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SECTION II.

OF THE CAUSES AND WAYS BY WHICH THE SPECIES OF ANIMALS DEGENERATE IN GENERAL.

22. *Subject proposed.* Hitherto we have investigated those things in which man differs from the rest of the animals. Now we come nearer to the primary object of the whole treatise, for we are to inquire of what kind and how great is the natural diversity which separates the races and the multifarious nations of men; and to consider whether the origin of this diversity can be traced to degeneration, or whether it is not so great as to compel us rather to conclude that there is more than one original species of man. Before this can be done, there are two questions which must be considered: First, what is *species* in zoology? Secondly, how in general a primordial species may degenerate into varieties? and now of each separately.

23. *What is species?* We say that animals belong to one and the same species, if they agree so well in form and constitution, that those things in which they do differ may have arisen from degeneration. We say that those, on the other hand, are of different species, whose essential difference is such as cannot be explained by the known sources of degeneration, if I may be allowed to use such a word. So far well in the abstract, as they say. Now we come to the real difficulty, which is to set forth the characters by which, *in the natural world*, we may distinguish mere varieties from genuine species.

The immortal Ray, in the last century, long before Buffon, thought those animals should be referred to the same species,

which copulate together, and have a fertile progeny. But, as in the domestic animals which man has subdued, this character seemed ambiguous and uncertain, on account of the enslaved life they lead; in the beginning of this century, the sagacious Frisch restricted it to wild animals alone, and declared that those were of the same species, who copulate in a natural state¹.

But it must be confessed that, even with this limitation, we make but little progress. For, in the first place, what very little chance is there of bringing so many wild animals, especially the exotic ones, about which it is of the greatest possible interest for us to know whether they are to be considered as mere varieties, or as different species, to that test of copulation? especially if their native countries are widely apart; as is the case with the *Satyrus Angolensis* (Chimpanzee) and that of the island of Borneo (Orang-utan).

Then it is universally the case that the obscurity and doubt is much smaller, and of much less importance, in the case of wild animals on the point in question, than of those very animals which are excluded by this argument, that is, the domestic. Here, in truth, is the great difficulty. Hence the wonderful differences of opinion about, for example, the common dog, whose races you see are by some referred to many primitive species; by others are considered as mere degenerated varieties from that stock which is called the domestic dog (*Chien de berger*); again, there are others who think that all these varieties are derived from the jackal; and, finally, others contend that the latter, together with all the domestic dogs and their varieties, are descended from the wolf, and so forth.

As then the principle sought to be deduced from copulation is not sufficient to define the idea of species and its difference

¹ "When beasts by nature copulate with each other, it is an unfailling sign that they are of the same species." Berthout van Berchem fil. has lately adopted the same test of species, "if animals mix when in a natural state." But he makes no mention of Frisch, or even of Ray, nay, he says, "M. de Buffon, who was the first to abandon the little-to-be-depended-upon distinctions of the nomenclators, was also the first to make it understood that copulation was the best criterion for ascertaining species." See *Mem. de la Société des Sciences Physiques de Lausanne*, T. II. p. 49.

from variety, so neither are the other things which are adduced with this object, for example, the constancy of any character. Thus the snowy colour and the red pupils of the white *variety* of rabbit are as constant as any specific character could possibly be. So that I almost despair of being able to deduce any notion of species in the study of zoology, except from *analogy* and resemblance. I see, for example, that the molar teeth of the African elephant differ most wonderfully in their conformation from those of the Asiatic. I do not know whether these elephants, which come from such different parts of the world, have ever copulated together; nor do I know any more how constant this conformation of the teeth may be in each. But since, so far in all the specimens which I have seen, I have observed the same difference; and since I have never known any example of molar teeth so changed by mere *degeneration*, I conjecture from analogy that those elephants are not to be considered as mere varieties, but must be held to be different species.

The ferret, on the contrary, does not seem to me a separate species, but must be considered as a mere variety of the polecat, not so much because I have known them copulate together, as because the former has red pupils, and from all analogy I consider that those mammals in whom the internal eye is destitute of the dark pigment, must be held to be mere varieties which have degenerated from their original stocks.

