ORIGIN OF SPECIES CHAPTER 4 pdf

1: Chapter 4: Natural Selection | ScienceBlogs

Chapter IV is perhaps the most important chapter in The Origin of Species, because it lays out the principle of natural selection, on which Darwin's theory of evolution is based. Darwin does not answer every question about the origin of species in his theory.

Darwin on Struggle for Existence In chapters 1 and 2 of Origin, Darwin had discussed the concept of "variation", both in domestic species ch. This forms the background for the more substantial discussion of "struggle for life" in ch. Although individuals making up a species share common characteristics -- with progeny resembling their parents in this regard -- there are individual variations within any co-specific population. For example, among a population of humans there is variation as to height, eye color, hair texture, and many other characteristics, even though humans share common characteristics that define us all as members of the species "homo sapiens", such as a large brain, two arms and legs, mainly hairless body, etc. Darwin now enters into his discussion of the conditions that obtain within a population of individuals, characterized by shared species characteristics and individual differences. In section two of this chapter, "Geometrical Ratio of Increase", Darwin borrows from the work of the political economist Robert Malthus, who argued as follows in his Principles of Population first edition , second edition Here each later number is gotten by multiplying the previous by 2 x2. As the first geometric series represents population, and the second arithmetic series represent food, Malthus argued that a growing population cannot feed all of its members. In fact, Malthus used an arithmetic progression which increased by only 1, so that population outstrips food resources even faster. Click here to read Malthus on population and food. Malthus used this theory -- which he applied only to humans -- against proponents of egalitarianism, who were in , the supporters of the French revolution. His argument was as follows: This led him to conclude that under ordinary circumstances, too many individuals can be produced within a species for the available supply of food and other necessaries of life. In other words, there is over-population. In a situation of overpopulation relative to food supplies, at least two possibilities exist: For Darwin it appears axiomatic that this overpopulation can be resolved only through competition. Here he shares a cultural or ideological viewpoint with Malthus. Both were imbued with the culture of the industrial revolution in England, characterized by competition among producers for markets, among countries for colonies, and among workers for employment. Though Darwin opts reflexively for competition as the basic form of interaction within a species, he does note some degree of association a kind of unconscious cooperation between individuals of different species in special circumstances. The section of this chapter entitled "Complex Relations of all Animals and Plants" heralds many ideas of ecology a term coined only later by the German evolutionist Ernst Haeckel. Darwin briefly describes the complex interactions of members of different species in what we would today call an "ecosystem", using the example of a woodland and its various animal, plant, and insect inhabitants. We will, however, in our later considerations of the problem of the relation between competition and cooperation in evolutionary theory. For the moment, it is an interesting, but off-hand discussion that seems almost out of place in the somewhat dismal picture Darwin paints of populations engaged in continual struggle for existence. Darwin on Natural Selection In ch. The question now arises: Most of us are no doubt familiar with the actions of an animal breeder or plant fancier who is trying to get a particular characteristic in its animals or plants. Suppose that a dog breeder wants to breed animals with longer necks. From among a pack of six animals, which should he or she choose? The obvious answer, and common practice is to choose the dogs which have longer necks relative to the others, in the hope that they will pass on that characteristic to their progeny. Breeding a male and a female with longer necks would seem to be the best option. Darwin calls this "artificial selecton", for a reason that will be clear in a moment. He makes the following argument by analogy: Animals in the Wild just as Y: Artificial Selection, which specifies which animals are to be bred is to B: Animals under Domestication An argument from analogy takes the following form: Since we know three of the four terms A, Y and B , we can get an idea of what X might be. In this case, the term for "X", the unknown process in nature which resolves the struggle for life, is understood on analogy to "Artificial Selection", it is "Natural Selection". Nature selects metaphorically

speaking, Darwin admits those animals that by chance have the variations necessary to survive in their circumstances. The process is a two-fold one: First, there is a degree of variation within any population of the same species. Because of over-population, these individuals are competing for inadequate food resources and other necessities of life. Second, those individuals who by chance happen to have the characteristics needed when the environment changes, are those "chosen" by natural selection. It is crucial to note that the first and second parts of the process are, according to Darwin, completely independent of each other. The process of variation cannot look ahead to see what variations will be needed later, in the next and succeeding generations. Variations, though following from laws of heredity, appear as random distributions in the population. Natural Selection then acts to choose those individuals with the "right" variations. These are the individuals that tend to reproduce, passing on their traits to the next generation. After this process if repeated over and over again, the population has modified characteristics; characteristics so modified that a biologist, looking at this group many generations later would classify them as a different species from the original. That, in a nutshell, is how Darwin sees the evolution of species, at least insofar as its chief factor is concerned: Consider a made-up, simplified example: Suppose we have a population of small mammals that are living in a cave. These animals vary in the amount of fur each carries, in their weight and height, etc. While circumstances are unchanged, these variations are without import. But suppose either of two circumstances occurs: In the first place, bigger animals with more fur will tend to be chosen for reproduction, as they can best withstand the temperature drop. In the second case, smaller animals with less fur will be selected, for they can best crawl through the tiny opening. Now, the change in the environment temperature drop or rock fall cannot be predicted in advance by the animals. So which variety big or small will be selected depends on chance. Of course, the decline in temperature or the rock fall are caused by physical processes governed by laws of nature. Darwin hypotheses that in general, the extremes tend to be selected, as each finds a different means of surviving in changed environments, though its important to note that sometimes none or too few of the animals have the needed characteristics. In this case, the population or species goes extinct. As a result of some varieties being selected and some going extinct, "gaps" appear between populations over time. This is known as "divergence of character". Darwin iterates repeats this process over and over again, producing the following hypothetical chart representing tens of thousands of generations: Some of the varieties organisms sharing a distinct variation go extinct -- their "tree line" ends; others at the two extremes tend to get selected as the environment varies. Each horizontal line with a Roman numeral to its right represents 1, generations. As you follow the paths of diverging branches up the tree, you get to level X, where the survivors, labeled a10, f10, and m10 have diverged so far, that a taxonomist would classify them as different species. They themselves would very inhabit different ecological niches and not recognize each other as relatives; indeed, one might be a predator of another. By generation XIV, each of these distinct species has diverged into a number of further species, forming new genera. The spreading species lines in the tree represent "descent with modification" from common ancestors. Put from the point of view of the biologist, each separate cluster of like individuals represents the origin of a species. Note that the base line with the letters through has dotted lines under it, which if extended beyond the diagram might meet. If they did, this would represent the species from which all other species are evolved. Darwin was not sure that all species had a common ancestor, though he speculated that they did, with this ancestor of ancestors arising, as he put it in a letter: Questions for Study on Natural Selection 1 Distinguish between the random nature of variations, and the causal nature of selection. How are these similar and how are they different?

