Nevertheless the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind. We have seen that the senses and intuitions, the various emotions and faculties, such as love, memory, attention, curiosity, imitation, reason, &c., of which man boasts,

may be found in an incipient, or even sometimes in a well-developed condition, in the lower animals. They are also capable of some inherited improvement, as we see in the domestic dog compared with the wolf or jackal. If it could be proved that certain high mental powers, such as the formation of general concepts, self-consciousness, &c., were absolutely peculiar to man, which seems extremely doubtful, it is not improbable that these qualities are merely the incidental results of other highly-advanced intellectual faculties; and these again mainly the result of the continued use of a perfect language. At what age does the new-born infant possess the power of abstraction, or become self-conscious, and reflect on its own existence? We cannot answer; nor can we answer in regard to the ascending organic scale. The half-art, half-instinct of language still bears the stamp of its gradual evolution. The ennobling belief in God is not universal with man; and the belief in spiritual agencies naturally follows from other mental powers. The moral sense perhaps affords the best and highest distinction between man and the lower animals; but I need say nothing on this head, as I have so lately endeavoured to shew that the social instincts, - the prime principle of man's moral constitution [285] - with the aid of active intellectual powers and the effects of habit, naturally lead to the golden rule, "As ye would that men should do to you, do ye to them likewise"; and this lies at the foundation of morality. In the next chapter I shall make some few remarks on the probable steps and means by which the several mental and moral faculties of man have been gradually evolved. That such evolution is at least possible, ought not to be denied, for we daily see these faculties developing in every infant; and we may trace a perfect gradation from the mind of an utter idiot, lower than that of an animal low in the scale, to the mind of a Newton.

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Footnotes

[236] See, for instance, on this subject, Quatrefages, *Unite de l'Espece Humaine*, 1861, p. 21, &c

[237] *Dissertation an Ethical Philosophy*, 1837, p. 231, &c

[238] *Metaphysics of Ethics* translated by J. W. Semple, Edinburgh, 1836, p. 136.

[239] Mr. Bain gives a list (*Mental and Moral Science*, 1868, pp. 543-725) of twenty-six British authors who have written on this subject, and whose names are familiar to every reader; to these, Mr. Bain's own name, and those of Mr. Lecky, Mr. Shadworth Hodgson, Sir J. Lubbock, and others, might be added.

[240] Sir B. Brodie, after observing that man is a social animal (*Psychological Enquiries*, 1854, p. 192), asks the pregnant question, "Ought not this to settle the disputed question as to the existence of a moral sense?" Similar ideas have probably occurred to many persons, as they did long ago to Marcus Aurelius. Mr. J. S. Mill speaks, in his celebrated work, *Utilitarianism*, pp. 459, 460, of the social feelings as a "powerful natural sentiment," and as "the natural basis of sentiment for utilitarian morality." Again he says, "Like the other acquired capacities above referred to, the moral faculty, if not a part of our nature, is a natural out-growth from it; capable, like them, in a certain small degree of springing up spontaneously." But in opposition to all this, he also remarks, "If, as in my own belief, the moral feelings are not innate, but acquired, they are not for that reason less natural." It is with hesitation that I venture to differ at all from so profound a thinker, but it can hardly be disputed that the social feelings are instinctive or innate in the lower animals; and why should they not be so in man? Mr. Bain (see, for instance, *The Emotions and the Will*, 1865, p. 481) and others believe that the moral sense is acquired by each individual during his lifetime. On the general theory of evolution this is at least extremely improbable. The ignoring of all transmitted mental qualities will, as it seems to me, be hereafter judged as a most serious blemish in the works of Mr. Mill.

[241] I am indebted to Mr. Walsh, of Illinois, for having sent me extracts from Leconte's *Introduction to Entomology*, pp. 101, 143.

[242] *Die Darwin'sche Theorie*, s. 101

[243] Mr. R. Brown in *Proc. Zoolog. Soc.*, 1868, p. 409

[244] Brehm, *Illustriertes Thierleben*, B. i., 1864, ss. 52, 79. For the case of the monkeys extracting thorns from each other, see s. 54. With respect to the Hamadryas turning over stones, the fact is given (s. 76), on the evidence of Alvarez, whose observations Brehm thinks quite trustworthy. For the cases of the old male baboons attacking the dogs, see s. 79; and with respect to the eagle, s. 56.

[245] Mr. Belt gives the case of a spider-monkey (*Ateles*) in Nicaragua, which was heard screaming for nearly two hours in the forest, and was found with an eagle perched close by it. The bird apparently feared to attack as long as it remained face to face; and Mr. Belt believes, from what he has seen of the habits of these monkeys, that they protect themselves from eagles by keeping two or three together. *The Naturalist in Nicaragua*, 1874, p. 118.

[246] *Annals and Magazine of Natural History*, November, 1868, p. 382

[247] Sir J. Lubbock, *Prehistoric Times*, 2nd ed., p. 446.

[248] As quoted by Mr. L. H. Morgan, *The American Beaver*, 1868, p. 272. Capt. Stansbury also gives an interesting account of the manner in which a very young pelican, carried away by a strong stream, was guided and encouraged in its attempts to reach the shore by half a dozen old birds

[249] As Mr. Bain states, "Effective aid to a sufferer springs from sympathy proper": *Mental and Moral Science*, 1868, p. 245.

[250] *Illustriertes Thierleben*, B. i., s. 85.

[251] *De l'Espece et de la Classe*, 1869, p. 97.

[252] *Die Darwin'sche Art-Lehre*, 1869, s. 54

[253] See also Hooker's *Himalayan Journals*, vol. ii., 1854, p. 333.

[254] Brehm, *Illustriertes Thierleben*, B. i., s. 7

[255] See his extremely interesting paper on "Gregariousness in Cattle, and in Man," *Macmillan's Magazine*, Feb., 1871, p. 353.

[256] See the first and striking chapter in Adam Smith's *Theory of Moral Sentiments*. Also Mr. Bain's *Mental and Moral Science*, 1868, pp. 244, and 275-282. Mr. Bain states, that, "Sympathy is, indirectly, a source of pleasure to the sympathiser"; and he accounts for this through reciprocity. He remarks that "The person benefited, or others in his stead, may make up, by sympathy and good offices returned, for all the sacrifice." But if, as appears to be the case, sympathy is strictly an instinct, its exercise would give direct pleasure, in the same manner as the exercise, as before remarked, of almost every other instinct.

[257] This fact, the Rev. L. Jenyns states (see his edition of White's *Nat. Hist. of Selborne*, 1853, p. 204), was first recorded by the illustrious Jenner, in *Phil. Transact.*, 1824, and has since been confirmed by several observers, especially by Mr. Blackwall. This latter careful observer examined, late in the autumn, during two years, thirty-six nests; he found that twelve contained young dead birds, five contained eggs on the point of being hatched, and three, eggs not nearly hatched. Many birds, not yet old enough for a prolonged flight, are likewise deserted and left behind. See Blackwall, *Researches in Zoology*, 1834, pp. 108, 118. For some additional evidence, although this is not wanted, see Leroy, *Lettres Phil.*, 1802, p. 217. For swifts, Gould's *Introduction to the Birds of Great Britain*, 1823, p. 5. Similar cases have been observed in Canada by Mr. Adams; *Pop. Science Review*, July, 1873, p. 283.

[258] Hume remarks (*An Enquiry Concerning the Principles of Morals*, ed. of 1751, p. 132), "There seems a necessity for confessing that the happiness and misery of others are not spectacles altogether indifferent to us, but that the view of the former... communicates a secret joy; the appearance of the latter... throws a melancholy damp over the imagination."

[259] *Mental and Moral Science*, 1868, p. 254.

[260] I refer here to the distinction between what has been called material and formal morality. I am glad to find that Professor Huxley (*Critiques and Addresses*, 1873, p. 287) takes the same view on this subject as I do. Mr. Leslie Stephen remarks (*Essays on Free Thinking and Plain Speaking*, 1873, p. 83), "The metaphysical distinction between material and formal morality is as irrelevant as other such distinctions.

[261] I have given one such case, namely of three Patagonian Indians who preferred being shot, one after the other, to betraying the plans of their companions in war (*Journal of Researches*, 1845, p. 103).

[262] Enmity or hatred seems also to be a highly persistent feeling, perhaps more so than any other that can be named. Envy is defined as hatred of another for some excellence or success; and Bacon insists (*Essay ix.*), "Of all other affections envy is the most importune and continual." Dogs are very apt to hate both strange men and strange dogs, especially if they live near at hand, but do not belong to the same family, tribe, or clan; this feeling would thus seem to be innate, and is certainly a most persistent one. It seems to be the complement and converse of the true social instinct. From what we hear of savages, it would appear that something of the same kind holds good with them. If this be so, it would be a small step in any one to transfer such feelings to any member of the same tribe if he had done him an injury and had become his enemy. Nor is it probable that the primitive conscience would reproach a man for injuring his enemy; rather it would reproach him, if he had not revenged himself. To do good in return for evil, to love your enemy, is a height of morality to which it may be doubted whether the social instincts would, by themselves, have ever led us. It is necessary that these instincts, together with sympathy, should have been highly cultivated and extended by the aid of reason, instruction, and the love or fear of God, before any such golden rule would ever be thought of and obeyed.

[263] *Insanity in Relation to Law*, Ontario, United States, 1871, p. 1

[264] E. B. Tylor, in *Contemporary Review*, April, 1873, p. 707.

[265] Dr. Prosper Despine, in his *Psychologie Naturelle*, 1868 (tom. i., p. 243; tom. ii., p. 169) gives many curious cases of the worst criminals who apparently have been entirely destitute of conscience.

[266] See an able article in the *North British Review*, 1867, p. 395. See also Mr. W. Bagehot's articles on the "Importance of Obedience and Coherence to Primitive Man," in the *Fortnightly Review*, 1867, p. 529, and 1868, p. 457, &c

[267] The fullest account which I have met with is by Dr. Gerland, in his *Ober den Aussterben der Naturvolker*, 1868: but I shall have to recur to the subject of infanticide in a future chapter

[268] See the very interesting discussion on suicide in Lecky's *History of European Morals*, vol. i., 1869, p. 223. With respect to savages, Mr. Winwood Reade informs me that the negroes of west Africa often commit suicide. It is well known how common it was amongst the miserable aborigines of South America after the Spanish conquest. For New Zealand, see *The Voyage of the Novara*, and for the Aleutian Islands, Muller, as quoted by Houzeau, *Les Facultes Mentales*, &c., tom. ii., p. 136.

[269] See Mr. Bagehot, *Physics and Politics*, 1872, p. 72

[270] See, for instance, Mr. Hamilton's account of the Kaffirs, *Anthropological Review*, 1870, p. xv.

[271] Mr. M'Lennan has given (*Primitive Marriage*, 1865, p. 176) a good collection of facts on this head

[272] Lecky, *History of European Morals*, vol. i., 1869, p. 109

[273] *Embassy to China*, vol. ii., p. 348.

[274] See on this subject copious evidence in chap. vii. of Sir J. Lubbock, *Origin of Civilisation*, 1870

[275] For instance Lecky, *History of European Morals*, vol. i., p. 124.

[276] This term is used in an able article in the *Westminster Review*, Oct., 1869, p. 498; For the "Greatest happiness principle," see J. S. Mill, *Utilitarianism*, p. 448

[277] Mill recognises (*System of Logic*, vol. ii., p. 422) in the clearest manner, that actions may be performed through habit without the anticipation of pleasure. Mr. H. Sidgwick also, in his "Essay on Pleasure and Desire" (*The Contemporary Review*, April, 1872, p. 671), remarks: "To sum up, in contravention of the doctrine that our conscious active impulses are always directed towards the production of agreeable sensations in ourselves, I would maintain that we find everywhere in consciousness extra-regarding impulse, directed towards something that is not pleasure; that in many case the impulse is so far incompatible with the self-regarding that the two do not easily co-exist in the same moment of consciousness." A dim feeling that our impulses do not by any means always arise from any contemporaneous or anticipated pleasure, has, I cannot but think, been one chief cause of the acceptance of the intuitive theory of morality, and of the rejection of the utilitarian or "Greatest happiness" theory. With respect to the latter theory the standard and the motive of conduct have no doubt often been confused, but they are really in some degree blended.

[278] Good instances are given by Mr. Wallace in *Scientific Opinion*, Sept. 15, 1869; and more fully in his *Contributions to the Theory of Natural Selection*, 1870, p. 353.

[279] Tennyson, *Idylls of the King*, p. 244

[280] Marcus Aurelius, *Meditations*, Bk. V, sect. 16.

[281] Letter to Mr. Mill in Bain's *Mental and Moral Science*, 1868, p. 722

[282] Maudsley, *Body and Mind*, 1870, p. 60.

[283] A writer in the *North British Review* (July, 1869, p. 531), well capable of forming a sound judgment, expresses himself strongly in favour of this conclusion. Mr. Lecky (*History of Morals*, vol. i., p. 143) seems to a certain extent to coincide therein.

[284] See his remarkable work on *Hereditary Genius*, 1869, p. 349. The Duke of Argyll (*Primeval Man*, 1869, p. 188) has some good remarks on the contest in man's nature between right and wrong.

[285] Marcus Aurelius, *Meditations*, Bk. V, sect. 55.

Chapter V

ON THE DEVELOPMENT OF THE INTELLECTUAL AND MORAL FACULTIES. DURING PRIMEVAL AND CIVILISED TIMES.

The subjects to be discussed in this chapter are of the highest interest, but are treated by me in an imperfect and fragmentary manner. Mr. Wallace, in an admirable paper before referred to,[286] argues that man, after he had partially acquired those intellectual and moral faculties which distinguish him from the lower animals, would have been but little liable to bodily modifications through natural selection or any other means. For man is enabled through his mental faculties "to keep with an unchanged body in harmony with the changing universe." He has great power of adapting his habits to new conditions of life. He invents weapons, tools, and various stratagems to procure food and to defend himself. When he migrates into a colder climate he uses clothes, builds sheds, and makes fires; and by the aid of fire cooks food otherwise indigestible. He aids his fellowmen in many ways, and anticipates future events. Even at a remote period he practised some division of labour.

The lower animals, on the other hand, must have their bodily structure modified in order to survive under greatly changed conditions. They must be rendered stronger, or acquire more effective teeth or claws, for defence against new enemies; or they must be reduced in size, so as to escape

detection and danger. When they migrate into a colder climate, they must become clothed with thicker fur, or have their constitutions altered. If they fail to be thus modified, they will cease to exist.

The case, however, is widely different, as Mr. Wallace has with justice insisted, in relation to the intellectual and moral faculties of man. These faculties are variable; and we have every reason to believe that the variations tend to be inherited. Therefore, if they were formerly of high importance to primeval man and to his ape-like progenitors, they would have been perfected or advanced through natural selection. Of the high importance of the intellectual faculties there can be no doubt, for man mainly owes to them his predominant position in the world. We can see, that in the rudest state of society, the individuals who were the most sagacious, who invented and used the best weapons or traps, and who were best able to defend themselves, would rear the greatest number of offspring. The tribes, which included the largest number of men thus endowed, would increase in number and supplant other tribes. Numbers depend primarily on the means of subsistence, and this depends partly on the physical nature of the country, but in a much higher degree on the arts which are there practised. As a tribe increases and is victorious, it is often still further increased by the absorption of other tribes.[287] The stature and strength of the men of a tribe are likewise of some importance for its success, and these depend in part on the nature and amount of the food which can be obtained. In Europe the men of the Bronze period were supplanted by a race more powerful, and, judging from their sword-handles, with larger hands;[288] but their success was probably still more due to their superiority in the arts.

All that we know about savages, or may infer from their traditions and from old monuments, the history of which is quite forgotten by the present inhabitants, shew that from the remotest times successful tribes have supplanted other tribes. Relics of extinct or forgotten tribes have been discovered throughout the civilised regions of the earth, on the wild plains of America, and on the isolated islands in the Pacific Ocean. At the present day civilised nations are everywhere supplanting barbarous nations, excepting where the climate opposes a deadly barrier; and they succeed mainly, though not exclusively, through their arts, which are the products of the intellect. It is, therefore, highly probable that with mankind the intellectual faculties have been mainly and gradually perfected through natural selection; and this conclusion is sufficient for our purpose. Undoubtedly it would be interesting to trace the development of each separate faculty from the state in which it exists in the lower animals to that in which it exists in man; but neither my ability nor knowledge permits the attempt.

It deserves notice that, as soon as the progenitors of man became social (and this probably occurred at a very early period), the principle of imitation, and reason, and experience would have increased, and much modified the intellectual powers in a way, of which we see only traces in the lower animals. Apes are much given to imitation, as are the lowest savages; and the simple fact previously referred to, that after a time no animal can be caught in the same place by the same sort of trap, shews that animals learn by experience, and imitate the caution of others. Now, if some one man in a tribe, more sagacious than the others, invented a new snare or weapon, or other means of attack or defence, the plainest self-interest, without the assistance of much reasoning power, would prompt the other members to imitate him; and all would thus profit. The habitual practice of each new art must likewise in some slight degree strengthen the intellect. If the new invention were an important one, the tribe would increase in number, spread, and supplant other tribes. In a tribe thus rendered more numerous there would always be a rather greater chance of the birth of other superior and inventive members. If such men left children to inherit their mental superiority, the chance of the birth of still more ingenious members would be somewhat better, and in a very small tribe decidedly better. Even if they left no children, the tribe would still include their blood-relations; and it has been ascertained by agriculturists[289] that by preserving and breeding from the family of an animal, which when slaughtered was found to be valuable, the desired character has been obtained.

Turning now to the social and moral faculties. In order that primeval men, or the ape-like progenitors of man, should become social, they must have acquired the same instinctive feelings, which impel other animals to live in a body; and they no doubt exhibited the same general disposition. They would have felt uneasy when separated from their comrades, for whom they would have felt some degree of love; they would have warned each other of danger, and have given mutual aid in attack or defence. All this implies some degree of sympathy, fidelity, and courage. Such social qualities, the paramount importance of which to the lower animals is disputed by no one, were no doubt acquired by the progenitors of man in a similar manner, namely, through natural selection, aided by

inherited habit. When two tribes of primeval man, living in the same country, came into competition, if (other circumstances being equal) the one tribe included a great number of courageous, sympathetic and faithful members, who were always ready to warn each other of danger, to aid and defend each other, this tribe would succeed better and conquer the other. Let it be borne in mind how all-important in the never-ceasing wars of savages, fidelity and courage must be. The advantage which disciplined soldiers have over undisciplined hordes follows chiefly from the confidence which each man feels in his comrades. Obedience, as Mr. Bagehot has well shewn,[290] is of the highest value, for any form of government is better than none. Selfish and contentious people will not cohere, and without coherence nothing can be effected. A tribe rich in the above qualities would spread and be victorious over other tribes: but in the course of time it would, judging from all past history, be in its turn overcome by some other tribe still more highly endowed. Thus the social and moral qualities would tend slowly to advance and be diffused throughout the world.

But it may be asked, how within the limits of the same tribe did a large number of members first become endowed with these social and moral qualities, and how was the standard of excellence raised? It is extremely doubtful whether the offspring of the more sympathetic and benevolent parents, or of those who were the most faithful to their comrades, would be reared in greater numbers than the children of selfish and treacherous parents belonging to the same tribe. He who was ready to sacrifice his life, as many a savage has been, rather than betray his comrades, would often leave no offspring to inherit his noble nature. The bravest men, who were always willing to come to the front in war, and who freely risked their lives for others, would on an average perish in larger numbers than other men. Therefore, it hardly seems probable that the number of men gifted with such virtues, or that the standard of their excellence, could be increased through natural selection, that is, by the survival of the fittest; for we are not here speaking of one tribe being victorious over another.

Although the circumstances, leading to an increase in the number of those thus endowed within the same tribe, are too complex to be clearly followed out, we can trace some of the probable steps. In the first place, as the reasoning powers and foresight of the members became improved, each man would soon learn that if he aided his fellow-men, he would commonly receive aid in return. From this low motive he might acquire the habit of aiding his fellows; and the habit of performing benevolent actions certainly strengthens the feeling of sympathy which gives the first impulse to benevolent actions. Habits, moreover, followed during many generations probably tend to be inherited.

But another and much more powerful stimulus to the development of the social virtues, is afforded by the praise and the blame of our fellow-men. To the instinct of sympathy, as we have already seen, it is primarily due, that we habitually bestow both praises and blame on others, whilst we love the former and dread the latter when applied to ourselves; and this instinct no doubt was originally acquired, like all the other social instincts, through natural selection. At how early a period the progenitors of man in the course of their development, became capable of feeling and being impelled by, the praise or blame of their fellow-creatures, we cannot of course say. But it appears that even dogs appreciate encouragement, praise, and blame. The rudest savages feel the sentiment of glory, as they clearly show by preserving the trophies of their prowess, by their habit of excessive boasting, and even by the extreme care which they take of their personal appearance and decorations; for unless they regarded the opinion of their comrades, such habits would be senseless.

They certainly feel shame at the breach of some of their lesser rules, and apparently remorse, as shewn by the case of the Australian who grew thin and could not rest from having delayed to murder some other woman, so as to propitiate his dead wife's spirit. Though I have not met with any other recorded case, it is scarcely credible that a savage, who will sacrifice his life rather than betray his tribe, or one who will deliver himself up as a prisoner rather than break his parole,[291] would not feel remorse in his inmost soul, if he had failed in a duty, which he held sacred.

We may therefore conclude that primeval man, at a very remote period, was influenced by the praise and blame of his fellows. It is obvious, that the members of the same tribe would approve of conduct which appeared to them to be for the general good, and would reprobate that which appeared evil. To do good unto others- to do unto others as ye would they should do unto you- is the foundationstone of morality. It is, therefore, hardly possible to exaggerate the importance during rude times of the love of praise and the dread of blame. A man who was not impelled by any deep, instinctive feeling, to sacrifice his life for the good of others, yet was roused to such actions by a

sense of glory, would by his example excite the same wish for glory in other men, and would strengthen by exercise the noble feeling of admiration. He might thus do far more good to his tribe than by begetting offspring with a tendency to inherit his own high character.

With increased experience and reason, man perceives the more remote consequences of his actions, and the self-regarding virtues, such as temperance, chastity, &c., which during early times are, as we have before seen, utterly disregarded, come to be highly esteemed or even held sacred. I need not, however, repeat what I have said on this head in the fourth chapter. Ultimately our moral sense or conscience becomes a highly complex sentiment- originating in the social instincts, largely guided by the approbation of our fellow-men, ruled by reason, self-interest, and in later times by deep religious feelings, and confirmed by instruction and habit.

It must not be forgotten that although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe, yet that an increase in the number of well-endowed men and an advancement in the standard of morality will certainly give an immense advantage to one tribe over another. A tribe including many members who, from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection. At all times throughout the world tribes have supplanted other tribes; and as morality is one important element in their success, the standard of morality and the number of well-endowed men will thus everywhere tend to rise and increase.