24. *Application of what has been said to the question whether we should divide mankind into varieties or species.* It is easily manifest whither what we have hitherto said has been tending. We have no other way, but that of analogy, by which we are likely to arrive at a solution of the problem above proposed. But as we enter upon this path, we ought always to have before our eyes the two golden rules which the great Newton has laid down for philosophizing. First, *That the same causes should be assigned to account for natural effects of the same kind.* We must therefore assign the same causes for the bodily diversity of the races of mankind to which we assign a similar diversity of body in the other *domestic* animals which

are widely scattered over the world. Secondly, *That we ought not to admit more causes of natural things than what are sufficient to explain the phenomena.* If therefore it shall appear that the causes of degeneration are sufficient to explain the phenomena of the corporeal diversity of mankind, we ought not to admit anything else deduced from the idea of the plurality of human species.

25. *How does the primitive species degenerate into varieties?*

As we are now about to treat of the modes of degeneration, I hope best to consult perspicuity in dealing with the subject if I arrange it again under two heads; of which the first will briefly relate the principal phenomena of the degeneration of brute animals; and the second will inquire into the causes of this degeneration. This being done, it will be easier in the following section to compare the phenomena of variety in mankind as well with those phenomena of degeneration in brute animals as with the causes of them.

26. *Principal phenomena of the degeneration of brute animals.* A few instances, and those taken from the warm-blooded animals alone, and also as far as possible from the mammals which are most like man in their corporeal economy, will be enough to show that there is no native variety in mankind which may not be observed to arise amongst other animals as a mere variety and by degeneration. But it is better to go over these things in separate chapters.

27. *Colour.* Thus in the way of colour, the pigs in Normandy are all white; in Savoy, black; in Bavaria¹, chesnut. The *Pecus bubulum* in Hungary generally varies from white to grey; in Franconia they are red, &c. In Corsica the dogs and horses are beautifully spotted. In Normandy, the peacocks are black; ours, on the other hand, are generally white. On the Guinea coast, the birds, especially of the hen tribe², and the dogs, are black like the aborigines; and, what is particularly remarkable, the Guinea dog (which Linnæus calls *C. Ægyptius*,

¹ Comp. Voigt, *Magazin*. T. VI. P. I. p. 10.

² See Dan. Beeckman's *Voyage to and from Borneo*, Lond. 1718, 8vo. p. 14.

I do not know why) is, like the men of that climate, distinguished for the velvety softness of his smooth skin, and the great and nearly specific cutaneous perspiration¹.

28. *Texture of the hair.* As to the texture of hair, what a difference is there not, I ask, in the wool alone of the sheep of different climates, from the tender Tibetan up to the thick and almost stiff Ethiopian? Or in the bristles of the sow, which are so soft in those of Normandy, that they are not fit for scouring-brushes? And what a difference there is, in this respect, between the boar and the domestic sow, especially as to the short wool which grows between the bristles⁴. How remarkable too is the effect of every region of the globe upon the hair of more than one kind of the domestic mammals, as the effect of the climate of Galatia on the bearded cattle of Angora, and on the rabbits and cats, who are so conspicuous for their woolly softness and the extraordinary length and generally snowy whiteness of their coats.

29. *Stature.* As to stature the difference between the Patagonian and the Laplander is much smaller than what is observed everywhere in other domestic animals of different parts of the world. Thus pigs, when transported to Cuba from Europe, grow to double their natural size². So also do cows when transported to Paraguay³.

30. *Figure and proportion of parts.* As to the proportion of parts, what a great difference there is between the horses of Arabia or Syria and of northern Germany; between the thick-footed cows of the Cape of Good Hope and the thin-footed ones of England! The hinder legs of the sows of Normandy are much higher than the front legs, &c. The cows in some parts of England and Ireland have no horns at all⁴; in Sicily, on the other hand, they have very large ones; but I must not say anything of the vast horns of the Abyssinian oxen, which Sir Joseph Banks showed me, for they, if we are to trust Bruce,

¹ Pechlin, *De Habitu et Colore Æthiopum*, Kilon. 1677, 8vo. p. 56.