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2: On the Origin of Species: Chapter IV, Natural Selection | Science | The Guardian

The original species of our genus were supposed to resemble each other in unequal degrees, as is so generally the case in nature; species (A) being more nearly related to B, C, and D, than to the other species; and species (I) more to G, H, K, L, than to the others.

Log in to post comments More like this Chapter 6: Difficulties with Theory Up until now, our route into the theory of evolution by natural selection has been all downhill. One thing has led effortlessly to another, with Darwin giving the occasional nudge to steer things in the right direction. Toss in a few figures and some contemporary citations. Instinct Science is fun. And I know that people who tell you science is fun usually do so in strained and pleading tones, and expect you to believe them because they have spiky hair and can play the harmonica. Mutual Affinities of Organic Beings: Rudimentary Organs From the first dawn of life, all organic beings are found to resemble each other in descending degrees, so that they can be classed in groups under groups. On the other hand, you and I are reading the Origin with a modern knowledge-base. We know sympatric speciation is rare and hard to prove, that allopatric speciation is common as crabgrass, and that genetic drift can produce divergence and eventually speciation. Darwin knew none of these things. All that came later, after people had accepted evolution and were looking for its mechanisms. He may well have spent so much time on explaining and defending sympatric speciation because it never occurred to him that speciation could occur any other way. This will become evident even more when we come to the sections on the problems Darwin saw for his theory, like the imperfection of the fossil record. By Harold not verified on 19 Jan permalink If very few of us have read The Origin of Species from end to end, it is not because it overtaxes our mind, but because we take in the whole case and are prepared to accept it long before we have come to the end of the innumerable instances and illustrations of which the book mainly consists. Darwin becomes tedious in the manner of a man who insists on continuing to prove his innocence after he has been acquitted. You assure him that there is not a stain on his character, and beg him to leave the court; but he will not be content with enough evidence; he will have you listen to all the evidence that exists in the world. Not that anything else in the Methuselah cycle made any sense, mind you Log in to post comments By tcb not verified on 20 Jan permalink We know sympatric speciation is rare and hard to prove, that allopatric speciation is common as crabgrass, and that genetic drift can produce divergence and eventually speciation We do not in fact know any of that. The research on three spined sticklebacks, shows that for three spined sticklebacks, sympatric speciation is extremely common, and allopatric speciation is insignificant in the sense that: For foraminifera, all observed speciation events that have been observed in sufficient detail are sympatric. Gould wanted to discredit sympatric speciation, and argued for the primacy of allopatric speciation, because if adaption, rather than separation, is primary, then this has disturbing implications for our own species. Donald not verified on 20 Jan permalink Never the less, I think most animal systematists still think allopatric speciation is the more usual event. I think, for example, based on distribution and relationship, that Austrofundulus species are the result of allopatric speciation events. If pressed about some of their relatives, I would have to admit to being less sure. Log in to post comments By Jim Thomerson not verified on 21 Jan permalink based on distribution and relationship, that Austrofundulus species are the result of allopatric speciation events. Geographically separated kinds will usually encounter different environments, resulting in differential selection. To answer this question, one should look at closely related kinds in both similar and different environments - which was the focus of recent experiments and studies on three spined sticklebacks. Uniqueness Of science among human artifacts ALL aspects of our culture are, of course, anthropoartifacts, including science. Yet among those artifacts science has a distinct uniqueness for us. During the recent several centuries in the course of human history humans have been developing science at an accelerating rate as a provider of convincing, ever closer approaching, approximate models of the real world. Origin and nature of life Astronomically there are two "physics", a "classical physics" system of and between galactic clusters, and a "quantum physics" system WITHIN the galactic clusters. As mass is just another face of energy it is commonsensible to regard not only life, but mass in general, as a format of temporarily constrained energy. It

therefore ensues that whereas the in-space expanding cosmic constructs, the galaxies clusters, are - overall - continuously converting their original pre-inflation mass back to energy, the overall evolution WITHIN them, within the clusters, is in the opposite direction, temporarily constrained energy packages such as black holes and biospheres and other energy-storing mass-formats are precariuosly forming and "doing best" to survive as long as "possible" The formation of Earth life Earth Life: It derives solely from our cognition.

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3: The Origin of Species by Charles Darwin: Chapter 4

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I have thought it best to call it Ch. IV and there is evidence that Darwin had some thought of doing the same. It corresponds to Ch. IX of Origin, Ed. It is impossible to reason concerning the will of the Creator, and therefore, according to this view, we can see no cause why or why not the individual organism should have been created on any fixed scheme. That all the organisms of this world have been produced on a scheme is certain from their general affinities; and if this scheme can be shown to be the same with that which would result from allied organic beings descending from common stocks, it becomes highly improbable that they have been separately created by individual acts of the will of a Creator. For as well might it be said that, although the planets move in courses conformably to the law of gravity, yet we ought to attribute the course of each planet to the individual act of the will of the Creator[]. It is in every case more conformable with what we know of the government of this earth, that the Creator should have imposed only general laws. As long as no method was known by which races could become exquisitely adapted to various ends, whilst the existence of species was thought to be proved by the sterility[] of their offspring, it was allowable to attribute each organism to an individual act of creation. But in the two former chapters it has I think been shown that the production, under existing conditions, of exquisitely adapted species, is at least possible. Is there then any direct evidence in favour [[of]] or against this view? I believe that the geographical distribution of organic beings in past and present times, the kind of affinity linking them together, their so-called "metamorphic" and "abortive" organs, appear in favour of this view. On the other hand, the imperfect evidence of the continuousness of the organic series, which, we shall immediately see, is required on our theory, is against it; and is the most weighty objection[]. The evidence, however, even on this point, as far as it goes, is favourable; and considering the imperfection of our knowledge, especially with respect to past ages, it would be surprising if evidence drawn from such sources were not also imperfect. In the Origin this does not occur; the reference to the action of secondary causes is more general, e. In a corresponding passage in the Origin, Ed. The author gives, as the chief bar to the acceptance of evolution, the fact that "we are always slow in admitting any great change of which we do not see the intermediate steps"; and goes on to quote Lyell on geological action. It will be remembered that the question of sterility remained a difficulty for Huxley. As I suppose that species have been formed in an analogous manner with the varieties of the domesticated animals and plants, so must there have existed intermediate forms between all the species of the same group, not differing more than recognised varieties differ. It must not be supposed necessary that there should have existed forms exactly intermediate in character between any two species of a genus, or even between any two varieties of a species; but it is necessary that there should have existed every intermediate form between the one species or variety of the common parent, and likewise between the second species or variety, and this same common parent. Thus it does not necessarily follow that there ever has existed [[a]] series of intermediate sub-varieties differing no more than the occasional seedlings from the same seed-capsule, between broccoli and common red cabbage; but it is certain that there has existed, between broccoli and the wild parent cabbage, a series of such intermediate seedlings, and again between red cabbage and the wild parent cabbage: It is of course possible that there may have been directly intermediate forms, for the broccoli may have long since descended from a common red cabbage, and this from the wild cabbage. So on my theory, it must have been with species of the same genus. Still more must the supposition be avoided that there has necessarily ever existed though one may have descended from other directly intermediate forms between any two genera or families--for instance between the genus Sus and the Tapir[]; although it is necessary that intermediate forms not differing more than the varieties of our domestic animals should have existed between Sus and some unknown parent form, and Tapir with this same parent form. The latter may have differed more from Sus and Tapir than these two genera now differ from each other. In this sense, according to our theory, there has been a gradual passage the steps not being wider apart than our domestic varieties between the species of the same genus, between genera of