It is, however, very difficult to form any judgment why one particular tribe and not another has been successful and has risen in the scale of civilisation. Many savages are in the same condition as when first discovered several centuries ago. As Mr. Bagehot has remarked, we are apt to look at the progress as normal in human society; but history refutes this. The ancients did not even entertain the idea, nor do the Oriental nations at the present day. According to another high authority, Sir Henry Maine, "The greatest part of mankind has never shewn a particle of desire that its civil institutions should be improved." [292] Progress seems to depend on many concurrent favourable conditions, far too complex to be followed out. But it has often been remarked, that a cool climate, from leading to industry and to the various arts, has been highly favourable thereto. The Esquimaux, pressed by hard necessity, have succeeded in many ingenious inventions, but their climate has been too severe for continued progress. Nomadic habits, whether over wide plains, or through the dense forests of the tropics, or along the shores of the sea, have in every case been highly detrimental. Whilst observing the barbarous inhabitants of Tierra del Fuego, it struck me that the possession of some property, a fixed abode, and the union of many families under a chief, were the indispensable requisites for civilisation. Such habits almost necessitate the cultivation of the ground and the first steps in cultivation would probably result, as I have elsewhere shewn, [293] from some such accident as the seeds of a fruit-tree falling on a heap of refuse, and producing an unusually fine variety. The problem, however, of the first advance of savages towards civilisation is at present much too difficult to be solved.

Natural Selection as affecting Civilised Nations.- I have hitherto only considered the advancement of man from a semi-human condition to that of the modern savage. But some remarks on the action of natural selection on civilised nations may be worth adding. This subject has been ably discussed by Mr. W. R. Greg, [294] and previously by Mr. Wallace and Mr. Galton. [295] Most of my remarks are taken from these three authors. With savages, the weak in body or mind are soon eliminated; and those that survive commonly exhibit a vigorous state of health. We civilised men, on the other hand, do our utmost to check the process of elimination; we build asylums for the imbecile, the maimed, and the sick; we institute poor-laws; and our medical men exert their utmost skill to save the life of every one to the last moment. There is reason to believe that vaccination has preserved thousands, who from a weak constitution would formerly have succumbed to small-pox. Thus the weak members of civilised societies propagate their kind. No one who has attended to the breeding of domestic animals will doubt that this must be highly injurious to the race of man. It is surprising how soon a want of care, or care wrongly directed, leads to the degeneration of a domestic race; but excepting in the case of man himself, hardly any one is so ignorant as to allow his worst animals to breed.

The aid which we feel impelled to give to the helpless is mainly an incidental result of the instinct of sympathy, which was originally acquired as part of the social instincts, but subsequently rendered, in

the manner previously indicated, more tender and more widely diffused. Nor could we check our sympathy, even at the urging of hard reason, without deterioration in the noblest part of our nature. The surgeon may harden himself whilst performing an operation, for he knows that he is acting for the good of his patient; but if we were intentionally to neglect the weak and helpless, it could only be for a contingent benefit, with an overwhelming present evil. We must therefore bear the undoubtedly bad effects of the weak surviving and propagating their kind; but there appears to be at least one check in steady action, namely that the weaker and inferior members of society do not marry so freely as the sound; and this check might be indefinitely increased by the weak in body or mind refraining from marriage, though this is more to be hoped for than expected.

In every country in which a large standing army is kept up, the finest young men are taken by the conscription or are enlisted. They are thus exposed to early death during war, are often tempted into vice, and are prevented from marrying during the prime of life. On the other hand the shorter and feebler men, with poor constitutions, are left at home, and consequently have a much better chance of marrying and propagating their kind.[296]

Man accumulates property and bequeaths it to his children, so that the children of the rich have an advantage over the poor in the race for success, independently of bodily or mental superiority. On the other hand, the children of parents who are short-lived, and are therefore on an average deficient in health and vigour, come into their property sooner than other children, and will be likely to marry earlier, and leave a larger number of offspring to inherit their inferior constitutions. But the inheritance of property by itself is very far from an evil; for without the accumulation of capital the arts could not progress; and it is chiefly through their power that the civilised races have extended, and are now everywhere extending their range, so as to take the place of the lower races. Nor does the moderate accumulation of wealth interfere with the process of selection. When a poor man becomes moderately rich, his children enter trades or professions in which there is struggle enough, so that the able in body and mind succeed best. The presence of a body of well-instructed men, who have not to labour for their daily bread, is important to a degree which cannot be over-estimated; as all high intellectual work is carried on by them, and on such work, material progress of all kinds mainly depends, not to mention other and higher advantages. No doubt wealth when very great tends to convert men into useless drones, but their number is never large; and some degree of elimination here occurs, for we daily see rich men, who happen to be fools or profligate, squandering away their wealth.

Primogeniture with entailed estates is a more direct evil, though it may formerly have been a great advantage by the creation of a dominant class, and any government is better than none. Most eldest sons, though they may be weak in body or mind, marry, whilst the younger sons, however superior in these respects, do not so generally marry. Nor can worthless eldest sons with entailed estates squander their wealth. But here, as elsewhere, the relations of civilised life are so complex that some compensatory checks intervene. The men who are rich through primogeniture are able to select generation after generation the more beautiful and charming women; and these must generally be healthy in body and active in mind. The evil consequences, such as they may be, of the continued preservation of the same line of descent, without any selection, are checked by men of rank always wishing to increase their wealth and power; and this they effect by marrying heiresses. But the daughters of parents who have produced single children, are themselves, as Mr. Galton [297] has shewn, apt to be sterile; and thus noble families are continually cut off in the direct line, and their wealth flows into some side channel; but unfortunately this channel is not determined by superiority of any kind.

Although civilisation thus checks in many ways the action of natural selection, it apparently favours the better development of the body, by means of good food and the freedom from occasional hardships. This may be inferred from civilised men having been found, wherever compared, to be physically stronger than savages.[298] They appear also to have equal powers of endurance, as has been proved in many adventurous expeditions. Even the great luxury of the rich can be but little detrimental; for the expectation of life of our aristocracy, at all ages and of both sexes, is very little inferior to that of healthy English lives in the lower classes.[299]

We will now look to the intellectual faculties. If in each grade of society the members were divided into two equal bodies, the one including the intellectually superior and the other the inferior, there can be little doubt that the former would succeed best in all occupations, and rear a greater number of children. Even in the lowest walks of life, skill and ability must be of some advantage; though in

many occupations, owing to the great division of labour, a very small one. Hence in civilised nations there will be some tendency to an increase both in the number and in the standard of the intellectually able. But I do not wish to assert that this tendency may not be more than counterbalanced in other ways, as by the multiplication of the reckless and improvident; but even to such as these, ability must be some advantage.

It has often been objected to views like the foregoing, that the most eminent men who have ever lived have left no offspring to inherit their great intellect. Mr. Galton says, "I regret I am unable to solve the simple question whether, and how far, men and women who are prodigies of genius are infertile. I have, however, shewn that men of eminence are by no means so." [300] Great lawgivers, the founders of beneficent religions, great philosophers and discoverers in science, aid the progress of mankind in a far higher degree by their works than by leaving a numerous progeny. In the case of corporeal structures, it is the selection of the slightly better-endowed and the elimination of the slightly less well-endowed individuals, and not the preservation of strongly-marked and rare anomalies, that leads to the advancement of a species. [301] So it will be with the intellectual faculties, since the somewhat abler men in each grade of society succeed rather better than the less able, and consequently increase in number, if not otherwise prevented. When in any nation the standard of intellect and the number of intellectual men have increased, we may expect from the law of the deviation from an average, that prodigies of genius will, as shewn by Mr. Galton, appear somewhat more frequently than before.

In regard to the moral qualities, some elimination of the worst dispositions is always in progress even in the most civilised nations. Malefactors are executed, or imprisoned for long periods, so that they cannot freely transmit their bad qualities. Melancholic and insane persons are confined, or commit suicide. Violent and quarrelsome men often come to a bloody end. The restless who will not follow any steady occupation- and this relic of barbarism is a great check to civilisation [302] - emigrate to newly-settled countries; where they prove useful pioneers. Intemperance is so highly destructive, that the expectation of life of the intemperate, at the age of thirty for instance, is only 13.8 years; whilst for the rural labourers of England at the same age it is 40.59 years. [303] Profligate women bear few children, and profligate men rarely marry; both suffer from disease. In the breeding of domestic animals, the elimination of those individuals, though few in number, which are in any marked manner inferior, is by no means an unimportant element towards success. This especially holds good with injurious characters which tend to reappear through reversion, such as blackness in sheep; and with mankind some of the worst dispositions, which occasionally without any assignable cause make their appearance in families, may perhaps be reversions to a savage state, from which we are not removed by very many generations. This view seems indeed recognised in the common expression that such men are the black sheep of the family.

With civilised nations, as far as an advanced standard of morality, and an increased number of fairly good men are concerned, natural selection apparently effects but little; though the fundamental social instincts were originally thus gained. But I have already said enough, whilst treating of the lower races, on the causes which lead to the advance of morality, namely, the approbation of our fellow-men- the strengthening of our sympathies by habit- example and imitation- reason- experience, and even self-interest- instruction during youth, and religious feelings.

A most important obstacle in civilised countries to an increase in the number of men of a superior class has been strongly insisted on by Mr. Greg and Mr. Galton, [304] namely, the fact that the very poor and reckless, who are often degraded by vice, almost invariably marry early, whilst the careful and frugal, who are generally otherwise virtuous, marry late in life, so that they may be able to support themselves and their children in comfort. Those who marry early produce within a given period not only a greater number of generations, but, as shewn by Dr. Duncan, [305] they produce many more children. The children, moreover, that are borne by mothers during the prime of life are heavier and larger, and therefore probably more vigorous, than those born at other periods. Thus the reckless, degraded, and often vicious members of society, tend to increase at a quicker rate than the provident and generally virtuous members. Or as Mr. Greg puts the case: "The careless, squalid, unambitious Irishman multiplies like rabbits: the frugal, foreseeing, self-respecting, ambitious Scot, stern in his morality, spiritual in his faith, sagacious and disciplined in his intelligence, passes his best years in struggle and in celibacy, marries late, and leaves few behind him. Given a land originally peopled by a thousand Saxons and a thousand Celts- and in a dozen generations five-sixths of the population would be Celts, but five-sixths of the property, of the power, of the intellect, would belong to the one-sixth of Saxons that remained. In the eternal 'struggle for existence,' it

would be the inferior and less favoured race that had prevailed- and prevailed by virtue not of its good qualities but of its faults."

There are, however, some checks to this downward tendency. We have seen that the intemperate suffer from a high rate of mortality, and the extremely profligate leave few offspring. The poorest classes crowd into towns, and it has been proved by Dr. Stark from the statistics of ten years in Scotland,[306] that at all ages the death-rate is higher in towns than in rural districts, "and during the first five years of life the town death-rate is almost exactly double that of the rural districts." As these returns include both the rich and the poor, no doubt more than twice the number of births would be requisite to keep up the number of the very poor inhabitants in the towns, relatively to those in the country. With women, marriage at too early an age is highly injurious; for it has been found in France that, "Twice as many wives under twenty die in the year, as died out of the same number of the unmarried." The mortality, also, of husbands under twenty is "excessively high,"[307] but what the cause of this may be, seems doubtful. Lastly, if the men who prudently delay marrying until they can bring up their families in comfort, were to select, as they often do, women in the prime of life, the rate of increase in the better class would be only slightly lessened.

It was established from an enormous body of statistics, taken during 1853, that the unmarried men throughout France, between the ages of twenty and eighty, die in a much larger proportion than the married: for instance, out of every 1000 unmarried men, between the ages of twenty and thirty, 11.3 annually died, whilst of the married, only 6.5 died.[308] A similar law was proved to hold good, during the years 1863 and 1864, with the entire population above the age of twenty in Scotland: for instance, out of every 1000 unmarried men, between the ages of twenty and thirty, 14.97 annually died, whilst of the married only 7.24 died, that is less than half.[309] Dr. Stark remarks on this, "Bachelorhood is more destructive to life than the most unwholesome trades, or than residence in an unwholesome house or district where there has never been the most distant attempt at sanitary improvement." He considers that the lessened mortality is the direct result of "marriage, and the more regular domestic habits which attend that state." He admits, however, that the intemperate, profligate, and criminal classes, whose duration of life is low, do not commonly marry; and it must likewise be admitted that men with a weak constitution, ill health, or any great infirmity in body or mind, will often not wish to marry, or will be rejected. Dr. Stark seems to have come to the conclusion that marriage in itself is a main cause of prolonged life, from finding that aged married men still have a considerable advantage in this respect over the unmarried of the same advanced age; but every one must have known instances of men, who with weak health during youth did not marry, and yet have survived to old age, though remaining weak, and therefore with a lessened chance of life or of marrying. There is another remarkable circumstance which seems to support Dr. Stark's conclusion, namely, that widows and widowers in France suffer in comparison with the married a very heavy rate of mortality; but Dr. Farr attributes this to the poverty and evil habits consequent on the disruption of the family, and to grief. On the whole we may conclude with Dr. Farr that the lesser mortality of married than of unmarried men, which seems to be a general law, "is mainly due to the constant elimination of imperfect types, and to the skilful selection of the finest individuals out of each successive generation"; the selection relating only to the marriage state, and acting on all corporeal, intellectual, and moral qualities.[310] We may, therefore, infer that sound and good men who out of prudence remain for a time unmarried, do not suffer a high rate of mortality.

If the various checks specified in the two last paragraphs, and perhaps others as yet unknown, do not prevent the reckless, the vicious and otherwise inferior members of society from increasing at a quicker rate than the better class of men, the nation will retrograde, as has too often occurred in the history of the world. We must remember that progress is no invariable rule. It is very difficult to say why one civilised nation rises, becomes more powerful, and spreads more widely, than another; or why the same nation progresses more quickly at one time than at another. We can only say that it depends on an increase in the actual number of the population, on the number of men endowed with high intellectual and moral faculties, as well as on their standard of excellence. Corporeal structure appears to have little influence, except so far as vigour of body leads to vigour of mind.

It has been urged by several writers that as high intellectual powers are advantageous to a nation, the old Greeks, who stood some grades higher in intellect than any race that has ever existed,[311] ought, if the power of natural selection were real, to have risen still higher in the scale, increased in number, and stocked the whole of Europe. Here we have the tacit assumption, so often made with respect to corporeal structures, that there is some innate tendency towards continued development

in mind and body. But development of all kinds depends on many concurrent favourable circumstances. Natural selection acts only tentatively. Individuals and races may have acquired certain indisputable advantages, and yet have perished from failing in other characters. The Greeks may have retrograded from a want of coherence between the many small states, from the small size of their whole country, from the practice of slavery, or from extreme sensuality; for they did not succumb until "they were enervated and corrupt to the very core." [312] The western nations of Europe, who now so immeasurably surpass their former savage progenitors, and stand at the summit of civilisation, owe little or none of their superiority to direct inheritance from the old Greeks, though they owe much to the written works of that wonderful people.

Who can positively say why the Spanish nation, so dominant at one time, has been distanced in the race? The awakening of the nations of Europe from the dark ages is a still more perplexing problem. At that early period, as Mr. Galton has remarked, almost all the men of a gentle nature, those given to meditation or culture of the mind, had no refuge except in the bosom of a Church which demanded celibacy; [313] and this could hardly fail to have had a deteriorating influence on each successive generation. During this same period the Holy Inquisition selected with extreme care the freest and boldest men in order to burn or imprison them. In Spain alone some of the best men- those who doubted and questioned, and without doubting there can be no progress- were eliminated during three centuries at the rate of a thousand a year. The evil which the Catholic Church has thus effected is incalculable, though no doubt counterbalanced to a certain, perhaps to a large, extent in other ways; nevertheless, Europe has progressed at an unparalleled rate.

The remarkable success of the English as colonists, compared to other European nations, has been ascribed to their "daring and persistent energy"; a result which is well illustrated by comparing the progress of the Canadians of English and French extraction; but who can say how the English gained their energy? There is apparently much truth in the belief that the wonderful progress of the United States, as well as the character of the people, are the results of natural selection; for the more energetic, restless, and courageous men from all parts of Europe have emigrated during the last ten or twelve generations to that great country, and have there succeeded best. [314] Looking to the distant future, I do not think that the Rev. Mr. Zincke takes an exaggerated view when he says: [315] "All other series of events- as that which resulted in the culture of mind in Greece, and that which resulted in the empire of Rome- only appear to have purpose and value when viewed in connection with, or rather as subsidiary to... the great stream of Anglo-Saxon emigration to the west." Obscure as is the problem of the advance of civilisation, we can at least see that a nation which produced during a lengthened period the greatest number of highly intellectual, energetic, brave, patriotic, and benevolent men, would generally prevail over less favoured nations.

Natural selection follows from the struggle for existence; and this from a rapid rate of increase. It is impossible not to regret bitterly, but whether wisely is another question, the rate at which man tends to increase; for this leads in barbarous tribes to infanticide and many other evils, and in civilised nations to abject poverty, celibacy, and to the late marriages of the prudent. But as man suffers from the same physical evils as the lower animals, he has no right to expect an immunity from the evils consequent on the struggle for existence. Had he not been subjected during primeval times to natural selection, assuredly he would never have attained to his present rank. Since we see in many parts of the world enormous areas of the most fertile land capable of supporting numerous happy homes, but peopled only by a few wandering savages, it might be argued that the struggle for existence had not been sufficiently severe to force man upwards to his highest standard. Judging from all that we know of man and the lower animals, there has always been sufficient variability in their intellectual and moral faculties, for a steady advance through natural selection. No doubt such advance demands many favourable concurrent circumstances; but it may well be doubted whether the most favourable would have sufficed, had not the rate of increase been rapid, and the consequent struggle for existence extremely severe. It even appears from what we see, for instance, in parts of S. America, that a people which may be called civilised, such as the Spanish settlers, is liable to become indolent and to retrograde, when the conditions of life are very easy. With highly civilised nations continued progress depends in a subordinate degree on natural selection; for such nations do not supplant and exterminate one another as do savage tribes. Nevertheless the more intelligent members within the same community will succeed better in the long run than the inferior, and leave a more numerous progeny, and this is a form of natural selection. The more efficient causes of progress seem to consist of a good education during youth whilst the brain is impressible, and of a high standard of excellence, inculcated by the ablest and best men, embodied in the laws, customs and traditions of the nation, and enforced by public

opinion. It should, however, be borne in mind, that the enforcement of public opinion depends on our appreciation of the approbation and disapprobation of others; and this appreciation is founded on our sympathy, which it can hardly be doubted was originally developed through natural selection as one of the most important elements of the social instincts.[316]

On the evidence that all civilised nations were once barbarous.- The present subject has been treated in so full and admirable a manner by Sir J. Lubbock,[317] Mr. Tylor, Mr. M'Lennan, and others, that I need here give only the briefest summary of their results. The arguments recently advanced by the Duke of Argyll[318] and formerly by Archbishop Whately, in favour of the belief that man came into the world as a civilised being, and that all savages have since undergone degradation, seem to me weak in comparison with those advanced on the other side. Many nations, no doubt, have fallen away in civilisation, and some may have lapsed into utter barbarism, though on this latter head I have met with no evidence. The Fuegians were probably compelled by other conquering hordes to settle in their inhospitable country, and they may have become in consequence somewhat more degraded; but it would be difficult to prove that they have fallen much below the Botocudos, who inhabit the finest parts of Brazil.

The evidence that all civilised nations are the descendants of barbarians, consists, on the one side, of clear traces of their former low condition in still-existing customs, beliefs, language, &c.; and on the other side, of proofs that savages are independently able to raise themselves a few steps in the scale of civilisation, and have actually thus risen. The evidence on the first head is extremely curious, but cannot be here given: I refer to such cases as that of the art of enumeration, which, as Mr. Tylor clearly shews by reference to the words still used in some places, originated in counting the fingers, first of one hand and then of the other, and lastly of the toes. We have traces of this in our own decimal system, and in the Roman numerals, where, after the V, which is supposed to be an abbreviated picture of a human hand, we pass on to VI, &c., when the other hand no doubt was used. So again, "When we speak of three-score and ten, we are counting by the vigesimal system, each score thus ideally made, standing for 20- for 'one man' as a Mexican or Carib would put it." [319] According to a large and increasing school of philologists, every language bears the marks of its slow and gradual evolution. So it is with the art of writing, for letters are rudiments of pictorial representations. It is hardly possible to read Mr. M'Lennan's work [320] and not admit that almost all civilised nations still retain traces of such rude habits as the forcible capture of wives. What ancient nation, as the same author asks, can be named that was originally monogamous? The primitive idea of justice, as shewn by the law of battle and other customs of which vestiges still remain, was likewise most rude. Many existing superstitions are the remnants of former false religious beliefs. The highest form of religion- the grand idea of God hating sin and loving righteousness- was unknown during primeval times.

Turning to the other kind of evidence: Sir J. Lubbock has shewn that some savages have recently improved a little in some of their simpler arts. From the extremely curious account which he gives of the weapons, tools, and arts, in use amongst savages in various parts of the world, it cannot be doubted that these have nearly all been independent discoveries, excepting perhaps the art of making fire.[321] The Australian boomerang is a good instance of one such independent discovery. The Tahitians when first visited had advanced in many respects beyond the inhabitants of most of the other Polynesian islands. There are no just grounds for the belief that the high culture of the native Peruvians and Mexicans was derived from abroad; [322] many native plants were there cultivated, and a few native animals domesticated. We should bear in mind that, judging from the small influence of most missionaries, a wandering crew from some semicivilised land, if washed to the shores of America, would not have produced any marked effect on the natives, unless they had already become somewhat advanced. Looking to a very remote period in the history of the world, we find, to use Sir J. Lubbock's well-known terms, a paleolithic and neolithic period; and no one will pretend that the art of grinding rough flint tools was a borrowed one. In all parts of Europe, as far east as Greece, in Palestine, India, Japan, New Zealand, and Africa, including Egypt, flint tools have been discovered in abundance; and of their use the existing inhabitants retain no tradition. There is also indirect evidence of their former use by the Chinese and ancient Jews. Hence there can hardly be a doubt that the inhabitants of these countries, which include nearly the whole civilised world, were once in a barbarous condition. To believe that man was aboriginally civilised and then suffered utter degradation in so many regions, is to take a pitifully low view of human nature. It is apparently a truer and more cheerful view that progress has been much more general than retrogression; that man has risen, though by slow and interrupted steps, from a lowly condition to the highest standard as yet attained by him in knowledge, morals and religion.

(go on to chapter 6)

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Footnotes

[286] *Anthropological Review*, May, 1864, p. clviii.

[287] After a time the members of tribes which are absorbed into another tribe assume, as Sir Henry Maine remarks (*Ancient Law*, 1861, p. 131), that they are the co-descendants of the same ancestors

[288] Morlot, *Soc. Vaud. Sc. Nat.*, 1860, p. 294.

[289] I have given instances in my *Variation of Animals under Domestication*, vol. ii., p. 196.