² Voigt, *Magazin*. l. c.

³ F. Saver. Clavigero, *Storia Antica del Messico*, T. IV. p. 142.

⁴ Comp. also Hippocrates, *De aeribus, aquis, et locis*, s. 44.

ought rather to be referred to some morbid disposition. We may however mention here the *Ovis polycerata*; and as to the variety of hoofs, there are whole races of sows with solid and with three-cloven hoofs¹. As to some other parts, we have sheep with broad tails; the fringes of the crested canary (what our people call *kapp. vögel*) and other things of this kind.

31. *Above all, the shape of the skull.* The shape has been observed to differ everywhere in the varieties of mankind; but all this difference is not a whit greater, if indeed it can be compared to that which may be observed amongst the different races of other domestic animals. The skull of the Ethiopian does not differ more from that of the European than that of the domestic sow from the osseous head of the boar; or than the head of the Neapolitan horse, which is called from its shape ram-headed, from that of the Hungarian horse, which the learned know well is conspicuous for its singular lowness and the size of its inferior jaw. In the urus, the progenitor of our domestic race of bulls, according to the observations of Camper, very large foveæ lacrymales are visible; which, on the contrary, are entirely obsolete in our country cattle. I say nothing of that manifestly monstrous degeneration of skull in the variety of hen they call the Paduan².

32. *Causes of degeneration.* Animal life supposes two faculties, depending upon the vital forces as primary conditions and principles of all and singular its functions; the one, namely, of so receiving the force of the stimuli which act upon the body that the parts are affected by it; the other of so reacting from this affection that the living motions of the body are in this way set in action and perfected. So there is no motion in the animal machine without a preliminary stimulus and a consequent reaction. These are the hinges on which all the physiology of the animal economy turns. And these are the fountains from which, just as the business itself of generation, so also the *causes*

¹ Voigt, *Magazin*, l. c.

² Pallas, *spicileg. zoologic.* fasc. iv. p. 22, and Sandifort, *Muséum Anatom. Acad. Lugd. Batav.* T. I. p. 306.

of degeneration flow; but in order to make this clear to those even who know but little of physiology, it will be as well to premise with a few words from that science.

33. *Formative force.* I have in another place professedly, and in a separate book devoted to this subject, endeavoured to show that the vulgar system of evolution, as it is called (according to which it is taught that no animal or plant is generated, but that all individual organic bodies were at the very earliest dawn of creation already formed in the shape of undeveloped germs and are now being only successively evolved), answers neither to the phenomena themselves of nature, nor to sound philosophic reasoning. But on the contrary, by properly joining together the two principles which explain the nature of organic bodies, that is the physico-mechanical with the teleological, we are conducted both by the phenomena of generation, and by sound reasoning, to lay down this proposition: That the genital liquid is only the shapeless material of organic bodies, composed of the innate matter of the inorganic kingdom, but differing in the force it shows, according to the phenomena; by which its first business is under certain circumstances of maturation, mixture, place, &c. to put on the form destined and determined by them; and afterwards through the perpetual function of nutrition to preserve it, and if by chance it should be mutilated, as far as lies in its power to restore it by reproduction.

Let me be allowed to distinguish this energy, so as to prevent its being confused with the other kinds of vital force, or with the vague and undefined words of the ancients, the plastic force, &c. by the name of the formative force (*nisus formativus*); by which name I wish to designate not so much the cause as some kind of perpetual and invariably consistent effect, deduced *à posteriori*, as they say, from the very constancy and universality of phenomena. Just in the same way as we use the name of attraction or gravity to denote certain forces, the *causes* of which however still remain hid, as they say, in Cimmerian darkness.