the same family, and between families of the same order, and so on, as far as facts, hereafter to be given, lead us; and the number of forms which must have at former periods existed, thus to make good this passage between different species, genera, and families, must have been almost infinitely great. What evidence[] is there of a number of intermediate forms having existed, making a passage in the above sense, between the species of the same groups? Some naturalists have supposed that if every fossil which now lies entombed, together with all existing species, were collected together, a perfect series in every great class would be formed. Considering the enormous number of species requisite to effect this, especially in the above sense of the forms not being directly intermediate between the existing species and genera, but only intermediate by being linked through a common but often widely different ancestor, I think this supposition highly improbable. I am however far from underrating the probable number of fossilised species: Although the almost infinitely numerous intermediate forms in no one class may have been preserved, it does not follow that they have not existed. The fossils which have been discovered, it is important to remark, do tend, the little way they go, to make good the series; for as observed by Buckland they all fall into or between existing groups[]. Moreover, those that fall between our existing groups, fall in, according to the manner required by our theory, for they do not directly connect two existing species of different groups, but they connect the groups themselves: But the Macrauchenia does not connect any one species of Pachydermata with some one other of Ruminantia but it shows that these two groups have at one time been less widely divided. So have fish and reptiles been at one time more closely connected in some points than they now are. Generally in those groups in which there has been most change, the more ancient the fossil, if not identical with recent, the more often it falls between existing groups, or into small existing groups which now lie between other large existing groups. Cases like the foregoing, of which there are many, form steps, though few and far between, in a series of the kind required by my theory. It is discussed in the Essay of , p. In the present Essay the following sentence in the margin appears to refer to Pachyderms and Ruminants: But no one has yet overturned the arguments of Hutton and Lyell, that the lowest formations known to us are only those which have escaped being metamorphosed [[illegible]]; if we argued from some considerable districts, we might have supposed that even the Cretaceous system was that in which life first appeared. A mere narrow and not very thick strip of matter, deposited along a coast where organisms most abound, would have no chance of escaping denudation and being preserved to the present time from such immensely distant ages[]. If the several known formations are at all nearly consecutive in time, and preserve a fair record of the organisms which have existed, my theory must be abandoned. But when we consider the great changes in mineralogical nature and texture between successive formations, what vast and entire changes in the geography of the surrounding countries must generally have been effected, thus wholly to have changed the nature of the deposits on the same area. What time such changes must have required! Moreover how often has it not been found, that between two conformable and apparently immediately successive deposits a vast pile of water-worn matter is interpolated in an adjoining district. We have no means of conjecturing in many cases how long a period[] has elapsed between successive formations, for the species are often wholly different: Consult the writings of any one who has particularly attended to any one stage in the Tertiary system and indeed of every system and see how deeply impressed he is with the time required for its accumulation[]. Reflect on the years elapsed in many cases, since the latest beds containing only living species have been formed;--see what Jordan Smith says of the 20, years since the last bed, which is above the boulder formation in Scotland, has been upraised; or of the far longer period since the recent beds of Sweden have been upraised feet, what an enormous period the boulder formation must have required, and yet how insignificant are the records although there has been plenty of elevation to bring up submarine deposits of the shells, which we know existed at that time. Think, then, over the entire length of the Tertiary epoch, and think over the probable length of the intervals, separating the Secondary deposits. Of these deposits, moreover, those consisting of sand and pebbles have seldom been favourable, either to the embedment or to the preservation of fossils[]. Nor can it be admitted as probable that any one Secondary formation contains a fair record even of those organisms which are most easily preserved, namely hard marine bodies. In how many cases have we not certain evidence that between the deposition of apparently closely consecutive beds, the lower one existed for an unknown time as land, covered with trees.

