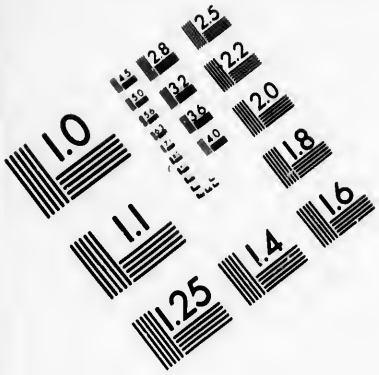

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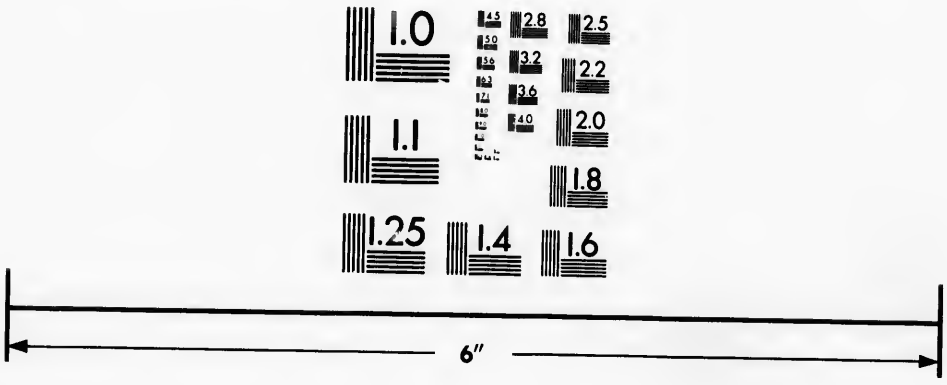

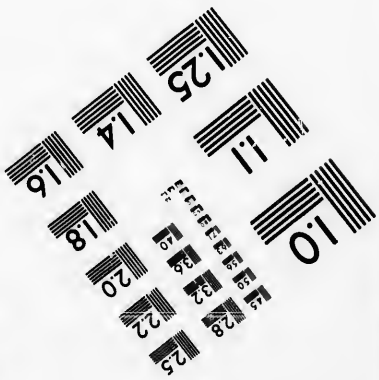

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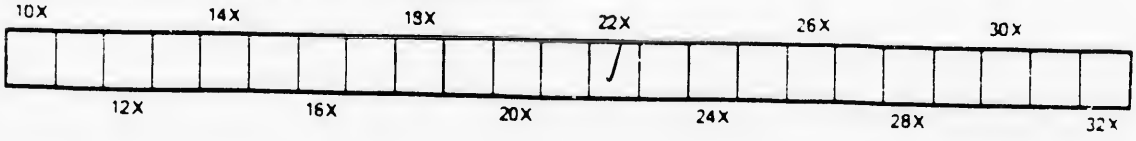

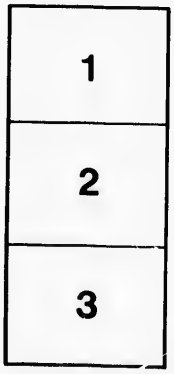

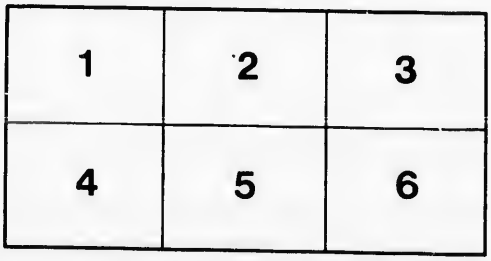

Is Species a Natural or Artificial Divison in Nature?

A Paper read before the Biological Section of the Hamilton Association, December 7th, 1888,

BY J. ALSTON MOFFAT,

(Member of the Council of the Entomological Society of Ontario.)

Is Species a natural or an artificial division in Nature? This is a question that will bear a good deal of discussion; for, although volumes upon volumes have been written about the origin of Species—what a Species is, and the correct use and application of the term has been left in the most nebulous condition imaginable, whilst, for practical value, this is of ten-fold more importance than the other, and ought to have been definitely settled before ever the other was discussed.

Violent controversies have been and are being carried on about Species with no profitable result, because the combatants are using the same term whilst meaning quite different things.

Wearied with the confusion, I found it necessary, for my own comfort, to settle the question to my own satisfaction at least. So I herewith give you my conclusions, and my reasons for them.