As then other vital forces, when they are excited by their

appointed and proper stimuli, become active and ready for reaction, so also the formative force is excited by the stimuli which belong to it, that is, by the kindling of heat in the egg during the process of incubation. But as other vital forces, as contractility, irritability, &c. put themselves out only by the mode of motion, this, on the other hand, of which we are talking, manifests itself by increase, and by giving a determinate form to matter; by which it happens that every plant and every animal propagates its species in its offspring (either immediately, or gradually by the successive access and change of other stimuli, through metamorphosis).

Now the way in which the formative force may sometimes turn aside from its determined direction and plan is principally in three forms. First, by the production of monsters; then by hybrid generation through the mixture of the genital liquid of different species; finally, by degeneration into varieties, properly so called. The production of monsters, by which, whether through some disturbance and as it were mistake of the formative force, or even through accidental or adventitious circumstances, as by external pressure, &c. a structure manifestly faulty and unnaturally deformed is intruded upon organic bodies, has nothing to do with our present purpose. Nor is this the place to consider hybrids sprung from the commingling of the generation of different species, since by a most wise law of nature (by which the infinite confusion of specific forms is guarded against) hybrids of this kind, especially in the animal kingdom, scarcely ever occur except through the interference of man: and then they are almost invariably sterile, so as to be unable to propagate any further their new ambiguous shape sprung from anomalous venery.

Still, meanwhile, this subject we are now discussing may be illustrated by the history of hybrids sprung from different species; partly on account of their analogy with those hybrids which spring from different *varieties*, of which we shall speak by and by; partly, because, like everything else, they go as proofs to refute that theory about the evolution of pre-formed germs, and to display clearly the power and efficacy of the for-

mative force; a consideration, which will escape no one who rightly appreciates those well-known and very remarkable experiments, in which, in the very rare instances of *prolific* hybrids, when their fecundation has been frequently repeated for many generations by the aid of the male seed of the same species, that new appearance of hybrid posterity has so sensibly deflected from the maternal form as more and more to pass into the paternal form of the other species, and so, finally, the former seems to become quite transmuted into the latter, by a sort of arbitrary metamorphosis¹.

But the mixture of specifically different generation, although it cannot overturn, or as it were suffocate, all the excitability of the formative force, still can impart to it a singular and anomalous direction. And so it happens that the continuous action, carried on for several series of generations of some peculiar stimuli in organic bodies, again has great influence in sensibly diverting the formative force from its accustomed path, which deflection is the most bountiful source of degeneration, and the mother of varieties properly so called. So now let us go to work and examine one by one the chief of these stimuli.

34. *Climate.* That the power of climate must be almost infinite, as on all organic bodies, so especially on warm-blooded animals, will quickly appear to any one who considers first, by how intimate and how constant a bond these animals are bound while alive to the action of the atmospheric air in which they dwell. Besides, how wonderfully this air (which was once held to be a simple element of itself) is made up of what they call multifarious elements, such as gasiform constituents, the accessories of light, heat, electricity, &c. Then of what different proportions of these matters does it not consist, and in consequence of this variety how different must be the atmospheric action on those we call animals! Especially when we

¹ Kölreuter. Third account of the news of some experiments relating to the sex of plants, &c., p. 51, s. 24, with the title, "An entirely complete change of one kind of plant into another."

throw in the consideration of so many other things, by whose accession climates differ so much, as the position of countries in respect of the zones of the globe, the elevation of the soil, mountains, the vicinity of the sea or lakes and rivers, the customary winds, and innumerable other things of this kind.