Some of the Secondary formations which contain most marine remains appear to have been formed in a wide and not deep sea, and therefore only those marine animals which live in such situations would be preserved[]. In all cases, on indented rocky coasts, or any other coast, where sediment is not accumulating, although often highly favourable to marine animals, none can be embedded: I may here instance the great western line of the S. American coast[], tenanted by many peculiar animals, of which none probably will be preserved to a distant epoch. From these causes, and especially from such deposits as are formed along a line of coast, steep above and below water, being necessarily of little width, and therefore more likely to be subsequently denuded and worn away, we can see why it is improbable that our Secondary deposits contain a fair record of the Marine Fauna of any one period. The East Indian Archipelago offers an area, as large as most of our Secondary deposits, in which there are wide and shallow seas, teeming with marine animals, and in which sediment is accumulating; now supposing that all the hard marine animals, or rather those having hard parts to preserve, were preserved to a future age, excepting those which lived on rocky shores where no sediment or only sand and gravel were accumulating, and excepting those embedded along the steeper coasts, where only a narrow fringe of sediment was accumulating, supposing all this, how poor a notion would a person at a future age have of the Marine Fauna of the present day. Lyell[] has compared the geological series to a work of which only the few latter but not consecutive chapters have been preserved; and out of which, it may be added, very many leaves have been torn, the remaining ones only illustrating a scanty portion of the Fauna of each period. On this view, the records of anteceding ages confirm my theory; on any other they destroy it. I am indebted to Prof. Finally, if we narrow the question into, why do we not find in some instances every intermediate form between any two species? It might be thought that in a vertical section of great thickness in the same formation some of the species ought to be found to vary in the upper and lower parts[], but it may be doubted whether any formation has gone on accumulating without any break for a period as long as the duration of a species; and if it had done so, we should require a series of specimens from every part. How rare must be the chance of sediment accumulating for some 20 or 30 thousand years on the same spot[], with the bottom subsiding, so that a proper depth might be preserved for any one species to continue living: In the case of terrestrial animals, what chance is there when the present time is become a pleistocene formation at an earlier period than this, sufficient elevation to expose marine beds could not be expected , what chance is there that future geologists will make out the innumerable transitional sub-varieties, through which the short-horned and long-horned cattle so different in shape of body have been derived from the same parent stock[]? Yet this transition has been effected in the same country, and in a far shorter time, than would be probable in a wild state, both contingencies highly favourable for the future hypothetical geologists being enabled to trace the variation.

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4: SparkNotes: The Origin of Species: Chapter IV, page 2

The Origin of Species Questions and Answers. The Question and Answer section for The Origin of Species is a great resource to ask questions, find answers, and discuss the novel.

Here Darwin gives us a portrait of natural selection, the driving force behind evolution. He starts by asking what happens when you put together two phenomena introduced earlier - variation between individuals and the struggle for existence. The answer is what he calls, "[the] preservation of favourable variations and the rejection of injurious variations" or natural selection. Those individuals with traits that best adapt them to the environment survive while others less well adapted die out. Natural selection can use minute and unnoticed variation as its raw material, so long as that variation makes a difference to survival and reproduction. In chapter 1 he laid out some impressive achievements of artificial selection - the domestic varieties produced by selective breeding. Nonetheless, Darwin writes here, "How fleeting are the wishes and efforts of man! It operates inexorably, or as Darwin put it "silently and insensibly" to reward the well-adapted and punish those ill-suited to their environment. How will the struggle for existence, discussed too briefly in the last chapter, act in regard to variation? Can the principle of selection, which we have seen is so potent in the hands of man, apply in nature? I think we shall see that it can act most effectually. Let it be borne in mind in what an endless number of strange peculiarities our domestic productions, and, in a lesser degree, those under nature, vary; and how strong the hereditary tendency is. Under domestication, it may be truly said that the whole organisation becomes in some degree plastic. Let it be borne in mind how infinitely complex and close-fitting are the mutual relations of all organic beings to each other and to their physical conditions of life. Can it, then, be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt remembering that many more individuals are born than can possibly survive that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection. Variations neither useful nor injurious would not be affected by natural selection, and would be left a fluctuating element, as perhaps we see in the species called polymorphic. We shall best understand the probable course of natural selection by taking the case of a country undergoing some physical change, for instance, of climate. The proportional numbers of its inhabitants would almost immediately undergo a change, and some species might become extinct. We may conclude, from what we have seen of the intimate and complex manner in which the inhabitants of each country are bound together, that any change in the numerical proportions of some of the inhabitants, independently of the change of climate itself, would most seriously affect many of the others. If the country were open on its borders, new forms would certainly immigrate, and this also would seriously disturb the relations of some of the former inhabitants. Let it be remembered how powerful the influence of a single introduced tree or mammal has been shown to be. But in the case of an island, or of a country partly surrounded by barriers, into which new and better adapted forms could not freely enter, we should then have places in the economy of nature which would assuredly be better filled up, if some of the original inhabitants were in some manner modified; for, had the area been open to immigration, these same places would have been seized on by intruders. In such case, every slight modification, which in the course of ages chanced to arise, and which in any way favoured the individuals of any of the species, by better adapting them to their altered conditions, would tend to be preserved; and natural selection would thus have free scope for the work of improvement. As man can produce and certainly has produced a great result by his methodical and unconscious means of selection, what may not nature effect? Man can act only on external and visible characters: She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; Nature only for that of the being which she tends. Every selected character is fully exercised by her; and the being is placed under well-suited conditions of life. Man keeps the natives of many climates in the same

country; he seldom exercises each selected character in some peculiar and fitting manner; he feeds a long and a short beaked pigeon on the same food; he does not exercise a long-backed or long-legged quadruped in any peculiar manner; he exposes sheep with long and short wool to the same climate. He does not allow the most vigorous males to struggle for the females. He does not rigidly destroy all inferior animals, but protects during each varying season, as far as lies in his power, all his productions. He often begins his selection by some half-monstrous form; or at least by some modification prominent enough to catch his eye, or to be plainly useful to him. Under nature, the slightest difference of structure or constitution may well turn the nicely-balanced scale in the struggle for life, and so be preserved. How fleeting are the wishes and efforts of man! It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life. We see nothing of these slow changes in progress, until the hand of time has marked the long lapse of ages, and then so imperfect is our view into long past geological ages, that we only see that the forms of life are now different from what they formerly were. Although natural selection can act only through and for the good of each being, yet characters and structures, which we are apt to consider as of very trifling importance, may thus be acted on. When we see leaf-eating insects green, and bark-feeders mottled-grey; the alpine ptarmigan white in winter, the red-grouse the colour of heather, and the black-grouse that of peaty earth, we must believe that these tints are of service to these birds and insects in preserving them from danger. Grouse, if not destroyed at some period of their lives, would increase in countless numbers; they are known to suffer largely from birds of prey; and hawks are guided by eyesight to their prey,-so much so, that on parts of the Continent persons are warned not to keep white pigeons, as being the most liable to destruction. Hence I can see no reason to doubt that natural selection might be most effective in giving the proper colour to each kind of grouse, and in keeping that colour, when once acquired, true and constant. Nor ought we to think that the occasional destruction of an animal of any particular colour would produce little effect: In plants the down on the fruit and the colour of the flesh are considered by botanists as characters of the most trifling importance: If, with all the aids of art, these slight differences make a great difference in cultivating the several varieties, assuredly, in a state of nature, where the trees would have to struggle with other trees and with a host of enemies, such differences would effectually settle which variety, whether a smooth or downy, a yellow or purple fleshed fruit, should succeed.