[290] See a remarkable series of articles on "Physics and Politics," in the *Fortnightly Review*, Nov., 1867; April 1, 1868; July 1, 1869, since separately published.

[291] Mr. Wallace gives cases in his *Contributions to the Theory of Natural Selection*, 1870, p. 354.

[292] *Ancient Law*, 1861, p. 22. For Mr. Bagehot's remarks, *Fortnightly Review*, April 1, 1868, p. 452

[293] *The Variation of Animals and Plants under Domestication*, vol. i., p. 309.

[294] *Fraser's Magazine*, Sept., 1868, p. 353. This article seems to have struck many persons, and has given rise to two remarkable essays and a rejoinder in the *Spectator*, Oct. 3 and 17, 1868. It has also been discussed in the *Quarterly Journal of Science*, 1869, p. 152, and by Mr. Lawson Tait in the *Dublin Quarterly Journal of Medical Science*, Feb., 1869, and by Mr. E. Ray Lankester in his *Comparative Longevity*, 1870, p. 128. Similar views appeared previously in the *Australasian*, July 13, 1867. I have borrowed ideas from several of these writers

[295] For Mr. Wallace, see *Anthropological Review*, as before cited. Mr. Galton in *Macmillan's Magazine*, Aug., 1865, p. 318; also his great work, *Hereditary Genius*, 1870.

[296] Prof. H. Fick (*Einfluss der Naturwissenschaft auf das Recht*, June, 1872) has some good remarks on this head, and on other such points.

[297] *Hereditary Genius*, 1870, pp. 132-140.

[298] Quatrefages, *Revue des Cours Scientifiques* 1867-68, p. 659

[299] See the fifth and sixth columns compiled from good authorities, in the table given in Mr. E. R. Lankester's *Comparative Longevity*, 1870, p. 115.

[300] *Hereditary Genius*, 1870, p. 330

[301] *Origin of Species*.(OOS)

[302] *Hereditary Genius*, 1870, p. 347

[303] E Ray Lankester, *Comparative Longevity*, 1870, p. 115. The table of the intemperate is from Neison's *Vital Statistics*. In regard to profligacy, see Dr. Farr, "Influence of Marriage on Mortality," *Nat. Assoc. for the Promotion of Social Science*, 1858.

[304] *Fraser's Magazine*, Sept., 1868, p. 353. *Macmillan's Magazine*, Aug., 1865, p. 318. The Rev. F. W. Farrar (*Fraser's Magazine*, Aug., 1870, p. 264) takes a different view

[305] "On the Laws of the Fertility of Women," in *Transactions of the Royal Society, Edinburgh*, vol. xxiv., p. 287; now published separately under the title of *Fecundity, Fertility, and Sterility*, 1871. See, also, Mr. Galton, *Hereditary Genius* pp. 352-357, for observations to the above effect.

[306] Tenth Annual Report of Births, Deaths, &c., in Scotland, 1867, p. xxix

[307] These quotations are taken from our highest authority on such questions, namely, Dr. Farr, in his paper "On the Influence of Marriage on the Mortality of the French People," read before the Nat. Assoc. for the Promotion of Social Science, 1858.

[308] Dr. Farr, *ibid.* The quotations given below are extracted from the same striking paper

[309] I have taken the mean of the quinquennial means, given in the Tenth Annual Report of Births, Deaths, &c., in Scotland, 1867. The quotation from Dr. Stark is copied from an article in the Daily News, Oct. 17, 1868. which Dr. Farr considers very carefully written

[310] Dr. Duncan remarks (Fecundity, Fertility, &c., 1871, p. 334) on this subject: "At every age the healthy and beautiful go over from the unmarried side to the married, leaving the unmarried columns crowded with the sickly and unfortunate."

[311] See the ingenious and original argument on this subject by Mr. Galton, Hereditary Genius, pp. 340-342

[312] Mr. Greg, Fraser's Magazine, Sept., 1868, p. 357.

[313] Hereditary Genius, 1870, pp. 357-359. The Rev. F. W. Farrar (Fraser's Magazine, Aug., 1870, p. 257) advances arguments on the other side. Sir C. Lyell had already (Principles of Geology, vol. ii., 1868, p. 489), in a striking passage, called attention to the evil influence of the Holy Inquisition in having, through selection, lowered the general standard of intelligence in Europe.

[314] Mr. Galton, Macmillan's Magazine, August, 1865, p. 325. See also, Nature, "On Darwinism and National Life," Dec., 1869, p. 184

[315] Last Winter in the United States, 1868, p. 29.

[316] I am much indebted to Mr. John Morley for some good criticisms on this subject: see, also Broca, "Les Selections," Revue d'Anthropologie, 1872.

[317] "On the Origin of Civilisation," Proceedings of the Ethnological Society, Nov. 26, 1867

[318] Primeval Man, 1869.

[319] Royal Institution of Great Britain, March 15, 1867. Also, Researches into the Early History of Mankind, 1865

[320] Primitive Marriage, 1865. See, likewise, an excellent article, evidently by the same author, in the North British Review, July, 1869. Also, Mr. L. H. Morgan, "A Conjectural Solution of the Origin of the Class, System of Relationship," in Proc. American Acad. of Sciences, vol. vii., Feb., 1868. Prof. Schaaffhausen (Anthropolog. Review, Oct., 1869, p. 373) remarks on "the vestiges of human sacrifices found both in Homer and the Old Testament."

[321] Sir J. Lubbock, Prehistoric Times, 2nd ed., 1869, chaps. xv. and xvi. et passim. See also the excellent 9th chapter in Tylor's Early History of Mankind, 2nd ed., 1870

[322] Dr. F. Muller has made some good remarks to this effect in the Reise der Novara: Anthropolog. Theil, Abtheil. iii., 1868, s. 127.

Chapter VI

ON THE AFFINITIES AND GENEALOGY OF MAN.

Even if it be granted that the difference between man and his nearest allies is as great in corporeal structure as some naturalists maintain, and although we must grant that the difference between them is immense in mental power, yet the facts given in the earlier chapters appear to declare, in the plainest manner, that man is descended from some lower form, notwithstanding that connecting-links have not hitherto been discovered.

Man is liable to numerous, slight, and diversified variations, which are induced by the same general causes, are governed and transmitted in accordance with the same general laws, as in the lower animals. Man has multiplied so rapidly, that he has necessarily been exposed to struggle for existence, and consequently to natural selection. He has given rise to many races, some of which differ so much from each other, that they have often been ranked by naturalists as distinct species. His body is constructed on the same homological plan as that of other mammals. He passes through the same phases of embryological development. He retains many rudimentary and useless structures, which no doubt were once serviceable. Characters occasionally make their re-appearance in him, which we have reason to believe were possessed by his early progenitors. If the origin of man had been wholly different from that of all other animals, these various appearances would be mere empty deceptions; but such an admission is incredible. These appearances, on the other hand, are intelligible, at least to a large extent, if man is the co-descendant with other mammals of some unknown and lower form.

Some naturalists, from being deeply impressed with the mental and spiritual powers of man, have divided the whole organic world into three kingdoms, the Human, the Animal, and the Vegetable, thus giving to man a separate kingdom.[323] Spiritual powers cannot be compared or classed by the naturalist: but he may endeavour to shew, as I have done, that the mental faculties of man and the lower animals do not differ in kind, although immensely in degree. A difference in degree, however great, does not justify us in placing man in a distinct kingdom, as will perhaps be best illustrated by comparing the mental powers of two insects, namely, a coccus or scale-insect and an ant, which undoubtedly belong to the same class. The difference is here greater than, though of a somewhat different kind from, that between man and the highest mammal. The female coccus, whilst young, attaches itself by its proboscis to a plant; sucks the sap, but never moves again; is fertilised and lays eggs; and this is its whole history. On the other hand, to describe the habits and mental powers of worker-ants, would require, as Pierre Huber has shewn, a large volume; I may, however, briefly specify a few points. Ants certainly communicate information to each other, and several unite for the same work, or for games of play. They recognise their fellow-ants after months of absence, and feel sympathy for each other. They build great edifices, keep them clean, close the doors in the evening, and post sentries. They make roads as well as tunnels under rivers, and temporary bridges over them, by clinging together. They collect food for the community, and when an object, too large for entrance, is brought to the nest, they enlarge the door, and afterwards build it up again. They store up seeds, of which they prevent the germination, and which, if damp, are brought up to the surface to dry. They keep aphides and other insects as milchcows. They go out to battle in regular bands, and freely sacrifice their lives for the common weal. They emigrate according to a preconcerted plan. They capture slaves. They move the eggs of their aphides, as well as their own eggs and cocoons, into warm parts of the nest, in order that they may be quickly hatched; and endless similar facts could be given.[324] On the whole, the difference in mental power between an ant and a coccus is immense; yet no one has ever dreamed of placing these insects in distinct classes, much less in distinct kingdoms. No doubt the difference is bridged over by other insects; and this is not the case with man and the higher apes. But we have every reason to believe that the breaks in the series are simply the results of many forms having become extinct.

Professor Owen, relying chiefly on the structure of the brain, has divided the mammalian series into four sub-classes. One of these he devotes to man; in another he places both the marsupials and the Monotremata; so that he makes man as distinct from all other mammals as are these two latter groups conjoined. This view has not been accepted, as far as I am aware, by any naturalist capable of forming an independent judgment, and therefore need not here be further considered.

We can understand why a classification founded on any single character or organ- even an organ so wonderfully complex and important as the brain- or on the high development of the mental

faculties, is almost sure to prove unsatisfactory. This principle has indeed been tried with hymenopterous insects; but when thus classed by their habits or instincts, the arrangement proved thoroughly artificial.[325] Classifications may, of course, be based on any character whatever, as on size, colour, or the element inhabited; but naturalists have long felt a profound conviction that there is a natural system. This system, it is now generally admitted, must be, as far as possible, genealogical in arrangement,- that is, the co-descendants of the same form must be kept together in one group, apart from the co-descendants of any other form; but if the parent-forms are related, so will be their descendants, and the two groups together will form a larger group. The amount of difference between the several groups- that is the amount of modification which each has undergone- is expressed by such terms as genera, families, orders, and classes. As we have no record of the lines of descent, the pedigree can be discovered only by observing the degrees of resemblance between the beings which are to be classed. For this object numerous points of resemblance are of much more importance than the amount of similarity or dissimilarity in a few points. If two languages were found to resemble each other in a multitude of words and points of construction, they would be universally recognised as having sprung from a common source, notwithstanding that they differed greatly in some few words or points of construction. But with organic beings the points of resemblance must not consist of adaptations to similar habits of life: two animals may, for instance, have had their whole frames modified for living in the water, and yet they will not be brought any nearer to each other in the natural system. Hence we can see how it is that resemblances in several unimportant structures, in useless and rudimentary organs, or not now functionally active, or in an embryological condition, are by far the most serviceable for classification; for they can hardly be due to adaptations within a late period; and thus they reveal the old lines of descent or of true affinity.

We can further see why a great amount of modification in some one character ought not to lead us to separate widely any two organisms. A part which already differs much from the same part in other allied forms has already, according to the theory of evolution, varied much; consequently it would (as long as the organism remained exposed to the same exciting conditions) be liable to further variations of the same kind; and these, if beneficial, would be preserved, and thus be continually augmented. In many cases the continued development of a part, for instance, of the beak of a bird, or of the teeth of a mammal, would not aid the species in gaining its food, or for any other object; but with man we can see no definite limit to the continued development of the brain and mental faculties, as far as advantage is concerned. Therefore in determining the position of man in the natural or genealogical system, the extreme development of his brain ought not to outweigh a multitude of resemblances in other less important or quite unimportant points.

The greater number of naturalists who have taken into consideration the whole structure of man, including his mental faculties, have followed Blumenbach and Cuvier, and have placed man in a separate Order, under the title of the Bimana, and therefore on an equality with the orders of the Quadrumana, Carnivora, &c. Recently many of our best naturalists have recurred to the view first propounded by Linnaeus, so remarkable for his sagacity, and have placed man in the same Order with the Quadrumana, under the title of the primates. The justice of this conclusion will be admitted: for in the first place, we must bear in mind the comparative insignificance for classification of the great development of the brain in man, and that the strongly-marked differences between the skulls of man and the Quadrumana (lately insisted upon by Bischoff, Aeby, and others) apparently follow from their differently developed brains. In the second place, we must remember that nearly all the other and more important differences between man and the Quadrumana are manifestly adaptive in their nature, and relate chiefly to the erect position of man; such as the structure of his hand, foot, and pelvis, the curvature of his spine, and the position of his head. The family of seals offers a good illustration of the small importance of adaptive characters for classification. These animals differ from all other Carnivora in the form of their bodies and in the structure of their limbs, far more than does man from the higher apes; yet in most systems, from that of Cuvier to the most recent one by Mr. Flower, [326] seals are ranked as a mere family in the Order of the Carnivora. If man had not been his own classifier, he would never have thought of founding a separate order for his own reception.

It would be beyond my limits, and quite beyond my knowledge, even to name the innumerable points of structure in which man agrees with the other primates. Our great anatomist and philosopher, Prof. Huxley, has fully discussed this subject,[327] and concludes that man in all parts of his organization differs less from the higher apes, than these do from the lower members of the same group. Consequently there "is no justification for placing man in a distinct order."

In an early part of this work I brought forward various facts, shewing how closely man agrees in constitution with the higher mammals; and this agreement must depend on our close similarity in minute structure and chemical composition. I gave, as instances, our liability to the same diseases, and to the attacks of allied parasites; our tastes in common for the same stimulants, and the similar effects produced by them, as well as by various drugs, and other such facts.

As small unimportant points of resemblance between man and the *Quadrumania* are not commonly noticed in systematic works, and as, when numerous, they clearly reveal our relationship, I will specify a few such points. The relative position of our features is manifestly the same; and the various emotions are displayed by nearly similar, movements of the muscles and skin, chiefly above the eyebrows and round the mouth. Some few expressions are, indeed, almost the same, as in the weeping of certain kinds of monkeys and in the laughing noise made by others, during which the corners of the mouth are drawn backwards, and the lower eyelids wrinkled. The external ears are curiously alike. In man the nose is much more prominent than in most monkeys; but we may trace the commencement of an aquiline curvature in the nose of the Hoolock gibbon; and this in the *Semnopithecus nasica* is carried to a ridiculous extreme.

The faces of many monkeys are ornamented with beards, whiskers, or moustaches. The hair on the head grows to a great length in some species of *Semnopithecus*;^[328] and in the bonnet monkey (*Macacus radiatus*) it radiates from a point on the crown, with a parting down the middle. It is commonly said that the forehead gives to man his noble and intellectual appearance; but the thick hair on the head of the bonnet monkey terminates downwards abruptly, and is succeeded by hair so short and fine that at a little distance the forehead, with the exception of the eyebrows, appears quite naked. It has been erroneously asserted that eyebrows are not present in any monkey. In the species just named the degree of nakedness of the forehead differs in different individuals; and Eschricht states^[329] that in our children the limit between the hairy scalp and the naked forehead is sometimes not well defined; so that here we seem to have a trifling case of reversion to a progenitor, in whom the forehead had not as yet become quite naked.

It is well known that the hair on our arms tends to converge from above and below to a point at the elbow. This curious arrangement, so unlike that in most of the lower mammals, is common to the gorilla, chimpanzee, orang, some species of *Hylobates*, and even to some few American monkeys. But in *Hylobates agilis* the hair on the forearm is directed downwards or towards the wrist in the ordinary manner; and in *H. lar* it is nearly erect, with only a very slight forward inclination; so that in this latter species it is in a transitional state. It can hardly be doubted that with most mammals the thickness of the hair on the back and its direction, is adapted to throw off the rain; even the transverse hairs on the fore-legs of a dog may serve for this end when he is coiled up asleep. Mr. Wallace, who has carefully studied the habits of the orang, remarks that the convergence of the hair towards the elbow on the arms of the orang may be explained as serving to throw off the rain, for this animal during rainy weather sits with its arms bent, and with the hands clasped round a branch or over its head. According to Livingstone, the gorilla also "sits in pelting rain with his hands over his head."^[330] If the above explanation is correct, as seems probable, the direction of the hair on our own arms offers a curious record of our former state; for no one supposes that it is now of any use in throwing off the rain; nor, in our present erect condition, is it properly directed for this purpose.

It would, however, be rash to trust too much to the principle of adaptation in regard to the direction of the hair in man or his early progenitors; for it is impossible to study the figures given by Eschricht of the arrangement of the hair on the human foetus (this being the same as in the adult) and not agree with this excellent observer that other and more complex causes have intervened. The points of convergence seem to stand in some relation to those points in the embryo which are last closed in during development. There appears, also, to exist some relation between the arrangement of the hair on the limbs, and the course of the medullary arteries.^[331]

It must not be supposed that the resemblances between man and certain apes in the above and in many other points- such as in having a naked forehead, long tresses on the head, &c.,- are all necessarily the result of unbroken inheritance from a common progenitor, or of subsequent reversion. Many of these resemblances are more probably due to analogous variation, which follows, as I have elsewhere attempted to shew,^[332] from co-descended organisms having a similar constitution, and having been acted on by like causes inducing similar modifications. With respect to the similar direction of the hair on the fore-arms of man and certain monkeys, as this

character is common to almost all the anthropomorphous apes, it may probably be attributed to inheritance; but this is not certain, as some very distinct American monkeys are thus characterised.

Although, as we have now seen, man has no just right to form a separate Order for his own reception, he may perhaps claim a distinct sub-order or family. Prof. Huxley, in his last work,[333] divides the primates into three suborders; namely, the Anthropidae with man alone, the Simiadae including monkeys of all kinds, and the Lemuridae with the diversified genera of lemurs. As far as differences in certain important points of structure are concerned, man may no doubt rightly claim the rank of a sub-order; and this rank is too low, if we look chiefly to his mental faculties. Nevertheless, from a genealogical point of view it appears that this rank is too high, and that man ought to form merely a family, or possibly even only a sub-family. If we imagine three lines of descent proceeding from a common stock, it is quite conceivable that two of them might after the lapse of ages be so slightly changed as still to remain as species of the same genus, whilst the third line might become so greatly modified as to deserve to rank as a distinct sub-family, or even Order. But in this case it is almost certain that the third line would still retain through inheritance numerous small points of resemblance with the other two. Here, then, would occur the difficulty, at present insoluble, how much weight we ought to assign in our classifications to strongly-marked differences in some few points,- that is, to the amount of modification undergone; and how much to close resemblance in numerous unimportant points, as indicating the lines of descent or genealogy. To attach much weight to the few but strong differences is the most obvious and perhaps the safest course, though it appears more correct to pay great attention to the many small resemblances, as giving a truly natural classification.

In forming a judgment on this head with reference to man, we must glance at the classification of the Simiadae. This family is divided by almost all naturalists into the catarrhine group, or Old World monkeys, all of which are characterised (as their name expresses) by the peculiar structure of their nostrils, and by having four premolars in each jaw; and into the platyrrhine group or New World monkeys (including two very distinct sub-groups), all of which are characterised by differently constructed nostrils, and by having six premolars in each jaw. Some other small differences might be mentioned. Now man unquestionably belongs in his dentition, in the structure of his nostrils, and some other respects, to the catarrhine or Old World division; nor does he resemble the platyrrhines more closely than the catarrhines in any characters, excepting in a few of not much importance and apparently of an adaptive nature. It is therefore against all probability that some New World species should have formerly varied and produced a man-like creature, with all the distinctive characters proper to the Old World division; losing at the same time all its own distinctive characters. There can, consequently, hardly be a doubt that man is an off-shoot from the Old World simian stem; and that under a genealogical point of view he must be classed with the catarrhine division.[334]

The anthropomorphous apes, namely the gorilla, chimpanzee, orang, and Hylobates, are by most naturalists separated from the other Old World monkeys, as a distinct sub-group. I am aware that Gratiolet, relying on the structure of the brain, does not admit the existence of this sub-group, and no doubt it is a broken one. Thus the orang, as Mr. St. G. Mivart remarks, "is one of the most peculiar and aberrant forms to be found in the Order." [335] The remaining non-anthropomorphous Old World monkeys, are again divided by some naturalists into two or three smaller subgroups; the genus *Semnopithecus*, with its peculiar sacculated stomach, being the type of one sub-group. But it appears from M. Gaudry's wonderful discoveries in Attica, that during the Miocene period a form existed there, which connected *Semnopithecus* and *Macacus*; and this probably illustrates the manner in which the other and higher groups were once blended together.

If the anthropomorphous apes be admitted to form a natural sub-group, then as man agrees with them, not only in all those characters which he possesses in common with the whole catarrhine group, but in other peculiar characters, such as the absence of a tail and of callosities, and in general appearance, we may infer that some ancient member of the anthropomorphous sub-group gave birth to man. It is not probable that, through the law of analogous variation, a member of one of the other lower sub-groups should have given rise to a man-like creature, resembling the higher anthropomorphous apes in so many respects. No doubt man, in comparison with most of his allies, has undergone an extraordinary amount of modification, chiefly in consequence of the great development of his brain and his erect position; nevertheless, we should bear in mind that he "is but one of several exceptional forms of primates." [336]

Every naturalist, who believes in the principle of evolution, will grant that the two main divisions of

the Simiadae, namely the catarrhine and platyrrhine monkeys, with their sub-groups, have all proceeded from some one extremely ancient progenitor. The early descendants of this progenitor, before they had diverged to any considerable extent from each other, would still have formed a single natural group; but some of the species or incipient genera would have already begun to indicate by their diverging characters the future distinctive marks of the catarrhine and platyrrhine divisions. Hence the members of this supposed ancient group would not have been so uniform in their dentition, or in the structure of their nostrils, as are the existing catarrhine monkeys in one way and the platyrrhines in another way, but would have resembled in this respect the allied Lemnidae, which differ greatly from each other in the form of their muzzles,[337] and to an extraordinary degree in their dentition.

The catarrhine and platyrrhine monkeys agree in a multitude of characters, as is shewn by their unquestionably belonging to one and the same Order. The many characters which they possess in common can hardly have been independently acquired by so many distinct species; so that these characters must have been inherited. But a naturalist would undoubtedly have ranked as an ape or a monkey, an ancient form which possessed many characters common to the catarrhine and platyrrhine monkeys, other characters in an intermediate condition, and some few, perhaps, distinct from those now found in either group. And as man from a genealogical point of view belongs to the catarrhine or Old World stock, we must conclude, however much the conclusion may revolt our pride, that our early progenitors would have been properly thus designated.[338] But we must not fall into the error of supposing that the early progenitors of the whole simian stock, including man, was identical with, or even closely resembled, any existing ape or monkey.