This air, then, which those we call animals suck in by breathing from the time of birth, modified so greatly by the variety of climates, is decomposed in their lungs as it were in a living laboratory. Part of what they inhale is distributed with the arterial blood over the whole body; but as a balance to another portion of this point, elements are liberated, which are partly deposited on the peripheral integuments of the body, and partly are carried back by the flow of venous blood to the respiratory organs; hence arise the various modifications of the blood itself, and the remarkable influxes of these humours, especially of fat, bile, &c. into the secretions. Hence finally the action of all these things as so many stimuli on a living solid, and hence the resulting reaction as well of this thus affected solid, as what especially belongs to our discussion, the direction and determination of the formative force. This great and perpetual influence of climate on the animal economy and the habit and conformation of the body, although there has been no time when it has not attracted the attention of good observers, has in our own time above all been illustrated and confirmed by the great advance that has been made in chemistry, and by a deeper study of physiology. Still it is always a difficult and arduous thing, in the discussion of these varieties, to settle what is to be attributed exclusively to climate, what rather to other causes of degeneration, and finally to the joint action of both. Meanwhile I will bring forward one or two instances of degeneration which seem most clearly to be derived from the effects of climate. For example, the white colour of many animals in northern regions, which have other colours in the temperate zones. Instances are, those of wolves, hares, cattle, falcons, crows, blackbirds, thrushes, chaffinches, &c. That this whiteness must be attributed to cold, we learn from the analogy of animals of the same kind who, under the same climate

during winter, change their summer colour into white or grey; as weasels and ermines, hares, squirrels, reindeer, the ptarmigan, snow-bunting, and others¹. So also I am more inclined to attribute to climate that snowy fleece so conspicuous for its silky softness of some of the animals of Angora than to the kind of diet, because that is shared by those who feed on all sorts of different things, by the carnivorous, as the cat for example, equally with the herbivorous ruminants, as goats, &c.

Such too seems to be the explanation of the coally blackness which under some districts of the torrid zone, as on the coasts of Guinea, animals of different orders, mammalia as well as birds, are seen to put on with the colour of the Ethiopians (s. 27). And it is above all worthy of remark that this Ethiopic blackness, just like that Syrian whiteness, although the animals may be transported into regions of a very different climate, is still preserved permanently for many series of generations. Nor is the power and influence of climate on the stature of organic bodies at all inferior; since cold obstructs their increase, which, on the contrary is manifestly augmented and promoted by heat. Thus the horses of Scotland, or cold North Wales, are small; in Scandinavia the horses and the cattle, like the indigenous races, are of tall and stalwart stature; in Smaland they are sensibly smaller, and in the north of East Gothland are in proportion smallest of all.

35. *Diet.* It seems extremely probable, what has been demonstrated principally by the sagacity of G. Fordyce, that the primary elements, as they are called, of every kind of alimentary substance, whether it be taken from the animal or the vegetable kingdom, are the same. Hence the same sort of chyle, and universally the same kind of blood, is elaborated by all the multifarious warm-blooded animals, carnivorous as well as herbivorous, out of the most different kinds of nourishment, if only it has been properly submitted to the organs of diges-

¹ Comp. besides others, Linnæus, in *Flora Lapponica*, p. 55, 352, ed. Smith.

tion. Still, however much this may appear to be true, it cannot be denied that the innumerable adventitious qualities of different matters of food, have had great power in changing the natures and properties of animals; to prove which a few instances will be enough.

Singing birds show that there is some specific power in some kinds of food to change the colour of animals; especially some sorts of larks and finches, which it has been proved, if they are fed upon hemp seed alone, sensibly grow black. The African sheep when transported to England is a proof how wonderfully, when the diet is changed, the texture of the hairs will change also; for its wool which is common by nature, and stiff like the hair of a camel, after it has been fed one year upon English pastures becomes of a most magnificent delicacy¹. The influence food has towards changing the stature and the proportions, is plain from the comparison of domestic animals. Horses which in marshy countries (called in the vernacular *Maschländer*) live upon rich food, as the Frisian especially, grow large; whereas, on the contrary, in rocky and stony countries, such as those of *Æland*, or on dry heathy soils, they remain stunted. Thus it is surprising how fat and bellied horses become on a fat soil, though their legs become shorter in proportion. But when they are fed upon drier grass, as, for example, the Cape grass, they secrete less fat, but are remarkable for their strong and fleshy legs; to say nothing of the multifarious diversities of the taste and weight of flesh, which again depend upon the variety of diet.