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5: The Origin of Species: Chapter 5

The original species of our genus were supposed to resemble each other in unequal degrees, as is so generally the case in nature; species (A) being more nearly related to B, C, and D than to the other species; and species (I) more to G, H, K, L, than to the others.

Despite periodic fluctuations, populations remain roughly the same size fact. Resources such as food are limited and are relatively stable over time fact. A struggle for survival ensues inference. Individuals in a population vary significantly from one another fact. Much of this variation is heritable fact. Individuals less suited to the environment are less likely to survive and less likely to reproduce; individuals more suited to the environment are more likely to survive and more likely to reproduce and leave their heritable traits to future generations, which produces the process of natural selection fact. This slowly effected process results in populations changing to adapt to their environments, and ultimately, these variations accumulate over time to form new species inference. Nature was widely believed to be unstable and capricious, with monstrous births from union between species, and spontaneous generation of life. After the turmoil of the English Civil War , the Royal Society wanted to show that science did not threaten religious and political stability. John Ray developed an influential natural theology of rational order; in his taxonomy , species were static and fixed, their adaptation and complexity designed by God, and varieties showed minor differences caused by local conditions. The biological classification introduced by Carl Linnaeus in also viewed species as fixed according to the divine plan. In , Georges Buffon suggested that some similar species, such as horses and asses, or lions, tigers, and leopards, might be varieties descended from a common ancestor. Wernerians thought strata were deposits from shrinking seas , but James Hutton proposed a self-maintaining infinite cycle, anticipating uniformitarianism. Both envisaged that spontaneous generation produced simple forms of life that progressively developed greater complexity, adapting to the environment by inheriting changes in adults caused by use or disuse. This process was later called Lamarckism. Lamarck thought there was an inherent progressive tendency driving organisms continuously towards greater complexity, in parallel but separate lineages with no extinction. Georges Cuvier strongly disputed such ideas, holding that unrelated, fixed species showed similarities that reflected a design for functional needs. All naturalists in the two English universities Oxford and Cambridge were Church of England clergymen, and science became a search for these laws. Grant revealed his enthusiasm for the transmutation of species, but Darwin rejected it. Filled with zeal for science, he studied catastrophist geology with Adam Sedgwick. In December , he joined the Beagle expedition as a gentleman naturalist and geologist. Darwin discovered fossils resembling huge armadillos , and noted the geographical distribution of modern species in hope of finding their "centre of creation". At the zoo he had his first sight of an ape, and was profoundly impressed by how human the orangutan seemed. In November , the anonymously published popular science book Vestiges of the Natural History of Creation , written by Scottish journalist Robert Chambers , widened public interest in the concept of transmutation of species. Vestiges used evidence from the fossil record and embryology to support the claim that living things had progressed from the simple to the more complex over time. Darwin read it soon after publication, and scorned its amateurish geology and zoology, [41] but he carefully reviewed his own arguments after leading scientists, including Adam Sedgwick, attacked its morality and scientific errors. While few naturalists were willing to consider transmutation, Herbert Spencer became an active proponent of Lamarckism and progressive development in the s. Reminded of his lack of expertise in taxonomy , Darwin began an eight-year study of barnacles , becoming the leading expert on their classification. Using his theory, he discovered homologies showing that slightly changed body parts served different functions to meet new conditions, and he found an intermediate stage in the evolution of distinct sexes. In , he completed the last part of his Beagle-related writing and began working full-time on evolution. He now realised that the branching pattern of evolutionary divergence was explained by natural selection working constantly to improve adaptation. His thinking changed from the view that species formed in isolated populations only , as on islands, to an emphasis on speciation without isolation ; that is, he saw increasing specialisation within large stable populations as continuously exploiting new

ecological niches. He conducted empirical research focusing on difficulties with his theory. He studied the developmental and anatomical differences between different breeds of many domestic animals, became actively involved in fancy pigeon breeding, and experimented with the help of his son Francis on ways that plant seeds and animals might disperse across oceans to colonise distant islands. By , his theory was much more sophisticated, with a mass of supporting evidence. Reasons suggested have included fear of religious persecution or social disgrace if his views were revealed, and concern about upsetting his clergymen naturalist friends or his pious wife Emma. His paper on Glen Roy had proved embarrassingly wrong, and he may have wanted to be sure he was correct. Darwin always finished one book before starting another. While he was researching, he told many people about his interest in transmutation without causing outrage. He firmly intended to publish, but it was not until September that he could work on it full-time. His estimate that writing his "big book" would take five years proved optimistic. Darwin was torn between the desire to set out a full and convincing account and the pressure to quickly produce a short paper. He met Lyell, and in correspondence with Joseph Dalton Hooker affirmed that he did not want to expose his ideas to review by an editor as would have been required to publish in an academic journal. He began a "sketch" account on 14 May , and by July had decided to produce a full technical treatise on species as his "big book" on Natural Selection. His theory including the principle of divergence was complete by 5 September when he sent Asa Gray a brief but detailed abstract of his ideas. Darwin described natural selection as being analogous to the artificial selection practised by animal breeders, and emphasised competition between individuals; Wallace drew no comparison to selective breeding , and focused on ecological pressures that kept different varieties adapted to local conditions. On 28 March Darwin wrote to Lyell asking about progress, and offering to give Murray assurances "that my Book is not more un-orthodox, than the subject makes inevitable. The third edition came out in , with a number of sentences rewritten or added and an introductory appendix, An Historical Sketch of the Recent Progress of Opinion on the Origin of Species, [85] while the fourth in had further revisions. The fifth edition, published on 10 February , incorporated more changes and for the first time included the phrase " survival of the fittest ", which had been coined by the philosopher Herbert Spencer in his Principles of Biology Darwin had told Murray of working men in Lancashire clubbing together to buy the 5th edition at fifteen shillings and wanted it made more widely available; the price was halved to 7 s 6 d by printing in a smaller font. It includes a glossary compiled by W. Book sales increased from 60 to per month. In a May letter, Darwin mentioned a print run of 2, copies, but it is not clear if this referred to the first printing only as there were four that year. Darwin corresponded with Royer about a second edition published in and a third in , but he had difficulty getting her to remove her notes and was troubled by these editions. By , it had appeared in an additional 18 languages. The existence of two rhea species with overlapping ranges influenced Darwin. These facts seemed to me to throw some light on the origin of speciesâ€”that mystery of mysteries, as it has been called by one of our greatest philosophers. He mentions his years of work on his theory, and the arrival of Wallace at the same conclusion, which led him to "publish this Abstract" of his incomplete work. He outlines his ideas, and sets out the essence of his theory: As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form. Darwin discusses contemporary opinions on the origins of different breeds under cultivation to argue that many have been produced from common ancestors by selective breeding. Ancon sheep with short legs , and 2 ubiquitous small differences example: However, for Darwin the small changes were most important in evolution. In Chapter II, Darwin specifies that the distinction between species and varieties is arbitrary, with experts disagreeing and changing their decisions when new forms were found. He concludes that "a well-marked variety may be justly called an incipient species" and that "species are only strongly marked and permanent varieties". Darwin and Wallace made variation among individuals of the same species central to understanding the natural world. Herbert Spencer , of the Survival of the Fittest , is more accurate, and is sometimes equally convenient. Darwin emphasizes that he used the phrase " struggle for existence.