We are often reminded that we should take Science exclusively as our guide in the interpretation of Nature. I most unhesitatingly and unreservedly accept the condition. The question immediately arises, What is Science? As defined by Webster, it is, first, "certain knowledge," and second, "knowledge arranged and systematized." The only thing in which all men are born absolutely equal, is in the matter of knowledge—that is, in the utter absence of all knowledge. Time, opportunity and capacity is required for the obtaining of knowledge—by our own observation and experience,

or by the observation and experience of others communicated to us, which, when perfectly reliable, should be accepted by us and be as useful to us as our own. The observations and experience of several persons, agreeing on some particular thing, is confirmatory; this, continued for generations, becomes absolute certainty. It is thus that we have attained to our knowledge of the laws of Nature, on whose stability we confidently rely. Long continued observation and experience having demonstrated that, given a certain condition and combination, a certain result will follow, and that that condition and combination will inevitably produce that result every time; change the condition or the combination, and a change in the result will assuredly follow. This we call a law of Nature, and it is the absolute stability of these that has made Science possible.

The next question is, what is Nature? I reply, all matter and life that we can investigate in time and space. Anything beyond this must belong to the supernatural, of which, by no natural powers in our possession, can we discover anything. We may draw inferences about it from what we know, but these will be always open to question; or, we may believe what we have been told about it, but there our knowledge on the whole subject ends, and our belief in the statement will be in exact proportion to our confidence in the source from which it came.

The term "Species," or its equivalent, is no doubt an ancient one, and would be in use long before classification was thought of.

When man at first began to observe the forms of life around him, he saw them separated into a great many different kinds. These kinds did not commingle and lose their identity. Each came from ancestors of its own kind, and its progeny was in its own likeness. This he concluded had been going on since their origin, and would go on to the end of their history. These kinds he called "Species," and associated with it the idea of permanence. Common names were early given by men to the common forms of their country, but it was discovered that different names had been given to the same form in different parts of the same country; so, to avoid confusion, it became necessary to describe the form and give it a name that would distinguish it in that and all other countries. As investigation became more general, and the students of one country travelled into others, their attention was arrested by the fact that some of the familiar forms had changed their appearance, and as he

progressed this became yet more apparent, until at length the description of one would not apply to the other, and it began to be suspected that the old idea of permanence was incorrect, and would have to be abandoned.

Different conditions had produced different results.

Systematic classification is the progressive work of time.

Our present system of Nature is but of recent origin; that it is not perfect is but to say that it is human in its origin. Still, it is an improvement on the past; it grasps all Nature, and divides it into the celestial and terrestrial. In the terrestrial it finds the organic and inorganic; of the organic it has constituted two kingdoms, the animal and the vegetable, [and here let me remark that I am going to deal exclusively with the animal kingdom]; this it has separated into sub-kingdoms, classes, orders, families, genera and species.

Now these divisions which it is so necessary for man to make, that he may the better understand and study his subject, has no clear dividing lines in Nature. There is an elasticity and a blending of parts in Nature, that, from the limited character of man's intellectual grasp, and the barrenness of his language to express what he may intellectually perceive, no human system has ever yet attained to. We know, as a matter of fact, that this Ball, which we call terrestrial, is as much a part of the celestial as any of those we term such; that the organic is depending on, and inseparably connected with the inorganic. Who can say where the vegetable ends and the animal begins? And just so it is through the whole list; it is at the point of divergence and not that of contact that any of them is clear.

It is upon structure that the divisions in the animal kingdom are principally founded—size, form and color. By a single bone may the class to which the animal belongs be known; by certain resemblances its family relationship is established; upon some points of difference, peculiar to it, its genus is found, and by minuter ones is its specific character determined.

It is now a well known fact that there are opposing influences at work in nature affecting the appearance of every living creature; the one tending to uniformity and the other to diversity. Prof. Huxley says: "The one end to which, in all living beings the formative impulse is tending, seems to be to mould the offspring into the likeness of the parent."

Prof. Louis Agassiz, after premising that all animals, even the

highest—men not excepted—are produced through eggs, says: "It is a marvellous process, that of the inner life of the yolk, leading to a result so extraordinary as the formation of a new living being. Here is something wonderful; not only the simplicity of the process by which the change is brought about, but still more marvellous is the fact that all this goes on from within. There is a principle acting by the aid of the substance which holds it, never deviating from its course, and always leading to the production of a being like the parent."