36. *Mode of life.* When I speak of the kind of life as a cause of degeneration, I include under that head all those points besides climate and diet which so far have to do with the natural economy of animals, that when they act long and continuously upon the same condition of body they are at length strong enough to change it to some extent. The principal of these are cultivation and the force of custom, whose power and

¹ Comp. Jam. Bates *On the Literal Doctrine of Original Sin*, Lond. 1766, 8vo. p. 224.

influence are again so manifestly conspicuous in our domestic animals.

Consider, for instance, the vast difference which separates the conformation and the proportions of the parts of the generous horse trained in the school, and the wild horse, which they call a wild beast. The latter, when it fights with others bites rather than kicks; the former, on the other hand, when bridled and armed with iron feet, prefers to attack his enemy with them, and almost unlearns to bite. Many kinds of mammals when subdued by man show by the hanging of their tails and the lapping of their ears a spirit tamed and subdued by slavery. In many the very corporeal functions of secretion, generation, &c. are changed in a wonderful way. In the domestic pig, for example, the adipose membrane appears in a vast mass, which is quite wanting in the boar, whose tender and as it were woolly hairs, on the contrary, inserted between the bristles, sensibly disappear in that domestic variety. These domestic animals are much more liable to monstrous births than their wild aborigines; and also to troops of new diseases, and especially to new kinds of worms of which no vestige is to be found in their wild and original variety; the truth of which assertion, though paradoxical, is not to be invalidated, as may be proved by the instance of the *Hydas intercutis*, called, in the vernacular, *Finnen*, Ital. *Lazaroli*¹. I place under this head also stunted stature from premature and unseasonable venery, and everything of that kind.

37. *Hybrid generation.* So much for the triple sources of degeneration which only by long and daily action, continued through many series of generations, are sufficiently strong, slowly, and by little and little, to change the primeval character of animals and produce varieties. But the case is different, and a new character is imparted to the immediate offspring, when different varieties of this kind, sprung at length from those

¹ Malpighii *Opera Posthuma*, p. 84, ed. Lond. 1697, fol.—so J. A. E. Goeze, *Discovery; that the hydatids in swine's flesh are no glander disease, but true bladder-worms.* 8vo. Hal. 1784.

causes, come to copulate together, for thus they give rise to a hybrid offspring, like neither parent altogether, but participating in the form of each, and being as it were a mean between the two. Hybrid is the name commonly given to the offspring of parents of manifestly different species, as mules sprung from the horse and ass, or birds from the union of the crested canary with the linnet. But this is not the place for us to speak of these, for there is no account to be taken of them in varieties of the human race. Not indeed that horrid stories are wanting of the union of men with brutes, when either men have had to do with the females of beasts (whether carried away by unbridled lust¹, or from some mad idea of continence², or because they expected some medicinal aid from this sort of crime³), or when we are told that women have been made use of by male brutes (whether that has happened through any violent rape⁴, or because women have solicited them in the madness of lust⁵, or have prostituted themselves from religious superstition⁶), still we have never known any instance related on good authority of any such connexion being fruitful, or that

¹ Comp. Th. Warton on Theocriti *Idyll.* i. 88, p. 19. "I have been told by a certain learned friend, that when he was travelling in Sicily and investigating closely not only the ancient monuments but also the manners of the people, that even their own priests used to ask the shepherds, who spend a solitary life in the Sicilian mountains, as a matter of course among the articles of confession, whether they had had anything to do with the she-goats."

² See Mart. à Baumgarten Equ. Germ. *Travels in Egypt, Arabia, &c.* p. 73. "As we went out of Alkan, in Egypt, we came to a village called Belbes, where we joined a caravan going to Damascus. There we saw a Saracenic saint, sitting on the heaps of sand, as naked as he came out of his mother's womb. We heard this saint whom we saw in that place publicly praised above all things; that he was a holy man, divine and perfect beyond all measure, because he never had any connexion with women or boys, but only with asses and mules."

³ With this object Pallas says that when the Persians suffer from hip-gout they copulate with the onagra. *Neue Nordische beyträge*, P. II. p. 38.