On the Birthplace and Antiquity of Man.- We are naturally led to enquire, where was the birthplace of man at that stage of descent when our progenitors diverged from the catarrhine stock? The fact that they belonged to the stock clearly shews that they inhabited the Old World; but not Australia nor any oceanic island, as we may infer from the laws of geographical distribution. In each great region of the world the living mammals are closely related to the extinct species of the same region. It is therefore probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's nearest allies, it is somewhat more probable that our early progenitors lived on the African continent than elsewhere. But it is useless to speculate on this subject; for two or three anthropomorphous apes, one the *Dryopithecus*[339] of Lartet, nearly as large as a man, and closely allied to *Hylobates*, existed in Europe during the Miocene age; and since so remote a period the earth has certainly undergone many great revolutions, and there has been ample time for migration on the largest scale.

At the period and place, whenever and wherever it was, when man first lost his hairy covering, he probably inhabited a hot country; a circumstance favourable for the frugi-ferous diet on which, judging from analogy, he subsisted. We are far from knowing how long ago it was when man first diverged from the catarrhine stock; but it may have occurred at an epoch as remote as the Eocene period; for that the higher apes had diverged from the lower apes as early as the Upper Miocene period is shewn by the existence of the *Dryopithecus*. We are also quite ignorant at how rapid a rate organisms, whether high or low in the scale, may be modified under favourable circumstances; we know, however, that some have retained the same form during an enormous lapse of time. From what we see going on under domestication, we learn that some of the co-descendants of the same species may be not at all, some a little, and some greatly changed, all within the same period. Thus it may have been with man, who has undergone a great amount of modification in certain characters in comparison with the higher apes.

The great break in the organic chain between man and his nearest allies, which cannot be bridged over by any extinct or living species, has often been advanced as a grave objection to the belief that man is descended from some lower form; but this objection will not appear of much weight to those who, from general reasons, believe in the general principle of evolution. Breaks often occur in all parts of the series, some being wide, sharp and defined, others less so in various degrees; as between the orang and its nearest allies- between the *Tarsius* and the other Lemnidae- between the elephant, and in a more striking manner between the *Ornithorhynchus* or *Echidna*, and all other mammals. But these breaks depend merely on the number of related forms which have become extinct. At some future period, not very distant as measured by centuries, the civilised races of man will almost certainly exterminate, and replace, the savage races throughout the world. At the same time the anthropomorphous apes, as Professor Schaaffhausen has remarked,[340] will no doubt be exterminated. The break between man and his nearest allies will then be wider, for it will intervene

between man in a more civilised state, as we may hope, even than the Caucasian, and some ape as low as a baboon, instead of as now between the negro or Australian and the gorilla.

With respect to the absence of fossil remains, serving to connect man with his ape-like progenitors, no one will lay much stress on this fact who reads Sir C. Lyell's discussion,[341] where he shews that in all the vertebrate classes the discovery of fossil remains has been a very slow and fortuitous process. Nor should it be forgotten that those regions which are the most likely to afford remains connecting man with some extinct ape-like creature, have not as yet been searched by geologists.

Lower Stages in the Genealogy of Man.- We have seen that man appears to have diverged from the catarrhine or Old World division of the Simiadae, after these had diverged from the New World division. We will now endeavour to follow the remote traces of his genealogy, trusting principally to the mutual affinities between the various classes and orders, with some slight reference to the periods, as far as ascertained, of their successive appearance on the earth. The Lemuridae stand below and near to the Simiadae, and constitute a very distinct family of the primates, or, according to Haeckel and others, a distinct Order. This group is diversified and broken to an extraordinary degree, and includes many aberrant forms. It has, therefore, probably suffered much extinction. Most of the remnants survive on islands, such as Madagascar and the Malayan archipelago, where they have not been exposed to so severe a competition as they would have been on well-stocked continents. This group likewise presents many gradations, leading, as Huxley remarks,[342] "insensibly from the crown and summit of the animal creation down to creatures from which there is but a step, as it seems, to the lowest, smallest, and least intelligent of the placental mammalia." From these various considerations it is probable that the Simiadae were originally developed from the progenitors of the existing Lemuridae; and these in their turn from forms standing very low in the mammalian series.

The marsupials stand in many important characters below the placental mammals. They appeared at an earlier geological period, and their range was formerly much more extensive than at present. Hence the Placentata are generally supposed to have been derived from the Implacentata or marsupials; not, however, from forms closely resembling the existing marsupials, but from their early progenitors. The Monotremata are plainly allied to the marsupials, forming a third and still lower division in the great mammalian series. They are represented at the present day solely by the Ornithorhynchus and Echidna; and these two forms may be safely considered as relics of a much larger group, representatives of which have been preserved in Australia through some favourable concurrence of circumstances. The Monotremata are eminently interesting, as leading in several important points of structure towards the class of reptiles.

In attempting to trace the genealogy of the Mammalia, and therefore of man, lower down in the series, we become involved in greater and greater obscurity; but as a most capable judge, Mr. Parker, has remarked, we have good reason to believe, that no true bird or reptile intervenes in the direct line of descent. He who wishes to see what ingenuity and knowledge can effect, may consult Prof. Haeckel's works.[343] I will content myself with a few general remarks. Every evolutionist will admit that the five great vertebrate classes, namely, mammals, birds, reptiles, amphibians, and fishes, are descended from some one prototype; for they have much in common, especially during their embryonic state. As the class of fishes is the most lowly organised, and appeared before the others, we may conclude that all the members of the vertebrate kingdom are derived from some fishlike animal. The belief that animals so distinct as a monkey, an elephant, a humming-bird, a snake, a frog, and a fish, &c., could all have sprung from the same parents, will appear monstrous to those who have not attended to the recent progress of natural history. For this belief implies the former existence of links binding closely together all these forms, now so utterly unlike.

Nevertheless, it is certain that groups of animals have existed, or do now exist, which serve to connect several of the great vertebrate classes more or less closely. We have seen that the Ornithorhynchus graduates towards reptiles; and Prof. Huxley has discovered, and is confirmed by Mr. Cope and others, that the dinosaurians are in many important characters intermediate between certain reptiles and certain birds- the birds referred to being the ostrich-tribe (itself a widely diffused remnant of a larger group) and the Archeopteryx, that strange secondary bird, with a long lizard-like tail. Again, according to Prof. Owen, [344] the ichthyosaurians - great sea-lizards furnished with paddles - present many affinities with fishes, or rather, according to Huxley, with amphibians; a class which, including in its highest division frogs and toads, is plainly allied to the ganoid fishes. These latter fishes swarmed during the earlier geological periods, and were constructed on what is

called a generalised type, that is, they presented diversified affinities with other groups of organisms. The *Lepidosiren* is also so closely allied to amphibians and fishes, that naturalists long disputed in which of these two classes to rank it; it, and also some few ganoid fishes, have been preserved from utter extinction by inhabiting rivers, which are harbours of refuge, and are related to the great waters of the ocean in the same way that islands are to continents.

Lastly, one single member of the immense and diversified class of fishes, namely, the lancelet or amphioxus, is so different from all other fishes, that Haeckel maintains that it ought to form a distinct class in the vertebrate kingdom. This fish is remarkable for its negative characters; it can hardly be said to possess a brain, vertebral column, or heart, &c.; so that it was classed by the older naturalists amongst the worms. Many years ago Prof. Good sir perceived that the lancelet presented some affinities with the ascidians, which are invertebrate, hermaphrodite, marine creatures permanently attached to a support. They hardly appear like animals, and consist of a simple, tough, leathery sack, with two small projecting orifices. They belong to the *Mollusca* of Huxley- a lower division of the great kingdom of the *Mollusca*; but they have recently been placed by some naturalists amongst the *Vermes* or worms. Their larvae somewhat resemble tadpoles in shape,[345] and have the power of swimming freely about. Mr. Kovalevsky[346] has lately observed that the larvae of ascidians are related to the *Vertebrata*, in their manner of development, in the relative position of the nervous system, and in possessing a structure closely like the *chorda dorsalis* of vertebrate animals; and in this he has been since confirmed by Prof. Kupffer. M. Kovalevsky writes to me from Naples, that he has now carried these observations yet further, and should his results be well established, the whole will form a discovery of the very greatest value. Thus, if we may rely on embryology, ever safest guide in classification, it seems that we have at last gained a clue to the source whence the *Vertebrata* were derived.[347] We should then be justified in believing that at an extremely remote period a group of animals existed, resembling in many respects the larvae of our present ascidians, which diverged into two great branches- the one retrograding in development and producing the present class of ascidians, the other rising to the crown and summit of the animal kingdom by giving birth to the *Vertebrata*.

We have thus far endeavoured rudely to trace the genealogy of the *Vertebrata* by the aid of their mutual affinities. We will now look to man as he exists; and we shall, I think, be able partially to restore the structure of our early progenitors, during successive periods, but not in due order of time. This, can be effected by means of the rudiments which man still retains, by the characters which occasionally make their appearance in him through reversion, and by the aid of the principles of morphology and embryology. The various facts, to which I shall here allude, have been given in the previous chapters.

The early progenitors of man must have been once covered with hair, both sexes having beards; their ears were probably pointed, and capable of movement; and their bodies were provided with a tail, having the proper muscles. Their limbs and bodies were also acted on by many muscles which now only occasionally reappear, but are normally present in the *Quadrupedia*. At this or some earlier period, the great artery and nerve of the humerus ran through a supra-condyloid foramen. The intestine gave forth a much larger diverticulum or caecum than that now existing. The foot was then prehensile, judging from the condition of the great toe in the foetus; and our progenitors, no doubt, were arboreal in their habits, and frequented some warm, forest-clad land. The males had great canine teeth, which served them as formidable weapons. At a much earlier period the uterus was double; the excreta were voided through a cloaca; and the eye was protected by a third eyelid or nictitating membrane. At a still earlier period the progenitors of man must have been aquatic in their habits; for morphology plainly tells us that our lungs consist of a modified swimbladder, which once served as a float. The clefts on the neck in the embryo of man show where the branchiae once existed. In the lunar or weekly recurrent periods of some of our functions we apparently still retain traces of our primordial birthplace, a shore washed by the tides. At about this same early period the true kidneys were replaced by the *corpora wolffiana*. The heart existed as a simple pulsating vessel; and the *chorda dorsalis* took the place of a vertebral column. These early ancestors of man, thus seen in the dim recesses of time, must have been as simply, or even still more simply organised than the lancelet or amphioxus.

There is one other point deserving a fuller notice. It has long been known that in the vertebrate kingdom one sex bears rudiments of various accessory parts, appertaining to the reproductive system, which properly belong to the opposite sex; and it has now been ascertained that at a very early embryonic period both sexes possess true male and female glands. Hence some remote

progenitor of the whole vertebrate kingdom appears to have been hermaphrodite or androgynous. [348] But here we encounter a singular difficulty. In the mammalian class the males possess rudiments of a uterus with the adjacent passage, in their vesiculae prostaticae; they bear also rudiments of mammae, and some male marsupials have traces of a marsupial sack. [349] Other analogous facts could be added. Are we, then, to suppose that some extremely ancient mammal continued androgynous, after it had acquired the chief distinctions of its class, and therefore after it had diverged from the lower classes of the vertebrate kingdom? This seems very improbable, for we have to look to fishes, the lowest of all the classes, to find any still existent androgynous forms. [350] That various accessory parts, proper to each sex, are found in a rudimentary condition in the opposite sex, may be explained by such organs having been gradually acquired by the one sex, and then transmitted in a more or less imperfect state to the other. When we treat of sexual selection, we shall meet with innumerable instances of this form of transmission, - as in the case of the spurs, plumes, and brilliant colours, acquired for battle or ornament by male birds, and inherited by the females in an imperfect or rudimentary condition.

The possession by male mammals of functionally imperfect mammary organs is, in some respects, especially curious. The Monotremata have the proper milk-secreting glands with orifices, but no nipples; and as these animals stand at the very base of the mammalian series, it is probable that the progenitors of the class also had milk-secreting glands, but no nipples. This conclusion is supported by what is known of their manner of development; for Professor Turner informs me, on the authority of Kolliker and Langer, that in the embryo the mammary glands can be distinctly traced before the nipples are in the least visible; and the development of successive parts in the individual generally represents and accords with the development of successive beings in the same line of descent. The marsupials differ from the Monotremata by possessing nipples; so that probably these organs were first acquired by the marsupials, after they had diverged from, and risen above, the Monotremata, and were then transmitted to the placental mammals. [351] No one will suppose that the marsupials still remained androgynous, after they had approximately acquired their present structure. How then are we to account for male mammals possessing mammae? It is possible that they were first developed in the females and then transferred to the males, but from what follows this is hardly probable. It may be suggested, as another view, that long after the progenitors of the whole mammalian class had ceased to be androgynous, both sexes yielded milk, and thus nourished their young; and in the case of the marsupials, that both sexes carried their young in marsupial sacks. This will not appear altogether improbable, if we reflect that the males of existing syngnathous fishes receive the eggs of the females in their abdominal pouches, hatch them, and afterwards, as some believe, nourish the young; - [352] that certain other male fishes hatch the eggs within their mouths or branchial cavities; - that certain male toads take the chaplets of eggs from the females, and wind them round their own thighs, keeping them there until the tadpoles are born; - that certain male birds undertake the whole duty of incubation, and that male pigeons, as well as the females, feed their nestlings with a secretion from their crops. But the above suggestion first occurred to me from mammary glands of male mammals being so much more perfectly developed than the rudiments of the other accessory reproductive parts, which are found in the one sex though proper to the other. The mammary glands and nipples, as they exist in male mammals, can indeed hardly be called rudimentary; they are merely not fully developed, and not functionally active. They are sympathetically affected under the influence of certain diseases, like the same organs in the female. They often secrete a few drops of milk at birth and at puberty: this latter fact occurred in the curious case before referred to, where a young man possessed two pairs of mammee. In man and some other male mammals these organs have been known occasionally to become so well developed during maturity as to yield a fair supply of milk. Now if we suppose that during a former prolonged period male mammals aided the females in nursing their offspring, [353] and that afterwards from some cause (as from the production of a smaller number of young) the males ceased to give this aid, disuse of the organs during maturity would lead to their becoming inactive; and from two well-known principles of inheritance, this state of inactivity would probably be transmitted to the males at the corresponding age of maturity. But at an earlier age these organs would be left unaffected, so that they would be almost equally well developed in the young of both sexes.

Conclusion. - Von Baer has defined advancement or progress in the organic scale better than any one else, as resting on the amount of differentiation and specialisation of the several parts of a being, - when arrived at maturity, as I should be inclined to add. Now as organisms have become slowly adapted to diversified lines of life by means of natural selection, their parts will have become more and more differentiated and specialised for various functions from the advantage gained by the division of physiological labour. The same part appears often to have been modified first for one

purpose, and then long afterwards for some other and quite distinct purpose; and thus all the parts are rendered more and more complex. But each organism still retains the general type of structure of the progenitor from which it was aboriginally derived. In accordance with this view it seems, if we turn to geological evidence, that organisation on the whole has advanced throughout the world by slow and interrupted steps. In the great kingdom of the Vertebrata it has culminated in man. It must not, however, be supposed that groups of organic beings are always supplanted, and disappear as soon as they have given birth to other and more perfect groups. The latter, though victorious over their predecessors, may not have become better adapted for all places in the economy of nature. Some old forms appear to have survived from inhabiting protected sites, where they have not been exposed to very severe competition; and these often aid us in constructing our genealogies, by giving us a fair idea of former and lost populations. But we must not fall into the error of looking at the existing members of any lowly-organised group as perfect representatives of their ancient predecessors.

The most ancient progenitors in the kingdom of the Vertebrata, at which we are able to obtain an obscure glance, apparently consisted of a group of marine animals,[354] resembling the larvae of existing ascidians. These animals probably gave rise to a group of fishes, as lowly organised as the lancelet; and from these the ganoids, and other fishes like the *Lepidosiren*, must have been developed. From such fish a very small advance would carry us on to the amphibians. We have seen that birds and reptiles were once intimately connected together; and the Monotremata now connect mammals with reptiles in a slight degree. But no one can at present say by what line of descent the three higher and related classes, namely, mammals, birds, and reptiles, were derived from the two lower vertebrate classes, namely, amphibians and fishes. In the class of mammals the steps are not difficult to conceive which led from the ancient Monotremata to the ancient marsupials; and from these to the early progenitors of the placental mammals. We may thus ascend to the Lemuridae; and the interval is not very wide from these to the Simiadae. The Simiadae then branched off into two great stems, the New World and Old World monkeys; and from the latter, at a remote period, Man, the wonder and glory of the Universe, proceeded.

Thus we have given to man a pedigree of prodigious length, but not, it may be said, of noble quality. The world, it has often been remarked, appears as if it had long been preparing for the advent of man: and this, in one sense is strictly true, for he owes his birth to a long line of progenitors. If any single link in this chain had never existed, man would not have been exactly what he now is. Unless we wilfully close our eyes, we may, with our present knowledge, approximately recognise our parentage; nor need we feel ashamed of it. The most humble organism is something much higher than the inorganic dust under our feet; and no one with an unbiased mind can study any living creature, however humble, without being struck with enthusiasm at its marvellous structure and properties.

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Footnotes

[323] Isidore Geoffroy St-Hilaire gives a detailed account of the position assigned to man by various naturalists in their classifications: *Hist. Nat. Gen.* tom. ii., 1859, pp. 170-189

[324] Some of the most interesting facts ever published on the habits of ants are given by Mr. Belt, in his *The Naturalist in Nicaragua*, 1874. See also Mr. Moggridge's admirable work, *Harvesting Ants*, &c., 1873, also "*L'Instinct chez les insectes*," by M. George Pouchet, *Revue des Deux Mondes*, Feb., 1870, p. 682.

[325] Westwood, *Modern Classification of Insects*, vol. ii., 1840, p. 87. -

[326] *Proceedings Zoological Society*, 1863, p. 4.

[327] *Evidence as to Man's Place in Nature*, 1863, p. 70, et passim

[328] Isidore Geoffroy St-Hilaire, *Hist. Nat. Gen.*, tom. ii., 1859, p. 217

[329] "Über die Richtung der Haare, &c.," Muller's Archiv für Anat. und Phys., 1837, s. 51.

[330] Quoted by Reade, African Sketch Book, vol. i., 1873, p. 152.

[331] On the hair in Hylobates, see Natural History of Mammals, by C. L. Martin, 1841, p. 415. Also, Isidore Geoffroy on the American monkeys and other kinds, Hist. Nat. Gen., vol. ii., 1859, pp. 216, 243. Eschricht, *ibid.*, ss. 46, 55, 61. Owen, Anatomy of Vertebrates, vol. iii., p. 619. Wallace, Contributions to the Theory of Natural Selection, 1870, p. 344.

[332] Origin of Species. The Variation of Animals and Plants under Domestication, vol. ii., 1868, p. 348.

[333] An Introduction to the Classification of Animals, 1869, p. 99.

[334] This is nearly the same classification as that provisionally adopted by Mr. St. G. Mivart, Transactions, Philosophical Society, 1867, p. 300, who, after separating the Lemnidae, divides the remainder of the Primates into the Homnidae, the Simiidae which answer to the catarrhines, the Cebidae, and the Haploidae, - these two latter groups answering to the platyrrhines. Mr. Mivart still abides by the same view; see Nature, 1871, p. 481.

[335] Transactions, Zoolog. Soc., vol. vi., 1867, p. 214.

[336] Mr. St. G. Mivart, Transactions of the Philosophical Society, 1867, p. 410.

[337] Messrs. Murie and Mivart on the Lemnoidea, Transactions, Zoological Society, vol. vii, 1869, p. 5.

[338] Haeckel has come to this same conclusion. See "Über die Entstehung des Menschengeschlechts," in Virchow's Sammlung. gemein. wissen. Vorträge, 1868, s. 61. Also his Naturliche Schöpfungsgeschichte, 1868, in which he gives in detail his views on the genealogy of man.

[339] Dr. C Forsyth Major, "Sur les Singes fossiles trouves en Italie," Soc. Ital. des Sc. Nat., tom., xv., 1872.

[340] Anthropological Review, April, 1867, p. 236

[341] Elements of Geology, 1865, pp. 583-585. Antiquity of Man, 1863, p. 145.

[342] Man's Place in Nature, p. 105.

[343] Elaborate tables are given in his Generelle Morphologie (B. ii., s. cliii. and s. 425); and with more especial reference to man in his Naturliche Schöpfungsgeschichte, 1868. Prof. Huxley, in reviewing this latter work (The Academy, 1869, p. 42), says that he considers the phylum or lines of descent of the Vertebrata to be admirably discussed by Haeckel, although he differs on some points. He expresses, also, his high estimate of the general tenor and spirit of the whole work.

[344] Palaeontology 1860, p. 199.

[345] At the Falkland Islands I had the satisfaction of seeing, in April, 1833, and therefore some years before any other naturalist, the locomotive larvae of a compound ascidian, closely allied to Synoicum, but apparently generically distinct from it. The tail was about five times as long as the oblong head, and terminated in a very fine filament. It was, as sketched by me under a simple microscope, plainly divided by transverse opaque partitions, which I presume represent the great cells figured by Kovalevsky. At an early stage of development the tail was closely coiled round the head of the larva

[346] Memoires de l'Acad. des Sciences de St. Petersburg, tom. x., No. 15, 1866

[347] But I am bound to add that some competent judges dispute this conclusion; for instance, M. Giard, in a series of papers in the Archives de Zoologie Experimentale, for 1872. Nevertheless, this

naturalist remarks, p. 281, "L'organisation de la larve ascidienne en dehors de toute hypothese et de toute theorie, nous montre comment la nature peut produire la disposition fondamentale du type vertebre (l'existence d'une corde dorsale) chez un invertebre par la seule condition vitale de l'adaptation, et cette simple possibilite du passage supprime l'abime entre les deux sous-regnes, encore bien qu'en ignore par ou le passage s'est fait en realite."

[348] This is the conclusion of Prof. Gegenbaur, one of the highest authorities in comparative anatomy: see *Grundzuge der vergleich. Anat.*, 1870, s. 876. The result has been arrived at chiefly from the study of the Amphibia; but it appears from the researches of Waldeyer (as quoted in *Journal of Anat. and Phys.*, 1869, p. 161), that the sexual organs of even "the higher vertebrata are, in their early condition, hermaphrodite." Similar views have long been held by some authors, though until recently without a firm basis

[349] The male *Thylacinus* offers the best instance. Owen, *Anatomy of Vertebrates*, vol. iii., p. 771

[350] Hermaphroditism has been observed in several species of *Serranus*, as well as in some other fishes, where it is either normal and symmetrical, or abnormal and unilateral. Dr. Zouteveen has given me references on this subject, more especially to a paper by Prof. Halbertsma, in the *Transact. of the Dutch Acad. of Sciences*, vol. xvi. Dr. Gunther doubts the fact, but it has now been recorded by too many good observers to be any longer disputed. Dr. M. Lessona writes to me, that he has verified the observations made by Cavolini on *Serranus*. Prof. Ercolani has recently shewn (*Acad. delle Scienze, Bologna*, Dec. 28, 1871) that eels are androgynous. -

[351] Prof. Gegenbaur has shewn (*Jenaische Zeitschrift*, Bd. vii., p. 212) that two distinct types of nipples prevail throughout the several mammalian orders, but that it is quite intelligible how both could have been derived from the nipples of the marsupials, and the latter from those of the *Monotremata*. See, also, a memoir by Dr. Max Huss, on the mammary glands, *ibid.*, B. viii., p. 176.