Now it is clear that if this principle or law of nature was always acting unopposed, there would be no difficulty in deciding (by structure) to what Species any form belonged, for there would be little or no diversity in a Species. But this, we know, is not the case. Herbert Spencer says: "Every Species spreading into a new habit, at coming in contact with new food, exposed to a different temperature, to a dryer or moister air, to a more irregular surface, to a new soil, etc., has its members, one and all, subject to various changed actions, which influence its muscular, vascular, respiratory, digestive and other organs." Now this is simply a clear and comprehensive statement of a fact, which we may see with our own eyes, but we must remember in connection with it, that all animals are not equally sensitive to these influences; some may show it, little, if at all, whilst in others it will be quite perceptible; and again, that the migrant or its descendants will attain to the maximum of change which that locality is capable of producing, and never any more. That a further migration is needed to produce more change, that these changes will invariably be in the same direction in the same kind of animal, that migrants going in opposite directions on the globe will come in contact with different influences that will produce different results in the same kind of creature; and that these influences under which it is living are performing their work and bringing it into harmony with its surroundings, wholly independent of the creature's will or inclinations. Of these operations the animal may be utterly unconscious, and even if it were conscious it would be as utterly unable to resist them.

Now all the living creatures of the present are, more or less, given to migrating, according as they can accommodate themselves to altered conditions in soil, climate and food, and the ancestors of these did the same ever since they were first originated. What

an immense diversity of influences then must some of them have been in contact with during their continuance in time and space, and, if sensitive to these, what a diversity in size, form and color is to be expected as a result. This helps to account for much of the marvellous diversity which we actually do find in nature everywhere around us

It is specially desirable to note here, that these influences we have been considering, which accomplish the change in organisms, are wholly external, acting from without, just as we saw that those which make uniformity were internal, acting wholly from within.

But there are several other influences at work in Nature producing variety in organisms, some of which we as yet know little or nothing about, hence the expression, "accidental variation." But as accident is not recognized in science, every effect having unquestionably an efficient cause, whether within the range of our ken or no, I prefer "individual variation" to express the idea associated with these peculiarities that unexpectedly show themselves, and which are often seized upon by breeders for the improvement of stock, and for the production of fancy and ornamental forms. This has been carried to an astonishing length in some departments, and these varieties may appear in Nature as well.

Here then the question arises, do these variations, by whatever cause produced, or by whatever name called, going off in opposite directions, ever attain a point of complete separation: that is, when individuals that have come from a common stock are brought together from the extremes of unlike, will Nature in them fail to acknowledge their original relationship. Consideration is required here. We know that many animals go in flocks, herds, coveys, swarms, &c., and that each of these aggregations incline to keep by themselves, and do not readily mingle in Nature; that an individual from one of these will be refused admission into another of the same kind, and can only obtain it by conquering a position. This we see frequently amongst domestic animals, and if the external forms are diverse the trouble is all the greater, so that it may require time, restraint, compulsion even, to get them at first to live together. This being accomplished, all our information goes to prove that no matter what external difference separates them, internally they are yet one. Mr. Tegetmeyer, the celebrated writer on poultry, when describing how he had bred the golden, the silver and

the common English pheasants together, said:—"After this the "reader will be ready to inquire, what constitutes a Species? All "that I can do is to echo the question, what constitutes a Species?" He had contemplated his birds and marked their great and striking dissimilarity, and concluded that they must be separate Species; he turned to his books, and the authorities pronounced them separate Species; he brought them together and they commingled freely, nature in them asserting they were not separate Species, they were but distinct varieties of one Species. Illustrations might be multiplied indefinitely, but one is sufficient to point the direction.

Another inquiry we have to make is: If separation for a sufficient length of time will completely extinguish all evidence of original relationship? There is the so called genus Bos. How long have the humped cattle of the East been separated from the bison of the West? Is it a thousand years, or five, ten, twenty or a hundred thousand, who can say? But bring them together, from any distance or in any of the multitudinous forms of which the genus is composed, and they commingle freely. Their distinctive peculiarities merge and blend until finally lost, proving them to be not Species of a genus, but varieties of a species, and that time and distance have failed to extinguish their original relationship.

The possibility is that at one time in the world's history, all these various forms of a Species of the present, were represented on the earth by a single form--and that form may have been quite unlike anything of the present—and if it lived under entirely different conditions it undoubtedly would be. But whether the Species originated in single ones or pairs, in a single locality, and spread from there over the globe, or came into existence singly or in pairs, in various localities, or in groups, or in multitudes, is not now possible to prove, and does not seem to be of any consequence. For if they were one in Nature, and identical in internal organization, the result would be the same. If then no amount of divergence in size, form and color, and no length of separation in time, places any obstacle in the way of the ordinary laws of generation, we have got a clear, definite, dividing line for Species, and one that proves Species to be a real and natural entity, quite different from Structure. For seeing that all life of the present, as well as that of the past, is, and has ever been, surrounded by, and in constant contact with, those influences that tend to produce change in Structure,