⁴ Baboons. Comp. Ph. Phillips's *Travels in Guinea* in Churchill's *Collection of Voyages*, T. VI. p. 211. "Here are a vast number of overgrown large baboons, some as big as a large mastiff dog, which go in droves of 50 and 100 together, and are very dangerous to be met with, especially by women, who, I have been credibly assured, they have often seized upon, ravished, and in that kind abused one after another, till they have killed them."

⁵ Thus Steller says that the women of Kamtschatka formerly copulated with dogs. *Beschreibung Von Kamtschatka*, p. 289.

⁶ As the women of Mendes with the sacred goat; on which singular custom see a copious dissertation by D'Hancarville, *Recherches sur l'origine des Arts de la Grèce*, T. I. p. 320.

any hybrid has ever been produced from the horrid union of beast and man. But we have only to do with those hybrids which spring from the intercourse of different varieties of one and the same species, as when, for example, the green canary bird is paired with the white variety, &c., which connexion has a wonderful effect in changing the colour and conformation of the new progeny which results therefrom; so that this is often applied with the greatest advantage in the impregnation of domestic animals for the purpose of improving and ennobling the offspring, especially in the case of horses and sheep.

38. *Hereditary peculiarities of animals from diseased temperament.* An hereditary disposition to disease would seem at first sight rather to belong to the pathology than to the natural history of animals. But when the matter is more carefully looked into, it is plain that in more ways than one it has something to do with those causes of degeneration we are concerned with. For, in the first place, some external qualities of animals, although according to common ideas they are never referred to a truly diseased constitution, still seem to come very nearly to that, since they are for the most part found in conjunction with an unnaturally weak affection. I include among these, for example, that peculiar whiteness of some animals, which the wise Verulam long ago called the colour of defect. We learn by the example of the Hungarian oxen, whose woolly skin only comes after castration, that we may frequently recognize as a cause the vicious constitution and defect of the corporeal economy. On the other hand, it is proved by the instances of the Angora cats and dogs, that morbid symptoms follow extraordinary whiteness of that kind, for it is a common observation that those animals are almost always hard of hearing.

It is also the case that some genuine diseases when the animal nature has been as it were used to them for a long series of generations seem to get sensibly milder and milder and less inconvenient, so that at last they can scarcely be considered more than a diseased affection. An example is afforded by that vicious species of whiteness which, when united to a deficiency of the black pigment which lines the internal eye of

hot-blooded animals, is known by the name of leucæthiopia. This when it seizes sporadically one or other of a family (for it is always a congenital affection) exhibits plainly the symptoms of cachexia, which everywhere comes very near to a leprous constitution. But in other cases when it has been established by a sort of hereditary right for many generations, it becomes a second nature, so that in the white variety of rabbits not a vestige remains of the original morbid affection; the existence of which however is determined by the analogy of other animals which have anomalously white pupils and red eyes. The ferret has been considered by some zoologists as a peculiar species of the genus *Mustela*, whereas, unless I am altogether deceived, it is as I have said above (s. 23) a mere variety of the pole-cat, and that of diseased origin through leucæthiopia.

39. *Problem proposed.* * Can mutilations and other artifices give a commencement to native varieties of animals? It is disputed whether deformities or mutilations, effected upon animals either by accident or advisedly, especially in those cases where they have been repeated for many series of generations, can at length in progress of time terminate in a sort of second nature, so that what before was done by art now degenerates into a congenital conformation. Some¹ have asserted this, whilst others² on the contrary have denied it. Those who are for the affirmative point to the examples of the young of different kinds of animals, dogs and cats for example, which are born without tails or ears after those parts have been cut off from their parents, as is proved by credible witnesses. And of boys among circumcised nations who are frequently born naturally *apellæ*³; and of scars which parents bear from wounds, whose marks afterwards are congenital in the infants. Buffon, indeed, went so far as to derive from the same source the peculiar characters of some animals, as the callosities on the breast and

¹ Hippocrates and Aristotle. And very recently Klügel, in Tom. i. of the Encyclopedia, p. 541, ed. 2nd.