ORIGIN OF SPECIES CHAPTER 4 pdf

6: Pokemon: The Origin of Species Chapter 4: Operant Conditioning, a pokÃ©mon fanfic | FanFiction

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Darwin was in the kitchen, getting ready for his first day at work, when he heard the Salvatore brothers arguing in the Boarding House Library. He said he could help. Even though it might not make much of a difference, since he does most of his thinking with his ass. Darwin grimaced, deciding to perform a cleansing ritual as soon as he got back from work. He grabbed one of his blood bottles from the fridge and put it into his backpack. He heard footsteps in the hall and then Stefan came into the kitchen. She had a run in with Damon. She probably told him. He was so betrayed! They swarmed around in his head. If Tyler tries to retaliate, he could get himself killed. At the old Church ruins in the woods. A path that started right in the back yard of the Boarding House led straight to them. He found the stairs leading to the crypt and followed them down. There was the stone door with the pentagram. He put his laptops on the ground and went to the door. He grabbed it and pulled it open. Then he took off his backpack and grabbed the bottle of blood from it. At first there was no answer, but then he saw a dark figure appearing. It stayed in the dark and all he could see was that it was a woman with long hair. She stayed silent for ten seconds, then: Just thought you needed it. The pain had to be excruciating. She took a step forward and her face came into the light. He could tell that she was pretty, even with her dark hair matted and her face dirty. Neither of them had expected him to come back. At least not this soon. How have he been able to keep it a secret for so long? Alaric reached out and took her hand, turning it over. He started to caress her palm lightly with his fingertips. Yet another secret he had to keep from her. He ignored Jenna and Alaric and went straight to John. It had been easy enough to enter the house. He had already been there on several occasions and knew it quite well. He could hear footsteps draw nearer and stepped back. Tyler entered the office and went to the desk. He looked up something on the computer. Stefan moved and Tyler immediately picked up the movement. His wolf powers made him faster than a normal human and he went for the door. He caught him and held him up against the wall with an arm on his throat. The door was open. He wanted to give Tyler some breathing space, but stayed close enough to him that he could catch him, if he tried to run again. We can find a way to live together without fighting. We can make it work. This is our home. Vampires can be compelled by Originals. Damon was leaning casually against the wall. They were side by side, rather than face to face. So what do you have to say? Finally, Tyler broke the silence: Will you go now? He grabbed it and checked the callerID. You have twenty minutes until Caroline dies. Somehow, he knew this was a trap,but there was no way he could let Caroline die. Tyler stood next to him with a confused look on his face. Damon was sitting alone by the bar, wondering exactly what John Gilbert had dug up. And even if he did have something and it turned out to be useful, could John really be trusted? No way in Hell. Strange, but looking familiar, somehow. Caroline asked me to talk to him. We have to continue this some other time. At the door he almost collided with Darwin, who was on his way in. Damon rolled his eyes. They are going to kill her, unless we bring them Tyler. Maybe I can help. Lighten Up Spray is actually something I found on the net. Apart from Darwin, who the Hell buys these things? Your review has been posted.

ORIGIN OF SPECIES CHAPTER 4 pdf

7: Darwin on the Origin of Species

Chapter Summary for Charles Darwin's On the Origin of Species, chapter 4 summary. Find a summary of this and each chapter of On the Origin of Species!

Natural selection will, therefore, promote mutations that reduce the probability of intercrossing between populations carrying different rearrangements and thus promote their reproductive isolation. This model encounters a disabling difficulty: Mutations associated with the rearranged chromosomes cannot flow from one to another population, whereas genetic exchange will freely occur between colinear chromosomes. Page 47 Share Cite Suggested Citation: Systematics and the Origin of Species: The National Academies Press. The speciation model of suppressed recombination has recently been tested by gene and DNA sequence comparisons between humans and chimpanzees, between Drosophila species, and between species related to Anopheles gambiae, the vector of malignant malaria in Africa. The process of evolution is continuous through time but yields in space discontinuous groups of organisms. The continuity of the process links the myriad living organisms with the last universal common ancestor, from which all living organisms descend. The discontinuities are encompassed in the Linnean system of classification, which is hierarchical, with gradually more inclusive categories: But species have a biological reality that is lacking in more inclusive groups of organisms. In sexually reproducing organisms, individual members of a species are able to interbreed and thus share in a common gene pool. Collectively, there is variation among the members of a species, but there is also continuity in space and time. Species are evolutionary units. Because of these properties, some philosophers have affirmed that species, but not more inclusive groups of organisms, are metaphysical individuals. Dobzhansky a,b pointed out in this double biological reality of the concept of species: The biological species concept, as it came to be known, defines species precisely by these two attributes: The evolutionary process of speciation, by which one species splits into two, is equivalent to the evolutionary emergence of reproductive isolation. Page 48 Share Cite Suggested Citation: He did not place the definition cited above in quotes and provided, in the same and other writings, additional definitions that pointed toward other species characteristics such as their being temporary instantiations of the evolutionary process: As he had earlier pointed out: Species are natural units that evolve and adapt autonomously. An ancestral species is transformed into two or more derived species when an array of interbreeding Mendelian populations becomes segregated into two or more reproductively isolated arrays. Species are, accordingly, systems of populations; the gene exchange between these systems is limited or prevented in nature by a reproductive isolating mechanism or perhaps by a combi- Page 49 Share Cite Suggested Citation: In short, a species is the most inclusive Mendelian population. In Systematics and the Origin of Species, Mayr commended Dobzhansky for identifying interbreeding and reproductive isolation as the distinguishing features of the species concept and proposed a short definition: Indeed, Mayr is generally perceived as the leading exponent of the biological species concept and the most successful investigator of the application of this concept to a great variety of species and species groups throughout the animal world, as several papers in this collection bear witness. Mayr repeatedly wrote that species are real and not merely human constructs that are convenient for organizing biological diversity, as some taxonomists, as well as nominalist philosophers, would claim. He supported the claim by Ghiselin , Hull , and others that species are metaphysical individuals, once this language was introduced in the evolutionary literature Mayr, , Polyploidy, the multiplication of the chromosome complement, may yield a new species in a single generation, reproductively isolated from its ancestral species. For example, a tetraploid plant crossed with a diploid ancestor produces sterile hybrid progeny. Polyploidy is more common among angiosperms than among gymnosperms. Polyploidy is also common among ferns. Some important cultivated plants are polyploids, such as wheat, oat, tobacco, potato, banana, strawberry, sugar cane, and coffee. Polyploidy is less common in animals; polyploidy species occur among hermaphrodites, such as earth- Page 50 Share Cite Suggested Citation: Chromosome rearrangements, such as Robertsonian fusions and fissions, translocations, and inversions, may play a role in speciation. There are a number of models proposing that chromosomal rearrangements accelerate genic diversification between