according to its susceptibility to receive the impression, we have no right to look in that direction for dividing lines between Species, and the torture of conflicting uncertainty endured by conscientious men, in their efforts to arrive at a correct conclusion by that method about various forms. Whether they are Species or Varieties, and which is the Species and which is the Variety, and where the line is to be drawn between them, is really deplorable, and is well voiced in the vigorous language of Darwin, when he says:—"After describing a set of forms as "distinct Species, tearing up my manuscript and making them one "Species, tearing that up and making them separate, and then "making them one again—as has often occurred to me—I have "gnashed my teeth, cursed Species, and asked what sin I had com- "mitted to be so punished?" And thus it is made abundantly manifest, that determination by structure is not necessarily a determination of Species at all, but only the defining of the differences between various forms, which may be improperly called Species; and that all this misery and conflict that is endured by Species-makers is quite uncalled for and unnecessary, for the differences are there, visible to the eye, and are easily described. The trouble comes in when the effort is made to decide just how much difference should be considered enough to make a Species, which is merely a matter of individual opinion, and of which there is an abundant diversity; and so it appears perfectly plain to me that the contention which has been going on for so many years under the head of the origin of Species is a misnomer; it is the origin of varieties that has been brought to view, and the ages yet to come will have ever to acknowledge their indebtedness to Darwin for the vast stores of facts which he has accumulated for their use on this subject.

In the *American Naturalist* for April, 1888, is an article by Mr. Chas. Morris, entitled "Intelligent Selection," in which he contends that man may have produced, in that way, as true Species as nature does by natural selection, and says "that Species have not "been produced by man is more an assertion than a demonstrated "fact," then claims that certain forms of pigeons and dogs might be "regarded as of specific value, or even generic, and says "if we take "the varieties of the dog, such wide differances in size, form and "habit, if found in Nature, would be at once accepted as well "defined Species." A perfectly true statement I believe, but one

that does not prove his contention; but I think it does prove most conclusively the extreme probability there is that we have in our catalogues an abundance of so called Species, that are not one whit better Species in Nature than those varieties of the dog.

So I conclude;—that Species is a natural division in Nature, and absolutely permanent in the line of descent.

That fertile progeny is an unmistakable evidence of oneness of Species.

That a Species is not necessarily one in size, form and color. True, it may be an individual form that has maintained its appearance, from its first origin to the present, unchanged, but that it is far more likely to be a great number of various forms that have been moulded, modified and diversified, in a thousand ways since its first origin, and no one of these various forms is entitled to claim the term to the exclusion of any one of the others, for each and all of them are required to complete the Species as it is in Nature.

That determination of Species by structure is artificial, and, from the very nature of things, uncertain. So a Species may generally be regarded as a group of more or less distinct forms, the origin of whose diversity may be involved in obscurity at the present day.

The question of origin belongs to the domain of philosophy rather than that of science, but science has demonstrated that no spontaneous origin of life has been found. Yet there was a time when life did not exist on this globe, so that it must have originated in some way; but life being granted, Species has to be as a matter of course, if life is to be permanent, for every form, no matter how low in the scale of being it may be, is perpetuated by ordinary generation in some way, and each Species perpetuates its own kind only, and never any other. But whether the Species of the present originated by a miracle of creation, and have been modified by the external influences of ages, eras and epochs, until they appear as we see them; or by a progressive succession of miracles of transmutation, until they have arrived at what they are, does not seem to matter much, for miracle it would be in either case, because transmutation is in just as direct violation of the laws of Nature, as we know them, as creation is. But if science can say negatively that Species is not self originating, it can never say positively they originated by miracle, for that belongs to the supernatural, of which science can

discover nothing. The most it can say is that it knows of nothing else that will account for it.

Unquestionably, the conditions and combinations were vastly different in various periods of the world's history, producing greatly different results, but we have not a shadow of a reason for supposing that the laws of Nature were different. It is certain knowledge that constitutes science, not uncertain opinion that has not yet crystallized into knowledge.

We have heard a great deal about "missing links." If the authorities fail to discriminate correctly between Species living and moving before their eyes, what are they likely to do with the crushed remains of extinct forms? If the links were all in their hands would they recognize them? If the skeletons of the widely divergent forms of our dog were found in the rocks they would hardly be taken for the same kind of animal, let alone the same Species

We have also heard a good deal about the breaking down of barriers between species and species, genus and genus, order and order, kingdom and kingdom. What were these barriers? Artificial ones, erected by man at the limit of his knowledge, which with an increase of that, he found it necessary to remove, as he had put them up in the wrong place; but Nature's one and only barrier, found in the whole breadth of the animal kingdom, stands just where it did before ever man began to investigate it, and as firmly as ever it did, and that is the one between Species, no other having any existence in Nature whatever.