[352] Mr. Lockwood believes (as quoted in *Quart. Journal of Science*, April, 1868, p. 269), from what he has observed of the development of *Hippocampus*, that the walls of the abdominal pouch of the male in some way afford nourishment. On male fishes hatching the ova in their mouths, see a very interesting paper by Prof. Wyman, in *Proc. Boston Soc. of Nat. Hist.*, Sept. 15, 1857; also Prof. Turner, in *Journal of Anatomy and Physiology*, Nov. 1, 1866, p. 78. Dr. Gunther has likewise described similar cases

[353] Mlle. C. Royer has suggested a similar view in her *Origine de l'homme*, &c., 1870.

[354] The inhabitants of the seashore must be greatly affected by the tides; animals living either about the mean high-water mark, or about the mean low-water mark, pass through a complete cycle of tidal changes in a fortnight. Consequently, their food supply will undergo marked changes week by week. The vital functions of such animals, living under these conditions for many generations, can hardly fail to run their course in regular weekly periods. Now it is a mysterious fact that in the higher and now terrestrial *Vertebrata*, as well as in other classes, many normal and abnormal processes one or more whole weeks as their periods; this would be rendered intelligible if the *Vertebrata* are descended from an animal allied to the existing tidal ascidians. Many instances of such periodic processes might be given, as the gestation of mammals, the duration of fevers, &c. The hatching of eggs affords also a good example, for, according to Mr. Bartlett (*Land and Water*, Jan. 7, 1871), the eggs of the pigeon are hatched in two weeks; those of the fowl in three; those of the duck in four; those of the goose in five; and those of the ostrich in seven weeks. As far as we can judge, a recurrent period, if approximately of the right duration for any process or function, would not, when once gained, be liable to change; consequently it might be thus transmitted through almost any number of generations. But if the function changed, the period would have to change, and would be apt to change almost abruptly by a whole week. This conclusion, if sound, is highly remarkable; for the period of gestation in each mammal, and the hatching of each bird's eggs, and many other vital processes, thus betray to us the primordial birthplace of these animals.

Chapter VII

ON THE RACES OF MAN.

It is not my intention here to describe the several so-called races of men; but I am about to enquire what is the value of the differences between them under a classificatory point of view, and how they have originated. In determining whether two or more allied forms ought to be ranked as species or varieties, naturalists are practically guided by the following considerations; namely, the amount of difference between them, and whether such differences relate to few or many points of structure, and whether they are of physiological importance; but more especially whether they are constant. Constancy of character is what is chiefly valued and sought for by naturalists. Whenever it can be shewn, or rendered probable, that the forms in question have remained distinct for a long period, this becomes an argument of much weight in favour of treating them as species. Even a slight degree of sterility between any two forms when first crossed, or in their offspring, is generally considered as a decisive test of their specific distinctness; and their continued persistence without blending within the same area, is usually accepted as sufficient evidence, either of some degree of mutual sterility, or in the case of animals of some mutual repugnance to pairing.

Independently of fusion from intercrossing, the complete absence, in a wellinvestigated region, of varieties linking together any two closely-allied forms, is probably the most important of all the criterions of their specific distinctness; and this is a somewhat different consideration from mere constancy of character, for two forms may be highly variable and yet not yield intermediate varieties. Geographical distribution is often brought into play unconsciously and sometimes consciously; so that forms living in two widely separated areas, in which most of the other inhabitants are specifically distinct, are themselves usually looked at as distinct; but in truth this affords no aid in distinguishing geographical races from so-called good or true species.

Now let us apply these generally-admitted principles to the races of man, viewing him in the same spirit as a naturalist would any other animal. In regard to the amount of difference between the races, we must make some allowance for our nice powers of discrimination gained by the long habit of observing ourselves. In India, as Elphinstone remarks, although a newly-arrived European cannot at first distinguish the various native races, yet they soon appear to him extremely dissimilar;[355] and the Hindoo cannot at first perceive any difference between the several European nations. Even the most distinct races of man are much more like each other in form than would at first be supposed; certain negro tribes must be excepted, whilst others, as Dr. Rohlf's writes to me, and as I have myself seen, have Caucasian features. This general similarity is well shewn by the French photographs in the Collection Anthropologique du Museum de Paris of the men belonging to various races, the greater number of which might pass for Europeans, as many persons to whom I have shewn them have remarked. Nevertheless, these men, if seen alive, would undoubtedly appear very distinct, so that we are clearly much influenced in our judgment by the mere colour of the skin and hair, by slight differences in the features, and by expression.

There is, however, no doubt that the various races, when carefully compared and measured, differ much from each other,- as in the texture of the hair, the relative proportions of all parts of the body, [356] the capacity of the lungs, the form and capacity of the skull, and even in the convolutions of the brain.[357] But it would be an endless task to specify the numerous points of difference. The races differ also in constitution, in acclimatisation and in liability to certain diseases. Their mental characteristics are likewise very distinct; chiefly as it would appear in their emotional, but partly in their intellectual faculties. Every one who has had the opportunity of comparison, must have been struck with the contrast between the taciturn, even morose, aborigines of S. America and the lighthearted, talkative negroes. There is a nearly similar contrast between the Malays and the Papuans,[358] who live under the same physical conditions, and are separated from each other only by a narrow space of sea.

We will first consider the arguments which may be advanced in favour of classing the races of man as distinct species, and then the arguments on the other side. If a naturalist, who had never before seen a Negro, Hottentot, Australian, or Mongolian, were to compare them, he would at once perceive that they differed in a multitude of characters, some of slight and some of considerable importance. On enquiry he would find that they were adapted to live under widely different climates, and that they differed somewhat in bodily constitution and mental disposition. If he were then told that hundreds of similar specimens could be brought from the same countries, he would assuredly

declare that they were as good species as many to which he had been in the habit of affixing specific names. This conclusion would be greatly strengthened as soon as he had ascertained that these forms had all retained the same character for many centuries; and that negroes, apparently identical with existing negroes, had lived at least 4000 years ago.[359] He would also hear, on the authority of an excellent observer, Dr. Lund,[360] that the human skulls found in the caves of Brazil entombed with many extinct mammals, belonged to the same type as that now prevailing throughout the American continent.

Our naturalist would then perhaps turn to geographical distribution, and he would probably declare that those forms must be distinct species, which differ not only in appearance, but are fitted for hot, as well as damp or dry countries, and for the arctic regions. He might appeal to the fact that no species in the group next to man- namely, the *Quadrumanus*, can resist a low temperature, or any considerable change of climate; and that the species which come nearest to man have never been reared to maturity, even under the temperate climate of Europe. He would be deeply impressed with the fact, first noticed by Agassiz,[361] that the different races of man are distributed over the world in the same zoological provinces, as those inhabited by undoubtedly distinct species and genera of mammals. This is manifestly the case with the Australian, Mongolian, and Negro races of man; in a less well-marked manner with the Hottentots; but plainly with the Papuans and Malays, who are separated, as Mr. Wallace has shewn, by nearly the same line which divides the great Malayan and Australian zoological provinces. The aborigines of America range throughout the continent; and this at first appears opposed to the above rule, for most of the productions of the Southern and Northern halves differ widely: yet some few living forms, as the opossum, range from the one into the other, as did formerly some of the gigantic *Edentata*. The Esquimaux, like other arctic animals, extend round the whole polar regions. It should be observed that the amount of difference between the mammals of the several zoological provinces does not correspond with the degree of separation between the latter; so that it can hardly be considered as an anomaly that the Negro differs more, and the American much less from the other races of man, than do the mammals of the African and American continents from the mammals of the other provinces. Man, it may be added, does not appear to have aboriginally inhabited any oceanic island; and in this respect, he resembles the other members of his class.

In determining whether the supposed varieties of the same kind of domestic animal should be ranked as such, or as specifically distinct, that is, whether any of them are descended from distinct wild species, every naturalist would lay much stress on the fact of their external parasites being specifically distinct. All the more stress would be laid on this fact, as it would be an exceptional one; for I am informed by Mr. Denny that the most different kinds of dogs, fowls, and pigeons, in England, are infested by the same species of *Pediculi* or lice. Now Mr. A. Murray has carefully examined the *Pediculi*. collected in different countries from the different races of man;[362] and he finds that they differ, not only in colour, but in the structure of their claws and limbs. In every case in which many specimens were obtained the differences were constant. The surgeon of a whaling ship in the Pacific assured me that when the *Pediculi*, with which some Sandwich Islanders on board swarmed, strayed on to the bodies of the English sailors, they died in the course of three or four days. These *Pediculi* were darker coloured, and appeared different from those proper to the natives of Chiloe in South America, of which he gave me specimens. These, again, appeared larger and much softer than European lice. Mr. Murray procured four kinds from Africa, namely, from the Negroes of the Eastern and Western coasts, from the Hottentots and Kaffirs; two kinds from the natives of Australia; two from North and two from South America. In these latter cases it may be presumed that the *Pediculi* came from natives inhabiting different districts. With insects slight structural differences, if constant, are generally esteemed of specific value: and the fact of the races of man being infested by parasites, which appear to be specifically distinct, might fairly be urged as an argument that the races themselves ought to be classed as distinct species.

Our supposed naturalist having proceeded thus far in his investigation, would next enquire whether the races of men, when crossed, were in any degree sterile. He might consult the work[363] of Professor Broca, a cautious and philosophical observer, and in this he would find good evidence that some races were quite fertile together, but evidence of an opposite nature in regard to other races. Thus it has been asserted that the native women of Australia and Tasmania rarely produce children to European men; the evidence, however, on this head has now been shewn to be almost valueless. The half-castes are killed by the pure blacks: and an account has lately been published of eleven half-caste youths murdered and burnt at the same time, whose remains were found by the police.[364] Again, it has often been said that when mulattoes intermarry, they produce few children;

on the other hand, Dr. Bachman, of Charleston,[365] positively asserts that he has known mulatto families which have intermarried for several generations, and have continued on an average as fertile as either pure whites or pure blacks. Enquiries formerly made by Sir C. Lyell on this subject led him, as he informs me, to the same conclusion.[366] In the United States the census for the year 1854 included, according to Dr. Bachman, 405,751 mulattoes; and this number, considering all the circumstances of the case, seems small; but it may partly be accounted for by the degraded and anomalous position of the class, and by the profligacy of the women. A certain amount of absorption of mulattoes into negroes must always be in progress; and this would lead to an apparent diminution of the former.

The inferior vitality of mulattoes is spoken of in a trustworthy work[367] as a well-known phenomenon; and this, although a different consideration from their lessened fertility, may perhaps be advanced as a proof of the specific distinctness of the parent races. No doubt both animal and vegetable hybrids, when produced from extremely distinct species, are liable to premature death; but the parents of mulattoes cannot be put under the category of extremely distinct species. The common mule, so notorious for long life and vigour, and yet so sterile, shews how little necessary connection there is in hybrids between lessened fertility and vitality; other analogous cases could be cited.

Even if it should hereafter be proved that all the races of men were perfectly fertile together, he who was inclined from other reasons to rank them as distinct species, might with justice argue that fertility and sterility are not safe criterions of specific distinctness. We know that these qualities are easily affected by changed conditions of life, or by close interbreeding, and that they are governed by highly complex laws, for instance, that of the unequal fertility of converse crosses between the same two species. With forms which must be ranked as undoubted species, a perfect series exists from those which are absolutely sterile when crossed, to those which are almost or completely fertile. The degrees of sterility do not coincide strictly with the degrees of difference between the parents in external structures or habits of life. Man in many respects may be compared with those animals which have long been domesticated, and a large body of evidence can be advanced in favour of the Pallasian doctrine,[368] that domestication tends to eliminate the sterility which is so general a result of the crossing of species in a state of nature. From these several considerations, it may be justly urged that the perfect fertility of the intercrossed races of man, if established, would not absolutely preclude us from ranking them as distinct species.

Independently of fertility, the characters presented by the offspring from a cross have been thought to indicate whether or not the parent-forms ought to be ranked as species or varieties; but after carefully studying the evidence, I have come to the conclusion that no general rules of this kind can be trusted. The ordinary result of a cross is the production of a blended or intermediate form; but in certain cases some of the offspring take closely after one parent-form, and some after the other. This is especially apt to occur when the parents differ in characters which first appeared as sudden variations or monstrosities.[369] I refer to this point, because Dr. Rohlfs informs me that he has frequently seen in Africa the offspring of negroes crossed with members of other races, either completely black or completely white, or rarely piebald. On the other hand, it is notorious that in America mulattoes commonly present an intermediate appearance.

We have now seen that a naturalist might feel himself fully justified in ranking the races of man as distinct species; for he has found that they are distinguished by many differences in structure and constitution, some being of importance. These differences have, also, remained nearly constant for very long periods of time. Our naturalist will have been in some degree influenced by the enormous range of man, which is a great anomaly in the class of mammals, if mankind be viewed as a single species. He will have been struck with the distribution of the several so-called races, which accords with that of other undoubtedly distinct species of mammals. Finally, he might urge that the mutual fertility of all the races has not as yet been fully proved, and even if proved would not be an absolute proof of their specific identity.

On the other side of the question, if our supposed naturalist were to enquire whether the forms of man keep distinct like ordinary species, when mingled together in large numbers in the same country, he would immediately discover that this was by no means the case. In Brazil he would behold an immense mongrel population of Negroes and Portuguese; in Chiloe, and other parts of South America, he would behold the whole population consisting of Indians and Spaniards blended in various degrees.[370] In many parts of the same continent he would meet with the most complex

crosses between Negroes, Indians, and Europeans; and judging from the vegetable kingdom, such triple crosses afford the severest test of the mutual fertility of the parent forms. In one island of the Pacific he would find a small population of mingled Polynesian and English blood; and in the Fiji Archipelago a population of Polynesians and Negritos crossed in all degrees. Many analogous cases could be added; for instance, in Africa. Hence the races of man are not sufficiently distinct to inhabit the same country without fusion; and the absence of fusion affords the usual and best test of specific distinctness.

Our naturalist would likewise be much disturbed as soon as he perceived that the distinctive characters of all the races were highly variable. This fact strikes every one on first beholding the negro slaves in Brazil, who have been imported from all parts of Africa. The same remark holds good with the Polynesians, and with many other races. It may be doubted whether any character can be named which is distinctive of a race and is constant. Savages, even within the limits of the same tribe, are not nearly so uniform in character, as has been often asserted. Hottentot women offer certain peculiarities, more strongly marked than those occurring in any other race, but these are known not to be of constant occurrence. In the several American tribes, colour and hairiness differ considerably; as does colour to a certain degree, and the shape of the features greatly, in the negroes of Africa. The shape of the skull varies much in some races;[371] and so it is with every other character. Now all naturalists have learnt by dearly bought experience, how rash it is to attempt to define species by the aid of inconstant characters.

But the most weighty of all the arguments against treating the races of man as distinct species, is that they graduate into each other, independently in many cases, as far as we can judge, of their having intercrossed. Man has been studied more carefully than any other animal, and yet there is the greatest possible diversity amongst capable judges whether he should be classed as a single species or race, or as two (Virey), as three (Jacquinot), as four (Kant), five (Blumenbach), six (Buffon), seven (Hunter), eight (Agassiz), eleven (Pickering), fifteen (Bory de St-Vincent), sixteen (Desmoulins), twenty-two (Morton), sixty (Crawfurd), or as sixty-three, according to Burke.[372] This diversity of judgment does not prove that the races ought not to be ranked as species, but it shews that they graduate into each other, and that it is hardly possible to discover clear distinctive characters between them.

Every naturalist who has had the misfortune to undertake the description of a group of highly varying organisms, has encountered cases (I speak after experience) precisely like that of man; and if of a cautious disposition, he will end by uniting all the forms which graduate into each other, under a single species; for he will say to himself that he has no right to give names to objects which he cannot define. Cases of this kind occur in the Order which include man, namely in certain genera of monkeys; whilst in other genera, as in *Cercopithecus*, most of the species can be determined with certainty. In the American genus *Cebus*, the various forms are ranked by some naturalists as species, by others as mere geographical races. Now if numerous specimens of *Cebus* were collected from all parts of South America, and those forms which at present appear to be specifically distinct, were found to graduate into each other by close steps, they would usually be ranked as mere varieties or races; and this course has been followed by most naturalists with respect to the races of man. Nevertheless, it must be confessed that there are forms, at least in the vegetable kingdom,[373] which we cannot avoid naming as species, but which are connected together by numberless gradations, independently of intercrossing.

Some naturalists have lately employed the term "sub-species" to designate forms which possess many of the characteristics of true species, but which hardly deserve so high a rank. Now if we reflect on the weighty arguments above given, for raising the races of man to the dignity of species, and the insuperable difficulties on the other side in defining them, it seems that the term "sub-species" might here be used with propriety. But from long habit the term "race" will perhaps always be employed. The choice of terms is only so far important in that it is desirable to use, as far as possible, the same terms for the same degrees of difference. Unfortunately this can rarely be done: for the larger genera generally include closely-allied forms, which can be distinguished only with much difficulty, whilst the smaller genera within the same family include forms that are perfectly distinct; yet all must be ranked equally as species. So again, species within the same large genus by no means resemble each other to the same degree: on the contrary, some of them can generally be arranged in little groups round other species, like satellites round planets.[374]

The question whether mankind consists of one or several species has of late years been much

discussed by anthropologists, who are divided into the two schools of monogenists and polygenists. Those who do not admit the principle of evolution, must look at species as separate creations, or in some manner as distinct entities; and they must decide what forms of man they will consider as species by the analogy of the method commonly pursued in ranking other organic beings as species. But it is a hopeless endeavour to decide this point, until some definition of the term "species" is generally accepted; and the definition must not include an indeterminate element such as an act of creation. We might as well attempt without any definition to decide whether a certain number of houses should be called a village, town, or city. We have a practical illustration of the difficulty in the never-ending doubts whether many closely-allied mammals, birds, insects, and plants, which represent each other respectively in North America and Europe, should be ranked as species or geographical races; and the like holds true of the productions of many islands situated at some little distance from the nearest continent.

Those naturalists, on the other hand, who admit the principle of evolution, and this is now admitted by the majority of rising men, will feel no doubt that all the races of man are descended from a single primitive stock; whether or not they may think fit to designate the races as distinct species, for the sake of expressing their amount of difference.[375] With our domestic animals the question whether the various races have arisen from one or more species is somewhat different. Although it may be admitted that all the races, as well as all the natural species within the same genus, have sprung from the same primitive stock, yet it is a fit subject for discussion, whether all the domestic races of the dog, for instance, have acquired their present amount of difference since some one species was first domesticated by man; or whether they owe some of their characters to inheritance from distinct species, which had already been differentiated in a state of nature. With man no such question can arise, for he cannot be said to have been domesticated at any particular period.

During an early stage in the divergence of the races of man from a common stock, the differences between the races and their number must have been small; consequently as far as their distinguishing characters are concerned, they then had less claim to rank as distinct species than the existing so-called races. Nevertheless, so arbitrary is the term of species, that such early races would perhaps have been ranked by some naturalists as distinct species, if their differences, although extremely slight, had been more constant than they are at present, and had not graduated into each other.

It is however possible, though far from probable, that the early progenitors of man might formerly have diverged much in character, until they became more unlike each other than any now existing races; but that subsequently, as suggested by Vogt,[376] they converged in character. When man selects the offspring of two distinct species for the same object, he sometimes induces a considerable amount of convergence, as far as general appearance is concerned. This is the case, as shown by von Nathusius,[377] with the improved breeds of the pig, which are descended from two distinct species; and in a less marked manner with the improved breeds of cattle. A great anatomist, Gratiolet, maintains that the anthropomorphous apes do not form a natural sub-group; but that the orang is a highly developed gibbon or *Semnopithecus*, the chimpanzee a highly developed *Macacus*, and the gorilla a highly developed mandrill. If this conclusion, which rests almost exclusively on brain-characters, be admitted, we should have a case of convergence at least in external characters, for the anthropomorphous apes are certainly more like each other in many points, than they are to other apes. All analogical resemblances, as of a whale to a fish, may indeed be said to be cases of convergence; but this term has never been applied to superficial and adaptive resemblances. It would, however be extremely rash to attribute to convergence close similarity of character in many points of structure amongst the modified descendants of widely distinct beings. The form of a crystal is determined solely by the molecular forces, and it is not surprising that dissimilar substances should sometimes assume the same form; but with organic beings we should bear in mind that the form of each depends on an infinity of complex relations, namely on variations, due to causes far too intricate to be followed,- on the nature of the variations preserved, these depending on the physical conditions, and still more on the surrounding organisms which compete with each,- and lastly, on inheritance (in itself a fluctuating element) from innumerable progenitors, all of which have had their forms determined through equally complex relations. It appears incredible that the modified descendants of two organisms, if these differed from each other in a marked manner, should ever afterwards converge so closely as to lead to a near approach to identity throughout their whole organisation. In the case of the convergent races of pigs above referred to, evidence of their descent from two primitive stock is, according to von Nathusius, still plainly retained, in certain bones of their skulls. If the races of man had descended, as is supposed

by some naturalists, from two or more species, which differed from each other as much, or nearly as much, as does the orang from the gorilla, it can hardly be doubted that marked differences in the structure of certain bones would still be discoverable in man as he now exists.

Although the existing races of man differ in many respects, as in colour, hair, shape of skull, proportions of the body, &c., yet if their whole structure be taken into consideration they are found to resemble each other closely in a multitude of points. Many of these are of so unimportant or of so singular a nature, that it is extremely improbable that they should have been independently acquired by aboriginally distinct species or races. The same remark holds good with equal or greater force with respect to the numerous points of mental similarity between the most distinct races of man. The American aborigines, Negroes and Europeans are as different from each other in mind as any three races that can be named; yet I was incessantly struck, whilst living with the Feugians on board the Beagle, with the many little traits of character, shewing how similar their minds were to ours; and so it was with a full-blooded negro with whom I happened once to be intimate.

He who will read Mr. Tylor's and Sir J. Lubbock's interesting works[378] can hardly fail to be deeply impressed with the close similarity between the men of all races in tastes, dispositions and habits. This is shown by the pleasure which they all take in dancing, rude music, acting, painting, tattooing, and otherwise decorating themselves; in their mutual comprehension of gesture-language, by the same expression in their features, and by the same inarticulate cries, when excited by the same emotions. This similarity, or rather identity, is striking, when contrasted with the different expressions and cries made by distinct species of monkeys. There is good evidence that the art of shooting with bows and arrows has not been handed down from any common progenitor of mankind, yet as Westropp and Nilsson have remarked,[379] the stone arrow-heads, brought from the most distant parts of the world, and manufactured at the most remote periods, are almost identical; and this fact can only be accounted for by the various races having similar inventive or mental powers. The same observation has been made by archaeologists[380] with respect to certain widely-prevalent ornaments, such as zig-zags, &c.; and with respect to various simple beliefs and customs, such as the burying of the dead under megalithic structures. I remember observing in South America,[381] that there, as in so many other parts of the world, men have generally chosen the summits of lofty hills, to throw up piles of stones, either as a record of some remarkable event, or for burying their dead.