populations and, therefore, facilitate speciation. The great multiplication of species of flightless Australian grasshoppers of the subfamily Morabinae can largely be attributed, according to White , , to underdominance in hybrids between populations with different chromosome rearrangements. A chromosomal rearrangement may first become established in a small local colony, either at the periphery of the distribution area of the ancestral species or inside it, by random drift. The colony may expand within a certain area and there displace the ancestral form if its members display high fitness in that area. The low fitness of the hybrids will keep the two populations separate and facilitate the evolution of prezygotic isolating mechanisms, which will inhibit the formation of hybrids. The hybrid dysfunction model of speciation encounters the following disabling difficulty Hey, ; Machado et al. A chromosome rearrangement will first appear in the population as a mutation in a single individual. This individual will be able to mate only with individuals without the mutation. If hybrids have reduced fitness, the chromosome mutation will be selected against and eliminated from the population. The hybrid dysfunction model is unlikely to have much general validity, precisely because it seems so unlikely that a chromosome rearrangement that reduces the fitness of heterozygotes will be at all established within its ancestral population, although this may occasionally occur by random Page 51 Share Cite Suggested Citation: A speciation model of suppressed recombination was proposed by Coluzzi in his account of multiple speciation events within the species complex related to Anopheles gambiae, the main vectors in Africa for the transmission of malignant malaria, caused by the protozoan Plasmodium falciparum. Seven species have been identifiedwithin the A. Suppressed-recombination models of speciation have recently been proposed by Rieseberg to account for speciation in wild sunflowers Riesberg et al. We will successively examine the humanâ€”chimpanzee and Drosophila evidence advanced in support of the model and then return to speciation in the A. In particular, nine chromosomes nos. The hypothesis proposes that alleles favored in one or the other population will be trapped at the chromosomal barrier and thus would cause the two populations to diverge genically as they adapt to their distinct prevailing environmental conditions. Accumulation of incompatibilities would gradually result in reproductive isolation and speciation. Gene flow can readily occur along regions not linked to the inverted region solid arrows but is severely inhibited in regions linked to the inversion dotted arrows. Natural selection favors the evolution of reproductive isolation between the populations by accumulation of incompatible alleles along the chromosome regions protected from recombination by the inversions. Figure was modified from Hey This hypothesis can be tested, according to Navarro and Barton b , by comparing genic differentiation between humans and chimps for different chromosome regions. According to evolutionary theory, the rate of nonsynonymous nucleotide substitution per nonsynonymous site KA is generally expected to be much lower than the rate of synonymous substitution per synonymous site KS , because random amino acid changes are usually deleterious, whereas synonymous changes are likely to be neutral or nearly so Kimura, Navarro and Barton b have investigated nucleotide sequences that exhibit nucleotide differences between chimps and humans in genes, about evenly distributed between rearranged chromosomes 59 genes and colinear chromosomes 56 genes Table 4.

ORIGIN OF SPECIES CHAPTER 4 pdf

8: On the Origin of Species - Chapter 4: Natural Selection Summary & Analysis

On the Origin of Species (or more completely, On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life), published on 24 November , is a work of scientific literature by Charles Darwin which is considered to be the foundation of evolutionary biology.

Not that it matters: When the wind stops, he looks up to see the small flock of pidgey swiftly departing. Blue walks over, breathing hard. His squirtle approaches from behind, staring after the departed pidgey for a moment before dropping onto all fours and investigating the grass around them. He looks over to where Leaf and Bulbasaur are and sees her pick up one of her own pokeballs before heading to them. Blue shakes his head. A large, winged black and yellow insect, all sharp stingers and pointed claws, appears on the screen. How much do you have? I can hide with Bulbasaur in some tall grass, try to grab one with vines if it gets close. Dig a hole, make a false cover and put some berries on it? I like the berry idea though. Bulbasaur sits under the trap? They agree, and get up to look for a good spot. A few rattata and pidgey run from the trio as they walk through the tall grass, and eventually they find a berry laden bush with three rattata around it. They seem willing to stand and fight at first, until Leaf brings Bulbasaur out. They flee before Red can bring out Charmander, and Blue throws a pokeball at the retreating rodents, missing one by a hair. Her pokemon walks over to it and begins to feed. He recoils, blinking in surprise, and looks at his trainer with a mournful sound. I just have to reward him with something he wants more. Operant conditioning deals with positive and negative reinforcement. He put rattata in a box which had a mechanism to release food, along with a lever, and a light display or speakers. The lever would only dispense food if they pressed it after the right signal. That was their reward, to reinforce the desired behavior. If they did it after the wrong one, they would get a small shock or something. That aversive stimulus was the punishment. The round cakes are colorful, and their scent fills the air as soon as she opens the wrapping. Bulbasaur and Squirtle sniff, their gazes locking on the brown and orange pastry Leaf holds up. Red had made the connection to his own learning not to touch a hot stove as a toddler before finding the studies that supported it. The water bottle is a positive punishment, because it adds an experience to minimize a behavior. The pokepuff is a positive reinforcement, because it reinforces a behavior. A negative reinforcement would be a positive experience for a pokemon, because it remove a noxious experience when doing a behavior, which encourages it to do that behavior again. It takes another few repetitions of this until Bulbasaur stops reaching for berries on his own. Finally he begins to stir and stretch his neck out for one, and when Leaf says "Stop! By the time the PokePuff is gone, Bulbasaur is obediently sitting in the middle of the berry bush without reaching for any of them. Leaf brushes her hands off on her pants. When Bulbasaur moves forward to pursue, Leaf tells him to stop, and Bulbasaur does. The screen displays a stadium. Red watches her tackle a mannequin, then begin biting it as his virtual self instructs her to. Red remembers learning about pokeball technology at school. Most of the students had just followed the lesson and taken notes at various levels of attention, but Red could barely listen and write at the same time, mind racing with possibilities. The class had gone silent, many kids turning to give Red a strange look. The teacher had reprimanded her, but then reiterated the well known point: Red had barely paid attention the rest of the day. His mind kept coming up with new things such a breakthrough would allow: The technology had been available from the very beginning. The first humans who had volunteered to be stored in a pokeball and then reformed had emerged physically healthy, but severely brain damaged. Over the years, the matter compression technology had continued to advance, and occasionally human testing was tried again. Criminals facing the death penalty were offered the choice of entering a pokeball instead: Time and again, the results were the same: At worst, permanent catatonia. Ultimately the decision was agreed by all levels of government: The creation or use of devices that would recognize and store humans became a felony of the greatest magnitude, allowing law enforcement to go all-out against anyone suspected of doing so. All further research on the topic was put to a halt. Blue rolls three shrunken pokeballs around on his palm by flexing his fingers, while Leaf scans the skies. The sun continues to inch along the sky, and eventually Blue excuses himself to duck behind some trees. I can submit it through the pokedex, but I have to wait for it to be peer reviewed to be accepted. I