² See Kant, in *Berliner Monatsschrift*, 1785, T. VI. p. 400.

³ Voigt, *Magazin*, T. VI. P. I. p. 22, and P. IV. p. 40.

legs of camels, or the bald scurfy forehead of the rook (*Corvus frugilegus*). Those who do not allow these last instances will not unwisely reject this opinion of Buffon, as what is called a *petitio principii*; but the other instances we spoke of they will think should rather be attributed to chance.

I have not at present adopted as my own either the affirmative or the negative of these opinions; I would willingly give my suffrage with those on the negative side, if they could explain why peculiarities of the same sort of conformation, which are first made intentionally or accidentally, cannot in any way be handed down to descendants, when we see that other marks of race which have come into existence from other causes which up to the present time are unknown, especially in the face, as noses, lips, and eye-brows are universally propagated in families for few or many generations with less or greater constancy, just in the same way as *organic*¹ disorders, as deficiencies of speech and pronunciation, and such like; unless perhaps they prefer saying that all these occur also by chance.

40. *Some considerations to be observed in the examination of the causes of degeneration.* Many of the causes of degeneration we have already spoken of are so very clear, and so placed beyond all possibility of doubt, that most phenomena of degeneration above enumerated may by an easy process be undoubtedly referred to them, as effects to their causes. But on the other hand even in that very way there is frequently such a concurrence or such a conflicting opposition of many of them; such a diverse and multifarious proneness of organic bodies to degeneration, or reaction from it; and besides, these causes have such effects upon these bodies according as they act immediately (so to speak) or otherwise; and finally, such is the difference of these effects by which they are preserved unimpaired by a sort of tenacious constancy through long series of generations, or by some power of change withdraw themselves

¹ A remarkable instance is related by Hacquet in the *Magazin* of Voigt just cited, T. VI. P. IV. p. 34.

again in a short space of time, that in consequence of this diversified and various relation there is need of the greatest caution in the examination of varieties.

Let me then, if only for the benefit of the student, at the end of this discourse, before we pass to the varieties of men themselves, lay down some maxims of caution at least, as corollaries to be carefully borne in mind in the discussion we are entering upon :

1. The more causes of degeneration which act in conjunction, and the longer they act upon the same species of animals, the more palpably that species may fall off from its primeval conformation. Now no animal can be compared to man in this respect, for he is omnivorous, and dwells in every climate, and is far more domesticated and far more advanced from his first beginnings than any other animal ; and so on him the united force of climate, diet, and mode of life must have acted for a very long time.

2. On the other hand an otherwise sufficiently powerful cause of degeneration may be changed and debilitated by the accession of other conditions, especially if they are as it were opposed to it. Hence everywhere in various regions of the terraqueous globe, even those which lie in the same geographical latitude, still a very different temperature of the air and an equally different and generally a contrary effect on the condition of animals may be observed, according as they differ in the circumstances of a higher or lower position, proximity to the sea, or marshes, or mountains, or woods, or of a cloudy or serene sky, or some peculiar character of soil, or other circumstances of that kind.

3. Sometimes a remarkable phenomenon of degeneration ought to be referred not so much to the immediate, as to the mediate, more remote, and at the first glance concealed influence of some cause. Hence the darker colour of peoples is not to be derived solely from the direct action of the sun upon the skin, but also from its more remote, as its powerful influence upon the functions of the liver.

4. Mutations which spring from the mediate influence of

causes of this sort seem to strike root all the deeper, and so to be all the more tenaciously propagated to following generations. Hence, if I mistake not, we are to look for the reason why the brown colour of skin contracted in the torrid zone will last longer in another climate than the white colour of northern animals if they are transported towards the south.

5. Finally, the mediate influences of those sort of causes may lie hid and be at such a distance, that it may be impossible even to conjecture what they are, and hence we shall have to refer the enigmatical phenomena of degeneration to them, as to their fountains. Thus, without doubt, we must refer to mediate causes of this kind, which still escape our observation, the racial and constant forms of skulls, the racial colour of eyes, &c.