Now when naturalists observe a close agreement in numerous small details of habits, tastes, and dispositions between two or more domestic races, or between nearly-allied natural forms, they use this fact as an argument that they are descended from a common progenitor who was thus endowed; and consequently that all should be classed under the same species. The same argument may be applied with much force to the races of man.

As it is improbable that the numerous and unimportant points of resemblance between the several races of man in bodily structure and mental faculties (I do not here refer to similar customs) should all have been independently acquired, they must have been inherited from progenitors who had these same characters. We thus gain some insight into the early state of man, before he had spread step by step over the face of the earth. The spreading of man to regions widely separated by the sea, no doubt, preceded any great amount of divergence of character in the several races; for otherwise we should sometimes meet with the same race in distinct continents; and this is never the case. Sir J. Lubbock, after comparing the arts now practised by savages in all parts of the world, specifies those which man could not have known, when he first wandered from his original birthplace; for if once learnt they would never have been forgotten.[382] He thus shews that "the spear, which is but a development of the knife-point, and the club, which is but a long hammer, are the only things left." He admits, however, that the art of making fire probably had been already discovered, for it is common to all the races now existing, and was known to the ancient cave-inhabitants of Europe. Perhaps the art of making rude canoes or rafts was likewise known; but as man existed at a remote epoch, when the land in many places stood at a very different level to what it does now, he would have been able, without the aid of canoes, to have spread widely. Sir J. Lubbock further remarks how improbable it is that our earliest ancestors could have "counted as high as ten, considering that so many races now in existence cannot get beyond four." Nevertheless, at this early period, the intellectual and social faculties of man could hardly have been inferior in any extreme degree to those possessed at present by the lowest savages; otherwise primeval man could not have been so eminently successful in the struggle for life, as proved by his early and wide diffusion.

From the fundamental differences between certain languages, some philologists have inferred that when man first became widely diffused, he was not a speaking animal; but it may be suspected that languages, far less perfect than any now spoken, aided by gestures, might have been used, and yet have left no traces on subsequent and more highly-developed tongues. Without the use of some language, however imperfect, it appears doubtful whether man's intellect could have risen to the standard implied by his dominant position at an early period.

Whether primeval man, when he possessed but few arts, and those of the rudest kind, and when his power of language was extremely imperfect, would have deserved to be called man, must depend on the definition which we employ. In a series of forms graduating insensibly from some ape-like creature to man as he now exists, it would be impossible to fix on any definite point where the term "man" ought to be used. But this is a matter of very little importance. So again, it is almost a matter of indifference whether the so-called races of man are thus designated, or are ranked as species or sub-species; but the latter term appears the more appropriate. Finally, we may conclude that when the principle of evolution is generally accepted, as it surely will be before long, the dispute between the monogenists and the polygenists will die a silent and unobserved death.

One other question ought not to be passed over without notice, namely, whether, as is sometimes assumed, each sub-species or race of man has sprung from a single pair of progenitors. With our domestic animals a new race can readily be formed by carefully matching the varying offspring from a single pair, or even from a single individual possessing some new character; but most of our races have been formed, not intentionally from a selected pair, but unconsciously by the preservation of many individuals which have varied, however slightly, in some useful or desired manner. If in one country stronger and heavier horses, and in another country lighter and fleeter ones, were habitually preferred, we may feel sure that two distinct sub-breeds would be produced in the course of time, without any one pair having been separated and bred from, in either country. Many races have been thus formed, and their manner of formation is closely analogous to that of natural species. We know, also, that the horses taken to the Falkland Islands have, during successive generations, become smaller and weaker, whilst those which have run wild on the Pampas have acquired larger and coarser heads; and such changes are manifestly due, not to any one pair, but to all the individuals having been subjected to the same conditions, aided, perhaps, by the principle of reversion. The new sub-breeds in such cases are not descended from any single pair, but from many individuals which have varied in different degrees, but in the same general manner; and we may conclude that the races of man have been similarly produced, the modifications being either the direct result of exposure to different conditions, or the indirect result of some form of selection. But to this latter subject we shall presently return.

On the Extinction of the Races of Man.- The partial or complete extinction of many races and sub-races of man is historically known. Humboldt saw in South America a parrot which was the sole living creature that could speak a word of the language of a lost tribe. Ancient monuments and stone implements found in all parts of the world, about which no tradition has been preserved by the present inhabitants, indicate much extinction. Some small and broken tribes, remnants of former races, still survive in isolated and generally mountainous districts. In Europe the ancient races were all, according to Shaaaffhausen,[383] "lower in the scale than the rudest living savages"; they must therefore have differed, to a certain extent, from any existing race. The remains described by Professor Broca from Les Eyzies, though they unfortunately appear to have belonged to a single family, indicate a race with a most singular combination of low or simious, and of high characteristics. This race is "entirely different from any other, ancient or modern, that we have heard of." [384] It differed, therefore, from the quaternary race of the caverns of Belgium.

Man can long resist conditions which appear extremely unfavourable for his existence.[385] He has long lived in the extreme regions of the North, with no wood for his canoes or implements, and with only blubber as fuel, and melted snow as drink. In the southern extremity of America the Fuegians survive without the protection of clothes, or of any building worthy to be called a hovel. In South Africa the aborigines wander over arid plains, where dangerous beasts abound. Man can withstand the deadly influence of the Terai at the foot of the Himalaya, and the pestilential shores of tropical Africa.

Extinction follows chiefly from the competition of tribe with tribe, and race with race. Various checks are always in action, serving to keep down the numbers of each savage tribe,- such as periodical

famines, nomadic habits and the consequent deaths of infants, prolonged suckling, wars, accidents, sickness, licentiousness, the stealing of women, infanticide, and especially lessened fertility. If any one of these checks increases in power, even slightly, the tribe thus affected tends to decrease; and when of two adjoining tribes one becomes less numerous and less powerful than the other, the contest is soon settled by war, slaughter, cannibalism, slavery, and absorption. Even when a weaker tribe is not thus abruptly swept away, if it once begins to decrease, it generally goes on decreasing until it becomes extinct.[386]

When civilised nations come into contact with barbarians the struggle is short, except where a deadly climate gives its aid to the native race. Of the causes which lead to the victory of civilised nations, some are plain and simple, others complex and obscure. We can see that the cultivation of the land will be fatal in many ways to savages, for they cannot, or will not, change their habits. New diseases and vices have in some cases proved highly destructive; and it appears that a new disease often causes much death, until those who are most susceptible to its destructive influence are gradually weeded out;[387] and so it may be with the evil effects from spirituous liquors, as well as with the unconquerably strong taste for them shewn by so many savages. It further appears, mysterious as is the fact, that the first meeting of distinct and separated people generates disease. [388] Mr. Sproat, who in Vancouver Island closely attended to the subject of extinction, believed that changed habits of life, consequent on the advent of Europeans, induces much ill health. He lays, also, great stress on the apparently trifling cause that the natives become "bewildered and dull by the new life around them; they lose the motives for exertion, and get no new ones in their place." [389]

The grade of their civilisation seems to be a most important element in the success of competing nations. A few centuries ago Europe feared the inroads of Eastern barbarians; now any such fear would be ridiculous. It is a more curious fact, as Mr. Bagehot has remarked, that savages did not formerly waste away before the classical nations, as they now do before modern civilised nations; had they done so, the old moralists would have mused over the event; but there is no lament in any writer of that period over the perishing barbarians.[390] The most potent of all the causes of extinction, appears in many cases to be lessened fertility and ill-health, especially amongst the children, arising from changed conditions of life, notwithstanding that the new conditions may not be injurious in themselves. I am much indebted to Mr. H. H. Howorth for having called my attention to this subject, and for having given me information respecting it. I have collected the following cases.

When Tasmania was first colonised the natives were roughly estimated by some at 7000 and by others at 20,000. Their number was soon greatly reduced, chiefly by fighting with the English and with each other. After the famous hunt by all the colonists, when the remaining natives delivered themselves up to the government, they consisted only of 120 individuals,[391] who were in 1832 transported to Flinders Island. This island, situated between Tasmania and Australia, is forty miles long, and from twelve to eighteen miles broad: it seems healthy, and the natives were well treated. Nevertheless, they suffered greatly in health. In 1834 they consisted (Bonwick, p. 250) of forty-seven adult males, forty-eight adult females, and sixteen children, or in all of 111 souls. In 1835 only one hundred were left. As they continued rapidly to decrease, and as they themselves thought that they should not perish so quickly elsewhere, they were removed in 1847 to Oyster Cove in the southern part of Tasmania. They then consisted (Dec. 20th, 1847) of fourteen men, twenty-two women and ten children.[392] But the change of site did no good. Disease and death still pursued them, and in 1864 one man (who died in 1869), and three elderly women alone survived. The infertility of the women is even a more remarkable fact than the liability of all to ill-health and death. At the time when only nine women were left at Oyster Cove, they told Mr. Bonwick (p. 386), that only two had ever borne children: and these two had together produced only three children!

With respect to the cause of this extraordinary state of things, Dr. Story remarks that death followed the attempts to civilise the natives. "If left to themselves to roam as they were wont and undisturbed, they would have reared more children, and there would have been less mortality." Another careful observer of the natives, Mr. Davis, remarks, "The births have been few and the deaths numerous. This may have been in a great measure owing to their change of living and food; but more so to their banishment from the mainland of Van Diemen's Land, and consequent depression of spirits" (Bonwick, pp. 388, 390).

Similar facts have been observed in two widely different parts of Australia. The celebrated explorer, Mr. Gregory, told Mr. Bonwick, that in Queensland "the want of reproduction was being already felt

with the blacks, even in the most recently settled parts, and that decay would set in." Of thirteen aborigines from Shark's Bay who visited Murchison River, twelve died of consumption within three months.[393]

The decrease of the Maories of New Zealand has been carefully investigated by Mr. Fenton, in an admirable report, from which all the following statements, with one exception, are taken.[394] The decrease in number since 1830 is admitted by every one, including the natives themselves, and is still steadily progressing. Although it has hitherto been found impossible to take an actual census of the natives, their numbers were carefully estimated by residents in many districts. The result seems trustworthy, and shows that during the fourteen years, previous to 1858, the decrease was 19.42 per cent. Some of the tribes, thus carefully examined, lived above a hundred miles apart, some on the coast, some inland; and their means of subsistence and habits differed to a certain extent (p. 28). The total number in 1858 was believed to be 53,700, and in 1872, after a second interval of fourteen years, another census was taken, and the number is given as only 36,359, shewing a decrease of 32.29 per cent! [395] Mr. Fenton, after shewing in detail the insufficiency of the various causes, usually assigned in explanation of this extraordinary decrease, such as new diseases, the profligacy of the women, drunkenness, wars, &c., concludes on weighty grounds that it depends chiefly on the unproductiveness of the women, and on the extraordinary mortality of the young children (pp. 31, 34). In proof of this he shews (p. 33) that in 1844 there was one non-adult for every 2.57 adults; whereas in 1858 there was only one nonadult for every 3.27 adults. The mortality of the adults is also great. He adduces as a further cause of the decrease the inequality of the sexes; for fewer females are born than males. To this latter point, depending perhaps on a widely distinct cause, I shall return in a future chapter. Mr. Fenton contrasts with astonishment the decrease in New Zealand with the increase in Ireland; countries not very dissimilar in climate, and where the inhabitants now follow nearly similar habits. The Maories themselves (p. 35) "attribute their decadence, in some measure, to the introduction of new food and clothing, and the attendant change of habits"; and it will be seen, when we consider the influence of changed conditions on fertility, that they are probably right. The diminution began between the years 1830 and 1840; and Mr. Fenton shews (p. 40) that about 1830, the art of manufacturing putrid corn (maize), by long steeping in water, was discovered and largely practised; and this proves that a change of habits was beginning amongst the natives, even when New Zealand was only thinly inhabited by Europeans. When I visited the Bay of Islands in 1835, the dress and food of the inhabitants had already been much modified: they raised potatoes, maize, and other agricultural produce, and exchanged them for English manufactured goods and tobacco.

It is evident from many statements in the life of Bishop Patteson,[396] that the Melanesians of the New Hebrides and neighbouring archipelagoes, suffered to an extraordinary degree in health, and perished in large numbers, when they were removed to New Zealand, Norfolk Island, and other salubrious places, in order to be educated as missionaries.

The decrease of the native population of the Sandwich Islands is as notorious as that of New Zealand. It has been roughly estimated by those best capable of judging, that when Cook discovered the islands in 1779, the population amounted to about 300,000. According to a loose census in 1823, the numbers then were 142,050. In 1832, and at several subsequent periods, an accurate census was officially taken, but I have been able to obtain only the following returns:

Year Native Population (Except during 1832 and 1836, when the few foreigners in the islands were included.) Annual rate of decrease per cent, assuming it to have been uniform between the successive censuses; these censuses being taken at irregular intervals.

| | | |
|------|---------|------|
| 1832 | 130,313 | |
| | | 4.46 |
| 1836 | 108,579 | |
| | | 2.47 |
| 1853 | 71,019 | |
| | | 0.81 |
| 1860 | 67,084 | |
| | | 2.18 |
| 1866 | 58,765 | |
| | | 2.17 |
| 1872 | 51,531 | |

We here see that in the interval of forty years, between 1832 and 1872, the population has decreased no less than sixty-eight per cent! This has been attributed by most writers to the profligacy of the women, to former bloody wars, and to the severe labour imposed on conquered tribes and to newly introduced diseases, which have been on several occasions extremely destructive. No doubt these and other such causes have been highly efficient, and may account for the extraordinary rate of decrease between the years 1832 and 1836; but the most potent of all the causes seems to be lessened fertility. According to Dr. Ruschenberger of the U. S. Navy, who visited these islands between 1835 and 1837, in one district of Hawaii, only twenty-five men out of 1134, and in another district only ten out of 637, had a family with as many as three children. Of eighty married women, only thirty-nine had ever borne children; and "the official report gives an average of half a child to each married couple in the whole island." This is almost exactly the same average as with the Tasmanians at Oyster Cove. Jarves, who published his History in 1843, says that "families who have three children are freed from all taxes; those having more, are rewarded by gifts of land and other encouragements." This unparalleled enactment by the government well shews how infertile the race had become. The Rev. A. Bishop stated in the Hawaiian Spectator in 1839, that a large proportion of the children die at early ages, and Bishop Staley informs me that this is still the case, just as in New Zealand. This has been attributed to the neglect of the children by the women, but it is probably in large part due to innate weakness of constitution in the children, in relation to the lessened fertility of their parents. There is, moreover, a further resemblance to the case of New Zealand, in the fact that there is a large excess of male over female births: the census of 1872 gives 31,650 males to 25,247 females of all ages, that is 125.36 males for every 100 females; whereas in all civilised countries the females exceed the males. No doubt the profligacy of the women may in part account for their small fertility; but their changed habits of life is a much more probable cause, and which will at the same time account for the increased mortality, especially of the children. The islands were visited by Cook in 1779, Vancouver in 1794, and often subsequently by whalers. In 1819 missionaries arrived, and found that idolatry had been already abolished and other changes effected by the king. After this period there was a rapid change in almost all the habits of life of the natives, and they soon became "the most civilised of the Pacific Islanders." One of my informants, Mr. Coan, who was born on the islands, remarks that the natives have undergone a greater change in their habits of life in the course of fifty years than Englishmen during a thousand years. From information received from Bishop Staley, it does not appear that the poorer classes have ever much changed their diet, although many new kinds of fruit have been introduced, and the sugar-cane is in universal use. Owing, however, to their passion for imitating Europeans, they altered their manner of dressing at an early period, and the use of alcoholic drinks became very general. Although these changes appear inconsiderable, I can well believe, from what is known with respect to animals, that they might suffice to lessen the fertility of the natives.[397]

Lastly, Mr. Macnamara states[398] that the low and degraded inhabitants of the Andaman Islands, on the eastern side of the Gulf of Bengal, are "eminently susceptible to any change of climate: in fact, take them away from their island homes, and they are almost certain to die, and that independently of diet or extraneous influences." He further states that the inhabitants of the Valley of Nepal, which is extremely hot in summer, and also the various hill-tribes of India, suffer from dysentery and fever when on the plains; and they die if they attempt to pass the whole year there.

We thus see that many of the wilder races of man are apt to suffer much in health when subjected to changed conditions or habits of life, and not exclusively from being transported to a new climate. Mere alterations in habits, which do not appear injurious in themselves, seem to have this same effect; and in several cases the children are particularly liable to suffer. It has often been said, as Mr. Macnamara remarks, that man can resist with impunity the greatest diversities of climate and other changes; but this is true only of the civilised races. Man in his wild condition seems to be in this respect almost as susceptible as his nearest allies, the anthropoid apes, which have never yet survived long, when removed from their native country.

Lessened fertility from changed conditions, as in the case of the Tasmanians, Maories, Sandwich Islanders, and apparently the Australians, is still more interesting than their liability to ill-health and death; for even a slight degree of infertility, combined with those other causes which tend to check the increase of every population, would sooner or later lead to extinction. The diminution of fertility may be explained in some cases by the profligacy of the women (as until lately with the Tahitians), but Mr. Fenton has shewn that this explanation by no means suffices with the New Zealanders, nor does it with the Tasmanians.

In the paper above quoted, Mr. Macnamara gives reasons for believing that the inhabitants of districts subject to malaria are apt to be sterile; but this cannot apply in several of the above cases. Some writers have suggested that the aborigines of islands have suffered in fertility and health from long continued interbreeding; but in the above cases infertility has coincided too closely with the arrival of Europeans for us to admit this explanation. Nor have we at present any reason to believe that man is highly sensitive to the evil effects of inter-breeding, especially in areas so large as New Zealand, and the Sandwich archipelago with its diversified stations. On the contrary, it is known that the present inhabitants of Norfolk Island are nearly all cousins or near relations, as are the Todas in India, and the inhabitants of some of the Western Islands of Scotland; and yet they seem not to have suffered in fertility.[399]

A much more probable view is suggested by the analogy of the lower animals. The reproductive system can be shewn to be susceptible to an extraordinary degree (though why we know not) to changed conditions of life; and this susceptibility leads both to beneficial and to evil results. A large collection of facts on this subject is given in chap. xviii. of vol. ii. of my *Variation of Animals and Plants under Domestication*, I can here give only the briefest abstract; and every one interested in the subject may consult the above work. Very slight changes increase the health, vigour, and fertility of most or all organic beings, whilst other changes are known to render a large number of animals sterile. One of the most familiar cases, is that of tamed elephants not breeding in India; though they often breed in Ava, where the females are allowed to roam about the forests to some extent, and are thus placed under more natural conditions. The case of various American monkeys, both sexes of which have been kept for many years together in their own countries, and yet have very rarely or never bred, is a more apposite instance, because of their relationship to man. It is remarkable how slight a change in the conditions often induces sterility in a wild animal when captured; and this is the more strange as all our domesticated animals have become more fertile than they were in a state of nature; and some of them can resist the most unnatural conditions with undiminished fertility.[400] Certain groups of animals are much more liable than others to be affected by captivity; and generally all the species of the same group are affected in the same manner. But sometimes a single species in a group is rendered sterile, whilst the others are not so; on the other hand, a single species may retain its fertility whilst most of the others fail to breed. The males and females of some species when confined, or when allowed to live almost, but not quite free, in their native country, never unite; others thus circumstanced frequently unite but never produce offspring; others again produce some offspring, but fewer than in a state of nature; and as bearing on the above cases of man, it is important to remark that the young are apt to be weak and sickly, or malformed, and to perish at an early age.

Seeing how general is this law of the susceptibility of the reproductive system to changed conditions of life, and that it holds good with our nearest allies, the Quadrumana, I can hardly doubt that it applies to man in his primeval state. Hence if savages of any race are induced suddenly to change their habits of life, they become more or less sterile, and their young offspring suffer in health, in the same manner and from the same cause, as do the elephant and hunting-leopard in India, many monkeys in America, and a host of animals of all kinds, on removal from their natural conditions.

We can see why it is that aborigines, who have long inhabited islands, and who must have been long exposed to nearly uniform conditions, should be specially affected by any change in their habits, as seems to be the case. Civilised races can certainly resist changes of all kinds far better than savages; and in this respect they resemble domesticated animals, for though the latter sometimes suffer in health (for instance European dogs in India), yet they are rarely rendered sterile, though a few such instances have been recorded.[401] The immunity of civilised races and domesticated animals is probably due to their having been subjected to a greater extent, and therefore having grown somewhat more accustomed, to diversified or varying conditions, than the majority of wild animals; and to their having formerly immigrated or been carried from country to country, and to different families or subraces having inter-crossed. It appears that a cross with civilised races at once gives to an aboriginal race an immunity from the evil consequences of changed conditions. Thus the crossed offspring from the Tahitians and English, when settled in Pitcairn Island, increased so rapidly that the island was soon overstocked; and in June 1856 they were removed to Norfolk Island. They then consisted of 60 married persons and 134 children, making a total of 194. Here they likewise increased so rapidly, that although sixteen of them returned to Pitcairn Island in 1859, they numbered in January 1868, 300 souls; the males and females being in exactly equal numbers. What a contrast does this case present with that of the Tasmanians; the Norfolk Islanders increased in only twelve and a half years from 194 to 300;

whereas the Tasmanians decreased during fifteen years from 120 to 46, of which latter number only ten were children.[402]

So again in the interval between the census of 1866 and 1872 the natives of full blood in the Sandwich Islands decreased by 8081, whilst the half-castes, who are believed to be healthier, increased by 847; but I do not know whether the latter number includes the offspring from the half-castes, or only the half-castes of the first generation.

The cases which I have here given all relate to aborigines, who have been subjected to new conditions as the result of the immigration of civilised men. But sterility and ill-health would probably follow, if savages were compelled by any cause, such as the inroad of a conquering tribe, to desert their homes and to change their habits. It is an interesting circumstance that the chief check to wild animals becoming domesticated, which implies the power of their breeding freely when first captured, and one chief check to wild men, when brought into contact with civilisation, surviving to form a civilised race, is the same, namely, sterility from changed conditions of life.

Finally, although the gradual decrease and ultimate extinction of the races of man is a highly complex problem, depending on many causes which differ in different places and at different times; it is the same problem as that presented by the extinction of one of the higher animals- of the fossil horse, for instance, which disappeared from South America, soon afterwards to be replaced, within the same districts, by countless troops of the Spanish horse. The New Zealander seems conscious of this parallelism, for he compares his future fate with that of the native rat now almost exterminated by the European rat. Though the difficulty is great to our imagination, and really great, if we wish to ascertain the precise causes and their manner of action, it ought not to be so to our reason, as long as we keep steadily in mind that the increase of each species and each race is constantly checked in various ways; so that if any new check, even a slight one, be superadded, the race will surely decrease in number; and decreasing numbers will sooner or later lead to extinction; the end, in most cases, being promptly determined by the inroads of conquering tribes.

On the Formation of the Races of Man.- In some cases the crossing of distinct races has led to the formation of a new race. The singular fact that the Europeans and Hindoos, who belong to the same Aryan stock, and speak a language fundamentally the same, differ widely in appearance, whilst Europeans differ but little from Jews, who belong to the Semitic stock, and speak quite another language, has been accounted for by Broca,[403] through certain Aryan branches having been largely crossed by indigenous tribes during their wide diffusion. When two races in close contact cross, the first result is a heterogeneous mixture: thus Mr. Hunter, in describing the Santali or hill-tribes of India, says that hundreds of imperceptible gradations may be traced "from the black, squat tribes of the mountains to the tall olive-coloured Brahman, with his intellectual brow, calm eyes, and high but narrow head"; so that it is necessary in courts of justice to ask the witnesses whether they are Santalis or Hindoos.[404] Whether a heterogeneous people, such as the inhabitants of some of the Polynesian islands, formed by the crossing of two distinct races, with few or no pure members left, would ever become homogeneous, is not known from direct evidence. But as with our domesticated animals, a cross-breed can certainly be fixed and made uniform by careful selection [405] in the course of a few generations, we may infer that the free intercrossing of a heterogeneous mixture during a long descent would supply the place of selection, and overcome any tendency to reversion; so that the crossed race would ultimately become homogeneous, though it might not partake in an equal degree of the characters of the two parent-races.

Of all the differences between the races of man, the colour of the skin is the most conspicuous and one of the best marked. It was formerly thought that differences of this kind could be accounted for by long exposure to different climates; but Pallas first shewed that this is not tenable, and he has since been followed by almost all anthropologists.[406] This view has been rejected chiefly because the distribution of the variously coloured races, most of whom have long inhabited their present homes, does not coincide with corresponding differences of climate. Some little weight may be given to such cases as that of the Dutch families, who, as we hear on excellent authority,[407] have not undergone the least change of colour after residing for three centuries in South Africa. An argument on the same side may likewise be drawn from the uniform appearance in various parts of the world of gipsies and Jews, though the uniformity of the latter has been somewhat exaggerated. [408] A very damp or a very dry atmosphere has been supposed to be more influential in modifying the colour of the skin than mere heat; but as D'Orbigny in South America, and Livingstone in Africa, arrived at diametrically opposite conclusions with respect to dampness and dryness, any conclusion

on this head must be considered as very doubtful.[409]

Various facts, which I have given elsewhere, prove that the colour of the skin and hair is sometimes correlated in a surprising manner with a complete immunity from the action of certain vegetable poisons, and from the attacks of certain parasites. Hence it occurred to me, that negroes and other dark races might have acquired their dark tints by the darker individuals escaping from the deadly influence of the miasma of their native countries, during a long series of generations.

I afterwards found that this same idea had long ago occurred to Dr. Wells.[410] It has long been known that negroes, and even mulattoes are almost completely exempt from the yellow fever, so destructive in tropical America.[411] They likewise escape to a large extent the fatal intermittent fevers, that prevail along at least 2600 miles of the shores of Africa, and which annually cause one-fifth of the white settlers to die, and another fifth to return home invalided.[412] This immunity in the negro seems to be partly inherent, depending on some unknown peculiarity of constitution, and partly the result of acclimatisation. Pouchet[413] states that the negro regiments recruited near the Soudan, and borrowed from the Viceroy of Egypt for the Mexican war, escaped the yellow fever almost equally with the negroes originally brought from various parts of Africa and accustomed to the climate of the West Indies. That acclimatisation plays a part, is shewn by the many cases in which negroes have become somewhat liable to tropical fevers, after having resided for some time in a colder climate.[414] The nature of the climate under which the white races have long resided likewise has some influence on them; for during the fearful epidemic of yellow fever in Demerara during

1837, Dr. Blair found that the death-rate of the immigrants was proportional to the latitude of the country whence they had come. With the negro the immunity, as far as it is the result of acclimatisation, implies exposure during a prodigious length of time; for the aborigines of tropical America who have resided there from time immemorial, are not exempt from yellow fever; and the Rev. H. B. Tristram states, that there are districts in northern Africa which the native inhabitants are compelled annually to leave, though the negroes can remain with safety.

That the immunity of the negro is in any degree correlated with the colour of his skin is a mere conjecture: it may be correlated with some difference in his blood, nervous system, or other tissues. Nevertheless, from the facts above alluded to, and from some connection apparently existing between complexion and a tendency to consumption, the conjecture seemed to me not improbable. Consequently I endeavoured, with but little success,[415] to ascertain how far it holds good. The late Dr. Daniell, who had long lived on the west coast of Africa, told me that he did not believe in any such relation. He was himself unusually fair, and had withstood the climate in a wonderful manner. When he first arrived as a boy on the coast, an old and experienced negro chief predicted from his appearance that this would prove the case. Dr. Nicholson, of Antigua, after having attended to this subject, writes to me that dark-coloured Europeans escape the yellow fever more than those that are light-coloured. Mr. J. M. Harris altogether denies that Europeans with dark hair withstand a hot climate better than other men: on the contrary, experience has taught him in making a selection of men for service on the coast of Africa, to choose those with red hair.[416] As far, therefore, as these slight indications go, there seems no foundation for the hypothesis, that blackness has resulted from the darker and darker individuals having survived better during long exposure to fever-generating miasma.

Dr. Sharpe remarks,[417] that a tropical sun, which burns and blisters a white skin, does not injure a black one at all; and, as he adds, this is not due to habit in the individual, for children only six or eight months old are often carried about naked, and are not affected. I have been assured by a medical man, that some years ago during each summer, but not during the winter, his hands became marked with light brown patches, like, although larger than freckles, and that these patches were never affected by sun-burning, whilst the white parts of his skin have on several occasions been much inflamed and blistered. With the lower animals there is, also, a constitutional difference in liability to the action of the sun between those parts of the skin clothed with white hair and other parts.[418] Whether the saving of the skin from being thus burnt is of sufficient importance to account for a dark tint having been gradually acquired by man through natural selection, I am unable to judge. If it be so, we should have to assume that the natives of tropical America have lived there for a much shorter time than the Negroes in Africa or the Papuans in the southern parts of the Malay archipelago, just as the lighter-coloured Hindoos have resided in India for a shorter time than the darker aborigines of the central and southern parts of the peninsula.

Although with our present knowledge we cannot account for the differences of colour in the races of man, through any advantage thus gained, or from the direct action of climate; yet we must not quite ignore the latter agency, for there is good reason to believe that some inherited effect is thus produced.[419]

We have seen in the second chapter that the conditions of life affect the development of the bodily frame in a direct manner, and that the effects are transmitted. Thus, as is generally admitted, the European settlers in the United States undergo a slight but extraordinary rapid change of appearance. Their bodies and limbs become elongated; and I hear from Col. Bernys that during the late war in the United States, good evidence was afforded of this fact by the ridiculous appearance presented by the German regiments, when dressed in ready-made clothes manufactured for the American market, and which were much too long for the men in every way. There is, also, a considerable body of evidence shewing that in the Southern States the house-slaves of the third generation present a markedly different appearance from the field-slaves.[420] If, however, we look to the races of man as distributed over the world, we must infer that their characteristic differences cannot be accounted for by the direct action of different conditions of life, even after exposure to them for an enormous period of time. The Esquimaux live exclusively on animal food; they are clothed in thick fur, and are exposed to intense cold and to prolonged darkness; yet they do not differ in any extreme degree from the inhabitants of southern China, who live entirely on vegetable food, and are exposed almost naked to a hot, glaring climate. The unclothed Fuegians live on the marine productions of their inhospitable shores; the Botocudos of Brazil wander about the hot forests of the interior and live chiefly on vegetable productions; yet these tribes resemble each other so closely that the Fuegians on board the "Beagle" were mistaken by some Brazilians for Botocudos. The Botocudos again, as well as the other inhabitants of tropical America, are wholly different from the Negroes who inhabit the opposite shores of the Atlantic, are exposed to a nearly similar climate, and follow nearly the same habits of life.

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Nor can the differences between the races of man be accounted for by the inherited effects of the increased or decreased use of parts, except to a quite insignificant degree. Men who habitually live in canoes, may have their legs somewhat stunted; those who inhabit lofty regions may have their chests enlarged; and those who constantly use certain sense-organs may have the cavities in which they are lodged somewhat increased in size, and their features consequently a little modified. With civilized nations, the reduced size of the jaws from lessened use- the habitual play of different muscles serving to express different emotions- and the increased size of the brain from greater intellectual activity, have together produced a considerable effect on their general appearance when compared with savages. Increased bodily stature, without any corresponding increase in the size of the brain, may (judging from the previously adduced case of rabbits), have given to some races an elongated skull of the dolichocephalic type.

Lastly, the little-understood principle of correlated development has sometimes come into action, as in the case of great muscular development and strongly projecting supra-orbital ridges. The colour of the skin and hair are plainly correlated, as is the texture of the hair with its colour in the Mandans of North America.[421] The colour also of the skin, and the odour emitted by it, are likewise in some manner connected. With the breeds of sheep the number of hairs within a given space and the number of excretory pores are related[422] from the analogy of our domesticated animals, many modifications of structure in man probably come under this principle of correlated development.

We have now seen that the external characteristic differences between the races of man cannot be accounted for in a satisfactory manner by the direct action of the conditions of life, nor by the effects of the continued use of parts, nor through the principle of correlation. We are therefore led to enquire whether slight individual differences, to which man is eminently liable, may not have been preserved and augmented during a long series of generations through natural selection. But here we are at once met by the objection that beneficial variations alone can be thus preserved; and as far as we are enabled to judge, although always liable to err on this head, none of the differences between the races of man are of any direct or special service to him. The intellectual and moral or social faculties must of course be excepted from this remark. The great variability of all the external differences between the races of man, likewise indicates that they cannot be of much importance; for if important, they would long ago have been either fixed and preserved, or eliminated. In this respect man resembles those forms, called by naturalists protean or polymorphic, which have remained extremely variable, owing, as it seems, to such variations being of an indifferent nature, and to their having thus escaped the action of natural selection.

We have thus far been baffled in all our attempts to account for the differences between the races of man; but there remains one important agency, namely Sexual Selection, which appears to have acted powerfully on man, as on many other animals. I do not intend to assert that sexual selection will account for all the differences between the races. An unexplained residuum is left, about which we can only say, in our ignorance, that as individuals are continually born with, for instance, heads a little rounder or narrower, and with noses a little longer or shorter, such slight differences might become fixed and uniform, if the unknown agencies which induced them were to act in a more constant manner, aided by long-continued intercrossing. Such variations come under the provisional class, alluded to in our second chapter, which for want of a better term are often called spontaneous. Nor do I pretend that the effects of sexual selection can be indicated with scientific precision; but it can be shewn that it would be an inexplicable fact if man had not been modified by this agency, which appears to have acted powerfully on innumerable animals. It can further be shewn that the differences between the races of man, as in colour, hairiness, form of features, &c., are of a kind which might have been expected to come under the influence of sexual selection. But in order to treat this subject properly, I have found it necessary to pass the whole animal kingdom in review. I have therefore devoted to it the Second Part of this work. At the close I shall return to man, and, after attempting to shew how far he has been modified through sexual selection, will give a brief summary of the chapters in this First Part.

NOTE ON THE RESEMBLANCES AND DIFFERENCES IN THE STRUCTURE AND THE DEVELOPMENT OF THE BRAIN IN MAN AND APES.

BY PROFESSOR HUXLEY, F. R. S.

The controversy respecting the nature and the extent of the differences in the structure of the brain in man and the apes, which arose some fifteen years ago, has not yet come to an end, though the subject matter of the dispute is, at present, totally different from what it was formerly. It was originally asserted and re-asserted, with singular pertinacity that the brain of all the apes, even the highest, differs from that of man, in the absence of such conspicuous structures as the posterior lobes of the cerebral hemispheres, with the posterior cornu of the lateral ventricle and the hippocampus minor, contained in those lobes, which are so obvious in man.

But the truth that the structures in question are as well developed in apes' as in human brains, or even better; and that it is characteristic of all the primates (if we exclude the lemurs) to have these parts well developed, stands at present on as secure a basis as any proposition in comparative anatomy. Moreover, it is admitted by every one of the long series of anatomists who, of late years, have paid special attention to the arrangement of the complicated sulci and gyri which appear upon the surface of the cerebral hemispheres in man and the higher apes, that they are disposed after the very same pattern in him, as in them. Every principal gyrus and sulcus of a chimpanzee's brain is clearly represented in that of a man, so that the terminology which applies to the one answers for the other. On this point there is no difference of opinion. Some years since, Professor Bischoff published a memoir^[423] on the cerebral convolutions of man and apes; and as the purpose of my learned colleague was certainly not to diminish the value of the differences between apes and men in this respect, I am glad to make a citation from him.

"That the apes, and especially the orang, chimpanzee and gorilla, come very close to man in their

organisation, much nearer than to any other animal, is a well known fact, disputed by nobody. Looking at the matter from the point of view of organisation alone, no one probably would ever have disputed the view of Linnaeus, that man should be placed, merely as a peculiar species, at the head of the mammalia and of those apes. Both shew, in all their organs, so close an affinity, that the most exact anatomical investigation is needed in order to demonstrate those differences which really exist. So it is with the brains. The brains of man, the orang, the chimpanzee, the gorilla, in spite of all the important differences which they present, come very close to one another" (loc. cit., p. 101).

There remains, then, no dispute as to the resemblance in fundamental characters, between the ape's brain and man's: nor any as to the wonderfully close similarity between the chimpanzee, orang and man, in even the details of the arrangement of the gyri and sulci of the cerebral hemispheres. Nor, turning to the differences between the brains of the highest apes and that of man, is there any serious question as to the nature and extent of these differences. It is admitted that the man's cerebral hemispheres are absolutely and relatively larger than those of the orang and chimpanzee; that his frontal lobes are less excavated by the upward protrusion of the roof of the orbits; that his gyri and sulci are, as a rule, less symmetrically disposed, and present a greater number of secondary plications. And it is admitted that, as a rule, in man, the temporo-occipital or "external perpendicular" fissure, which is usually so strongly marked a feature of the ape's brain is but faintly marked. But it is also clear, that none of these differences constitutes a sharp demarcation between the man's and the ape's brain. In respect to the external perpendicular fissure of Gratiolet, in the human brain for instance, Professor Turner remarks:[424] "In some brains it appears simply as an indentation of the margin of the hemisphere, but, in others, it tends for some distance more or less transversely outwards. I saw it in the right hemisphere of a female brain pass more than two inches outwards; and on another specimen, also the right hemisphere, it proceeded for four-tenths of an inch outwards, and then extended downwards, as far as the lower margin of the outer surface of the hemisphere. The imperfect definition of this fissure in the majority of human brains, as compared with its remarkable distinctness in the brain of most *Quadrumana*, is owing to the presence, in the former, of certain superficial, well marked, secondary convolutions which bridge it over and connect the parietal with the occipital lobe. The closer the first of these bridging gyri lies to the longitudinal fissure, the shorter is the external parieto-occipital fissure" (loc. cit., p. 12).

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The obliteration of the external perpendicular fissure of Gratiolet, therefore, is not a constant character of the human brain. On the other hand, its full development is not a constant character of the higher ape's brain. For, in the chimpanzee, the more or less extensive obliteration of the external perpendicular sulcus by "bridging convolutions," on one side or the other, has been noted over and over again by Prof. Rolleston, Mr. Marshall, M. Broca and Professor Turner. At the conclusion of a special paper on this subject the latter writes:[425] "The three specimens of the brain of a Chimpanzee," just described, prove that the generalisation which Gratiolet has attempted to draw of the complete absence of the first connecting convolution and the concealment of the second, as essentially characteristic features in the brain of this animal, is by no means universally applicable. In only one specimen did the brain, in these particulars, follow the law which Gratiolet has expressed. As regards the presence of the superior bridging convolution, I am inclined to think that it has existed in one hemisphere, at least, in a majority of the brains of this animal which have, up to this time, been figured or described. The superficial position of the second bridging convolution is evidently less frequent, and has as yet, I believe, only been seen in the brain (A) recorded in this communication. The asymmetrical arrangement in the convolutions of the two hemispheres, which previous observers have referred to in their descriptions, is also well illustrated in these specimens" (pp. 8, 9).

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Even were the presence of the temporo-occipital, or external perpendicular, sulcus, a mark of distinction between the higher apes and man, the value of such a distinctive character would be rendered very doubtful by the structure of the brain in the platyrrhine apes. In fact, while the temporo-occipital is one of the most constant of sulci in the catarrhine, or Old World, apes, it is never very strongly developed in the New World apes; it is absent in the smaller platyrrhine; rudimentary in *Pithecia*;[426] and more or less obliterated by bridging convolutions in *Ateles*.

A character which is thus variable within the limits of a single group can have no great taxonomic value.

It is further established, that the degree of asymmetry of the convolution of the two sides in the human brain is subject to much individual variation; and that, in those individuals of the bushman race who have been examined, the gyri and sulci of the two hemispheres are considerably less complicated and more symmetrical than in the European brain, while, in some individuals of the chimpanzee, their complexity and asymmetry become notable. This is particularly the case in the brain of a young male chimpanzee figured by M. Broca. (*L'ordre des Primates*, p. 165, fig. 11.) Again, as respects the question of absolute size, it is established that the difference between the largest and the smallest healthy human brain is greater than the difference between the smallest healthy human brain and the largest chimpanzee's or orang's brain.

Moreover, there is one circumstance in which the orang's and chimpanzee's brains resemble man's, but in which they differ from the lower apes, and that is the presence of two corpora candicantia- the *Cynomorpha* having but one.

In view of these facts I do not hesitate in this year 1874, to repeat and insist upon the proposition which I enunciated in 1863:[427] "So far as cerebral structure goes, therefore, it is clear that man differs less from the chimpanzee or the orang, than these do even from the monkeys, and that the difference between the brain of the chimpanzee and of man is almost insignificant when compared with that between the chimpanzee brain and that of a lemur."

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In the paper to which I have referred, Professor Bischoff does not deny the second part of this statement, but he first makes the irrelevant remark that it is not wonderful if the brains of an orang and a lemur are very different; and secondly, goes on to assert that, "If we successively compare the brain of a man with that of an orang; the brain of this with that of a chimpanzee; of this with that of a gorilla, and so on of a *Hylobates*, *Semnopithecus*, *Cynocephalus*, *Cercopithecus*, *Macacus*, *Cebus*, *Callithrix*, *Lemur*, *Stenops*, *Hapale*, we shall not meet with a greater, or even as great a break in the degree of development of the convolutions, as we find between the brain of a man and that of an orang or chimpanzee."

To which I reply, firstly, that whether this assertion be true or false, it has nothing whatever to do with the proposition enunciated in *Man's Place in Nature*, which refers not to the development of the convolutions alone, but to the structure of the whole brain. If Professor Bischoff had taken the trouble to refer to p. 96 of the work he criticises, in fact, he would have found the following passage: "And it is a remarkable circumstance that though, so far as our present knowledge extends, there is one true structural break in the series of forms of simian brains, this hiatus does not lie between

man and the manlike apes, but between the lower and the lowest simians, or in other words, between the Old and New World apes and monkeys and the lemurs. Every lemur which has yet been examined, in fact, has its cerebellum partially visible from above; and its posterior lobe, with the contained posterior cornu and hippocampus minor, more or less rudimentary. Every marmoset, American monkey, Old World monkey, baboon or manlike ape, on the contrary, has its cerebellum entirely hidden, posteriorly, by the cerebral lobes, and possesses a large posterior cornu with a well-developed hippocampus minor."

This statement was a strictly accurate account of what was known when it was made; and it does not appear to me to be more than apparently weakened by the subsequent discovery of the relatively small development of the posterior lobes in the siamang and in the howling monkey. Notwithstanding the exceptional brevity of the posterior lobes in these two species, no one will pretend that their brains, in the slightest degree, approach those of the lemurs. And if, instead of putting Hapale out of its natural place, as Professor Bischoff most unaccountably does, we write the series of animals he has chosen to mention as follows: Homo, Pitheculus, Troglodytes, Hylobates, Semnopithecus, Cynocephalus, Cereopithecus, Macacus, Cebus, Callithrix, Hapale, Lemur, Stenops, I venture to reaffirm that the great break in this series lies between Hapale and Lemur, and that this break is considerably greater than that between any other two terms of that series. Professor Bischoff ignores the fact that long before he wrote, Gratiolet had suggested the separation of the lemurs from the other primates on the very ground of the difference in their cerebral characters; and that Professor Flower had made the following observations in the course of his description of the brain of the Javan loris:[428]

"And it is especially remarkable that, in the development of the posterior lobes, there is no approximation to the lemurine, short hemisphered brain, in those monkeys which are commonly supposed to approach this family in other respects, viz., the lower members of the platyrrhine group."

So far as the structure of the adult brain is concerned, then, the very considerable additions to our knowledge, which have been made by the researches of so many investigators, during the past ten years, fully justify the statement which I made in 1863. But it has been said, that, admitting the similarity between the adult brains of man and apes, they are nevertheless, in reality, widely different, because they exhibit fundamental differences in the mode of their development. No one would be more ready than I to admit the force of this argument, if such fundamental differences of development really exist. But I deny that they do exist. On the contrary, there is a fundamental agreement in the development of the brain in men and apes.

Gratiolet originated the statement that there is a fundamental difference in the development of the brains of apes and that of man- consisting in this; that, in the apes, the sulci which first make their appearance are situated on the posterior region of the cerebral hemispheres, while, in the human foetus, the sulci first become visible on the frontal lobes.[429]

This general statement is based upon two observations, the one of a gibbon almost ready to be born, in which the posterior gyri were "well developed," while those of the frontal lobes were "hardly indicated"[430] (loc. cit., p. 39), and the other of a human foetus at the 22nd or 23rd week of utero-gestation, in which Gratiolet notes that the insula was uncovered, but that nevertheless "des incisures sement de lobe anterieur, une scissure peu profonde indique la separation du lobe occipital, tres-reduit, d'ailleurs des cette epoque. Le reste de la surface cerebrale est encore absolument lisse."

Three views of this brain are given in plate II, figs. 1, 2, 3, of the work cited, shewing the upper, lateral and inferior views of the hemispheres, but not the inner view. It is worthy of note that the figure by no means bears out Gratiolet's description, inasmuch as the fissure (antero-temporal) on the posterior half of the face of the hemisphere is more marked than any of those vaguely indicated in the anterior half. If the figure is correct, it in no way justifies Gratiolet's conclusion: "Il y a donc entre ces cerveaux [those of a Callithrix and of a gibbon] et celui du foetus humain une difference fondamentale. Chez celui-ci, longtemps avant que les plis temporaux apparaissent, les plis frontaux, essayent d'exister."

Since Gratiolet's time, however, the development of the gyri and sulci of the brain has been made the subject of renewed investigation by Schmidt, Bischoff, Pansch,[431] and more particularly by Ecker,[432] whose work is not only the latest, but by far the most complete, memoir on the subject.

The final results of their inquiries may be summed up as follows:

1. In the human foetus, the sylvian fissure is formed in the course of the third month of utero-gestation. In this, and in the fourth month, the cerebral hemispheres are smooth and rounded (with the exception of the sylvian depression), and they project backwards far beyond the cerebellum.

2. The sulci, properly so called, begin to appear in the interval between the end of the fourth and the beginning of the sixth month of foetal life, but Ecker is careful to point out that, not only the time, but the order, of their appearance is subject to considerable individual variation. In no case, however, are either the frontal or the temporal sulci the earliest.

The first which appears, in fact, lies on the inner face of the hemisphere (whence doubtless Gratiolet, who does not seem to have examined that face in his foetus, overlooked it), and is either the internal perpendicular (occipito-parietal), or the calcarine sulcus, these two being close together and eventually running into one another. As a rule the occipito-parietal is the earlier of the two.

3. At the latter part of this period, another sulcus, the "postero-parietal," or "Fissure of Rolando" is developed, and it is followed, in the course of the sixth month, by the other principal sulci of the frontal, parietal, temporal and occipital lobes. There is, however, no clear evidence that one of these constantly appears before the other; and it is remarkable that, in the brain at the period described and figured by Ecker (loc. cit., pp. 212-213 tab. II, figs. 1, 2, 3, 4), the antero-temporal sulcus (scissure parallele) so characteristic of the ape's brain, is as well, if not better developed than the fissure of Rolando, and is much more marked than the proper frontal sulci.

Taking the facts as they now stand, it appears to me that the order of the appearance of the sulci and gyri in the foetal human brain is in perfect harmony with the general doctrine of evolution, and with the view that man has been evolved from some ape-like form; though there can be no doubt that that form was, in many respects, different from any member of the primates now living.

Von Baer taught us, half a century ago, that, in the course of their development, allied animals put on at first, the characters of the greater groups to which they belong, and, by degrees, assume those which restrict them within the limits of their family, genus, and species; and he proved, at the same time, that no developmental stage of a higher animal is precisely similar to the adult condition of any lower animal. It is quite correct to say that a frog passes through the condition of a fish, inasmuch as at one period of its life the tadpole has all the characters of a fish, and if it went no further, would have to be grouped among fishes. But it is equally true that a tadpole is very different from any known fish.

In like manner, the brain of a human foetus, at the fifth month, may correctly be said to be, not only the brain of an ape, but that of an arctopithecine or marmoset-like ape; for its hemispheres, with their great posterior lobe, and with no sulci but the sylvian and the calcarine, present the characteristics found only in the group of the arctopithecine primates. But it is equally true, as Gratiolet remarks, that, in its widely open sylvian fissure, it differs from the brain of any actual marmoset. No doubt it would be much more similar to the brain of an advanced foetus of a marmoset. But we know nothing whatever of the development of the brain in the marmosets. In the Platyrrhini proper, the only observation with which I am acquainted is due to Pansch, who found in the brain of a foetal *Cebus apella*, in addition to the sylvian fissure and the deep calcarine fissure, only a very shallow antero-temporal fissure (scissure parallele of Gratiolet).

Now this fact, taken together with the circumstance that the antero-temporal sulcus is present in such Platyrrhini as the *Saimiri*, which present mere traces of sulci on the anterior half of the exterior of the cerebral hemispheres, or none at all, undoubtedly, so far as it goes, affords fair evidence in favour of Gratiolet's hypothesis, that the posterior sulci appear before the anterior, in the brains of the Platyrrhini. But, it by no means follows, that the rule which may hold good for the Platyrrhini extends to the Catarrhini. We have no information whatever respecting the development of the brain in the Cynomorphia; and, as regards the Anthropomorpha, nothing but the account of the brain of the gibbon near birth, already referred to. At the present moment there is not a shadow of evidence to show that the sulci of a chimpanzee's, or orang's, brain do not appear in the same order as a man's.

Gratiolet opens his preface with the aphorism: "Il est dangereux dans les sciences de conclure trop vite." I fear he must have forgotten this sound maxim by the time he had reached the discussion of the differences between men and apes, in the body of his work. No doubt, the excellent author of one of the most remarkable contributions to the just understanding of the mammalian brain which has ever been made, would have been the first to admit the insufficiency of his data had he lived to profit by the advance of inquiry. The misfortune is that his conclusions have been employed by persons incompetent to appreciate their foundation, as arguments in favour of obscurantism.[433]

But it is important to remark that, whether Gratiolet was right or wrong in his hypothesis respecting the relative order of appearance of the temporal and frontal sulci, the fact remains; that, before either temporal or frontal sulci, appear, the foetal brain of man presents characters which are found only in the lowest group of the primates (leaving out the lemurs); and that this is exactly what we should expect to be the case, if man has resulted from the gradual modification of the same form as that from which the other primates have sprung.

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N.B. Part II of the Descent of man (Chapters 8-21) are not on-line.

Footnotes

[355] History of India, 1841, vol. i., p. 323. Father Ripa makes exactly the same remark with respect to the Chinese.

[356] A vast number of measurements of whites, blacks, and Indians, are given in the Investigations in the Military and Anthropolog. Statistics of American Soldiers by B. A. Gould, 1869, pp. 298-358; "On the capacity of the lungs," p. 471. See also the numerous and valuable tables, by Dr. Weisbach, from the observations of Dr. Scherzer and Dr. Schwarz, in the Reise der Novara: Anthropolog. Theil, 1867

[357] See, for instance, Mr. Marshall's account of the brain of a bushwoman, in Philosophical Transactions, 1864, p. 519

[358] Wallace The Malay Archipelago, vol. ii., 1869, p. 178.

[359] With respect to the figures in the famous Egyptian caves of Abou-Simbel, M. Pouchet says (The Plurality of the Human Races, Eng. transl., 1864, p. 50), that he was far from finding recognisable representations of the dozen or more nations which some authors believe that they can recognise. Even some of the most strongly-marked races cannot be identified with that degree of unanimity which might have been expected from what has been written on the subject. Thus Messrs. Nott and Gliddon (Types of Mankind, p. 148), state that Rameses II, or the Great, has features superbly European; whereas Knox, another firm believer in the specific distinctness of the races of man (Races of Man, 1850, p. 201), speaking of young Memnon (the same as Rameses II, as I am informed by Mr. Birch), insists in the strongest manner that he is identical in character with the Jews of Antwerp. Again, when I looked at the statue of Amunoph III, I agreed with two officers of the establishment, both competent judges, that he had a strongly-marked negro type of features; but Messrs. Nott and Gliddon (ibid., p. 146, fig. 53), describe him as a hybrid, but not of "negro intermixture."

[360] As quoted by Nott and Gliddon, Types of Mankind, 1854, p. 439. They give also corroborative evidence; but C. Vogt thinks that the subject requires further investigation.

[361] "Diversity of Origin of the Human Races," in the Christian Examiner, July, 1850.

[362] Transactions of the Royal Society of Edinburgh, vol. xxii, 1861, p. 567.

[363] On the Phenomena of Hybridity in the Genus Homo, Eng. transl., 1864

[364] See the interesting letter by Mr. T. A. Murray, in the Anthropological Review, April, 1868, p. liii. In this letter Count Strzelecki's statement that Australian women who have borne children to a white man, are afterwards sterile with their own race, is disproved. M. A. de Quatrefages

has also collected (*Revue des Cours Scientifiques*, March, 1869, p. 239), much evidence that Australians and Europeans are not sterile when crossed

[365] *An Examination of Prof. Agassiz's Sketch of the Nat. Provinces of the Animal World*, Charleston, 1855, p. 44

[366] Dr. Rohlf's writes to me that he found the mixed races in the Great Sahara, derived from Arabs, Berbers, and Negroes of three tribes, extraordinarily fertile. On the other hand, Mr. Winwood Reade informs me that the Negroes on the Gold Coast, though admiring white men and mulattoes, have a maxim that mulattoes should not intermarry, as the children are few and sickly. This belief, as Mr. Reade remarks, deserves attention, as white men have visited and resided on the Gold Coast for four hundred years, so that the natives have had ample time to gain knowledge through experience.

[367] *Military and Anthropological Statistics of American Soldiers*, by B. A. Gould, 1869, p. 319.

[368] *The Variation of Animals and Plants under Domestication*, vol. ii p. 109. I may here remind the reader that the sterility of species when crossed is not a specially acquired quality, but, like the incapacity of certain trees to be grafted together, is incidental on other acquired differences. The nature these differences is unknown, but they relate more especially to the reproductive system, and much less so to external structure or to ordinary differences in constitution. One important element in the sterility of crossed species apparently lies in one or both having been long habituated to fixed conditions; for we know that changed conditions have a special influence on the reproductive system, and we have good reason to believe (as before remarked) that the fluctuating conditions of domestication tend to eliminate that sterility which is so general with species, in a natural state, when crossed. It has elsewhere been shewn by me (*ibid.*, vol. ii., p. 185, and *Origin of Species*, (OOS), that the sterility of crossed species has not been acquired through natural selection: we can see that when two forms have already been rendered very sterile, it is scarcely possible that their sterility should be augmented by the preservation or survival of the more and more sterile individuals; for, as the sterility increases, fewer and fewer offspring will be produced from which to breed, and at last only single individuals will be produced at the rarest intervals. But there is even a higher grade of sterility than this. Both Gartner and Kolreuter have proved that in genera of plants, including many species, a series can be formed from species which, when crossed, yield fewer and fewer seeds, to species which never produce a single seed, but yet are affected by the pollen of the other species, as shewn by the swelling of the germen. It is here manifestly impossible to select the more sterile individuals, which have already ceased to yield seeds; so that the acme of sterility, when the germen alone is affected, cannot have been gained through selection. This acme, and no doubt the other grades of sterility, are the incidental results of certain unknown differences in the constitution of the reproductive system of the species which are crossed.

[369] *The Variation of Animals, &c.*, vol. ii., p. 92.

[370] M. de Quatrefages has given (*Anthropological Review*, Jan., 1869, p. 22), an interesting account of the success and energy of the Paulistas in Brazil, who are a much crossed race of Portuguese and Indians, with a mixture of the blood of other races.

[371] For instance, with the aborigines of America and Australia, Prof. Huxley says (*Transact. Internat. Congress of Prehist. Arch.*, 1868, p. 105), that the skulls of many South Germans and Swiss are "as short and as broad as those of the Tartars," &c.

[372] See a good discussion on this subject in Waitz, *Introduction to Anthropology*, Eng. transl., 1863, pp. 198-208, 227. I have taken some of the above statements from H. Tuttle's *Origin and Antiquity of Physical Man*, Boston, 1866, p. 35.

[373] Prof. Nageli has carefully described several striking cases in his *Botanische Mittheilungen*, B. ii., 1866, ss. 294-369. Prof. Asa Gray has made analogous remarks on some intermediate forms in the *Compositae* of N. America.

[374] *Origin of Species*. (OOS)

[375] See Prof. Huxley to this effect in the *Fortnightly Review*, 1865, p. 275.

[376] Lectures on Man, Eng. transl., 1864, p. 468

[377] Die Rassen des Schweines, 1860, s. 46. Vorstudien fur Geschichte, &c., "Schweinesschadel," 1864, s. 104. With respect to cattle, see M. de Quatrefages, Unite de l'Espece Humaine, 1861, p. 119.

[378] Tylor's Early History of Mankind, 1865: with respect to gesture-language, see p. 54.

Lubbock's Prehistoric Times, 2nd ed., 1869

[379] "On Analogous Forms of Implements," in Memoirs of Anthropological Society by H. M. Westropp. The Primitive Inhabitants of Scandinavia, Eng. transl., edited by Sir J. Lubbock, 1868, p. 104

[380] Westropp "On Cromlechs," &c., Journal of Ethnological Soc., as given in Scientific Opinion, June 2, 1869, p. 3

[381] Journal of Researches: Voyage of the Beagle, p. 46.

[382] Prehistoric Times, 1869, p. 574.

[383] Translation in Anthropological Review, Oct., 1868, p. 431

[384] Transactions, International Congress of Prehistoric Archaeology 1868, pp. 172-175. See also Broca (tr.) in Anthropological Review, Oct., 1868, p. 410.

[385] Dr. Gerland, Uber das Aussterben der Naturvolker 1868, s. 82.

[386] Gerland, *ibid.*, s. 12, gives facts in support of this statement.

[387] See remarks to this effect in Sir H. Holland's Medical Notes and Reflections, 1839, p. 390

[388] I have collected (Journal of Researches: Voyage of the Beagle, p. 435) a good many cases bearing on this subject; see also Gerland, *ibid.*, s. 8. Poeppig speaks of the "breath of civilisation as poisonous to savages.

[389] Sproat, Scenes and Studies of Savage Life, 1868, p. 284.

[390] Bagehot, "Physics and Politics," Fortnightly Review, April 1, 1868, p. 455.

[391] All the statements here given are taken from The Last of the Tasmanians, by J. Bonwick, 1870

[392] This is the statement of the Governor of Tasmania, Sir W. Denison, Varieties of Vice-Regal Life, 1870, vol. i., p. 67.

[393] For these cases, see Bonwick's Daily Life of the Tasmanians, 1870, p. 90: and The Last of the Tasmanians, 1870, p. 386.

[394] Observations on the Aboriginal Inhabitants of New Zealand, published by the Government, 1859

[395] New Zealand, by Alex. Kennedy, 1873, p. 47.

[396] Life of J. C. Patteson, by C. M. Younge, 1874; see more especially vol. i., p. 530.

[397] The foregoing statements are taken chiefly from the following works: Jarves' History of the Hawaiian Islands, 1843, pp. 400-407. Cheever, Life in the Sandwich Islands, 1851, p. 277. Ruschenberger is quoted by Bonwick, Last of the Tasmanians, 1870, p. 378. Bishop is quoted by Sir E. Belcher, Voyage Round the World, 1843, vol. i., p. 272. I owe the census of the several years to the kindness of Mr. Coan, at the request of Dr. Youmans of New York; and in most cases I have

compared the Youmans figures with those given in several of the above-named works. I have omitted the census for 1850, as I have seen two widely different numbers given.

[398] The Indian Medical Gazette, Nov. 1, 1871, p. 240.

[399] On the close relationship of the Norfolk Islanders, Sir W. Denison, *Varieties of Vice-Regal Life*: vol. i., 1870, p. 410. For the Todas, see Col. Marshall's work 1873, p. 110. For the Western Islands of Scotland, Dr. Mitchell, *Edinburgh Medical Journal*, March to June, 1865.

[400] For the evidence on this head, see *Variation of Animals, &c.*, vol. ii., p. 111.

[401] *Variation of Animals, &c.*, vol. ii., p. 16

[402] These details are taken from *The Mutineers of the Bounty*, by Lady Belcher, 1870; and from Pitcairn Island, ordered to be printed by the House of Commons, May 29, 1863. The following statements about the Sandwich Islanders are from the *Honolulu Gazette*, and from Mr. Coan.

[403] "On Anthropology," translation, *Anthropological Review*, Jan., 1868, p. 38

[404] *The Animals of Rural Bengal*, 1868, p. 134

[405] *The Variation of Animals and Plants under Domestication* vol. ii., p. 95.

[406] Pallas, *Act. Acad. St. Petersburg*, 1780, part ii., p. 69. He was followed by Rudolphi, in his *Beitrag zur Anthropologie*, 1812. An excellent summary of the evidence is given by Godron, *De l'Espece*, 1859, vol. ii., p. 246, &c

[407] Sir Andrew Smith, as quoted by Knox, *Races of Man*, 1850, p. 473

[408] See De Quatrefages on this head, *Revue des Cours Scientifiques*, Oct. 17, 1868, p. 731

[409] Livingstone's *Travels and Researches in S. Africa*, 1857, pp. 338, 339. D'Orbigny, as quoted by Godron, *De l'Espece*, vol. ii., p. 266.

[410] See a paper read before the Royal Soc. in 1813, and published in his *Essays* in 1818. I have given an account of Dr. Wells' views in the "Historical Sketch" (p. 2) to my *Origin of Species*. Various cases of colour correlated with constitutional peculiarities are given in my *Variation of Animals and Plants under Domestication*, vol. ii., pp. 227, 335

[411] See, for instance, Nott and Gliddon, *Types of Mankind*, p. 68

[412] Major Tulloch in a paper read before the Statistical Society, April 20, 1840, and given in the *Athenaeum*, 1840, p. 353

[413] *The Plurality of the Human Race* (translat.), 1864, p. 60

[414] Quatrefages, *Unite de l'Espece Humaine*, 1861, p. 205. Wartz, *Introduction to Anthropology*, translat., vol. i., 1863, p. 124. Livingstone gives analogous cases in his *Travels*.

[415] In the spring of 1862 I obtained permission from the Director-General of the Medical department of the Army, to transmit to the surgeons of the various regiments on foreign service a blank table, with the following appended remarks, but I have received no returns. "As several well-marked cases have been recorded with our domestic animals of a relation between the colour of the dermal appendages and the constitution; and it being notorious that there is some limited degree of relation between the colour of the races of man and the climate inhabited by them; the following investigation seems worth consideration. Namely, whether there is any relation in Europeans between the colour of their hair, and their liability to the diseases of tropical countries. If the surgeons of the several regiments, when stationed in unhealthy tropical districts, would be so good as first to count, as a standard of comparison, how many men, in the force whence the sick are drawn, have dark and light-coloured hair, and hair of intermediate or doubtful tints; and if a similar account were kept by the same medical gentlemen, of all the men who suffered from malarious and

yellow fevers, or from dysentery, it would soon be apparent, after some thousand cases had been tabulated, whether there exists any relation between the colour of the hair and constitutional liability to tropical diseases. Perhaps no such relation would be discovered, but the investigation is well worth making. In case any positive result were obtained, it might be of some practical use in selecting men for any particular service. Theoretically the result would be of high interest, as indicating one means by which a race of men inhabiting from a remote period an unhealthy tropical climate, might have become dark-coloured by the better preservation of dark-haired or dark-complexioned individuals during a long succession of generations.

[416] *Anthropological Review*, Jan., 1866, p. xxi. Dr. Sharpe also says, with respect to India (*Man a Special Creation*, 1873, p. 118), "that it has been noticed by some medical officers that Europeans with light hair and florid complexions suffer less from diseases of tropical countries than persons with dark hair and sallow complexions; and, so far as I know, there appear to be good grounds for this remark." On the other hand, Mr. Heddle, of Sierra Leone, "who has had more clerks killed under him than any other man," by the climate of the west African coast (W. Reade, *African Sketch Book*, vol. ii., p. 522), holds a directly opposite view, as does Capt. Burton.

[417] *Man a Special Creation*, 1873, p. 119

[418] *Variation of Animals and Plants under Domestication*, vol. ii., pp. 336, 337.

[419] See, for instance, Quatrefages (*Revue des Cours Scientifiques*, Oct. 10, 1868, p. 724) on the effects of residence in Abyssinia and Arabia, and other analogous cases. Dr. Rolle (*Der Mensch, seine Abstammung, &c.*, 1865, s. 99) states, on the authority of Khanikof, that the greater number of German families settled in Georgia, have acquired in the course of two generations dark hair and eyes. Mr. D. Forbes informs me that the Quechuas in the Andes vary greatly in colour, according to the position of the valleys inhabited by them.

[420] Harlan, *Medical Researches*, p. 532. Quatrefages (*Unite de l'Espece Humaine*, 1861, p. 128) has collected much evidence on this head.

[421] Mr. Catlin states (*N. American Indians*, 3rd ed., 1842, vol. i., p. 49) that in the whole tribe of the Mandans, about one in ten or twelve of the members, of all ages and both sexes, have bright silvery grey hair, which is hereditary. Now this hair is as coarse and harsh as that of a horse's mane, whilst the hair of other colours is fine and soft

[422] On the odour of the skin, Godron, *De l'Espece*, tom. ii., p. 217. On the pores of the skin, Dr. Wilckens, *Die Aufgaben der Landwirth. Zootechnik*, 1869, s. 7.

[423] "Die Grosshirnwindungen des Menschen"; *Abhandlungen der K. Bayerischen Akademie*, B. x., 1868.

[424] *Convolutions of the Human Cerebrum Topographically Considered*, 1866, p. 12.

[425] "Notes more especially on the bridging convolutions in the Brain of the Chimpanzee," *Proceedings of the Royal Society of Edinburgh*, 1865-6.

[426] Flower, "On the Anatomy of *Pithecia Monachus*," *Proceedings of the Zoological Society*, 1862.

[427] *Man's Place in Nature*, p. 102.

[428] *Transactions of the Zoological Society*, vol. v., 1862.

[429] "Chez tous les singes, les plis posterieurs se developpent les premiers; les plis anterieurs se developpent plus tard, aussi la vertebre occipitale et la parietale sont-elles relativement tres-grandes chez le fœtus. L'Homme presente une exception remarquable quant a l'epoque de l'apparition des plis frontaux, qui sont les premiers indiques; mais le developpement general du lobe frontal, envisage seulement par rapport a son volume, suit les memes lois que dans les singes"; Gratiolet, *Memoire sur les plis cerebres de l'Homme et des Primateaux*, p. 39, tab. iv, fig. 3.

[430] Gratiolet's words are (loc. cit., p. 39): "Dans le fœtus dont il s'agit les plis cerebraux

postérieurs sont bien développés, tandis que les plis du lobe frontal sont à peine indiqués." The figure, however (pl. iv, fig. 3), shews the fissure of Rolando, and one of the frontal sulci plainly enough. Nevertheless, M. Alix, in his "Notice sur les travaux anthropologiques de Gratiolet" (Mem. de la Société d'Anthropologie de Paris, 1868, page 32), writes thus: "Gratiolet a eu entre les mains le cerveau d'un fœtus de Gibbon, singe éminemment supérieur, et tellement rapproché de l'orang, que des naturalistes très-compétents l'ont rangé parmi les anthropoïdes. M. Huxley, par exemple, n'hésite pas sur ce point. Eh bien, c'est sur le cerveau d'un fœtus de Gibbon que Gratiolet a vu les circonvolutions du lobe temporo-sphénoïdal déjà développées lorsqu'il n'existent pas encore de plis sur le lobe frontal. Il était donc bien autorisé à dire que, chez l'homme les circonvolutions apparaissent d' a en w, tandis que chez les singes elles se développent d'w en a."

[431] Ueber die typische Anordnung der Furchen und Windungen auf den Grosshirn-Hemisphären des Menschen und der Affen," Archiv für Anthropologie, iii., 186

[432] "Zur Entwicklungsgeschichte der Furchen und Windungen der Grosshirn-Hemisphären im Fœtus des Menschen." Archiv für Anthropologie, iii., 1868.

[433] For example, M. l'Abbe Lecomte in his terrible pamphlet, Le Darwinisme et l'origine de l'homme, 1873.