just need to discover or verify something new. So the more papers I publish, the more chances of being cited by others, but high quality research will likely shoot my score way up. Once I hit 20 I can become an Instructor. When do you get your own lab? I need to demonstrate knowledge of every major species in the region to apply to become a Professor, and once I pass that test, my dissertation has to disprove or overturn a previous theory that has already been established. The rewards are structured more toward verifying and disproving than submitting. Get a head start on it? So I got a chance to observe first hand the proper procedures and format and standards, which will help a lot in doing my own research and getting it accepted. More than Gym Leaders have, even. They watch as it inches closer Leaf and Red dash to the bush, where the squirming rodent is trying to twist around and bite the vines holding it. The lens blinks red, then stills. Such a good boy! Did I miss it?! Leaf and Red glance at each other before collapsing in laughter. Blue blinks at them, then scowls, cheeks darkening as he puts the pokeball away and finishes zipping and buttoning his pants. Eventually Red recovers enough to explain, and they retreat to the hill after Leaf instructs Bulbasaur to return to the bushes. You did get the chance to finish, right? The clouds drift across the sun, darkening the fields as wind sends ripples through the grass. Red checks the time, noting that they have another two hours of sun left. Plenty to reach Viridian City by nightfall, though only if the pidgey shows up within the next thirty minutes Leaf gives a small gasp, then points: Within moments they land and begin to hop over to the bush. Blue curses, and Leaf bites her lower lip. What would the other two pidgey do when Bulbasaur grabs the third? The bushes would provide some cover, but outnumbered the way he is, Bulbasaur might be seriously hurt before they can reach him. The pokeballs soar through the air as the three pidgey explode into action, flapping and chirping in alarm as one of them struggles against the vines holding it. Bulbasaur keeps his target from flying away, but the other two are already pecking his vines to free their companion. The wrapped pidgey gets its second wing free and begins to flap, lifting itself a bit. Bulbasaur gets dragged from concealment as he tries to hold onto the pidgey, and the two free birds immediately shift focus to attack him with their beaks and talons. So inconvenient- "Squirtle, Water Gun! For a second there Red had been worried Squirtle would hit Charmander, but the turtle continues to shoot jets of water at the unengaged bird as Charmander knocks away the lower one. By the time they reach the scuffle, Blue has a pokeball in each hand, pressing their buttons to expand them and pointing their lens at the pidgeys. Precious seconds pass as he tries to keep them steady on the birds, shifting his arms slightly as the two free pidgey fly around and occasionally dive at their pokemon. Gotta keep their wings busy. Squirtle keeps the third pidgey at bay with bursts of water every time it attempts to get close, while their target continues to drag Bulbasaur farther away as it tries to lift off. Finally a pair of dings sound. He releases it just as he hits, but the bird is already airborn, and barely flinches. The tackle does turn it around however, and its first few flaps aim it toward them instead of away. Blue throws, then shifts the left ball to his right hand and throws again, aiming higher. The pidgey climbs over the first ball, only to be hit by the second. Charmander continues to struggle with the second pidgey, and Red can see both pokemon tiring. The ball hits the second pidgey and bounces off it before opening and sucking it inside as it falls.

ORIGIN OF SPECIES CHAPTER 4 pdf

9: The Origin of Species: Chapter 4

Chapter 4: Natural Selection Summary and Analysis. Natural selection is a process that is the result of the ideas expressed in the previous two chapters: variations that occur in the wild and the struggle for survival among all organisms.

Origin of Species Chapter 4 Summary Natural Selection Natural selection occurs when favorable characteristics in a species are selected for while injurious variations are selected against. Variations that are neither would not be affected. While species in mainland areas are constantly subject to emigration and immigration, island settings are optimal for studying natural selection because of the isolation. Only slight modifications are necessary for selection to occur, since species are always competing and no species is perfect. Compared to artificial selection, natural selection improves the overall fitness of species rather than just focusing on visible characteristics. It is also constantly working, so changes may be too slow for man to see in his lifespan. It is the little differences among the characteristics of different species that eventually determines which characteristic or species prevails. Climate and food play a role in such selection. Also, when certain small modifications are acquired, they will undoubtedly cause more modifications, some of which may be unexpected. Variations often tend to reappear in the young of different species, since survival of the young leads to more organisms surviving to adulthood. These variations then affect the structure of the adult. While natural selection will change both young and adult features, what it cannot do is negatively impact one species solely for the benefit of another. Another type of natural selection is sexual selection. Natural selection can modify the sexes separately so that males and females have completely different features and habits. This can manifest in the form of special weapons or attractive features in the males, since this increases their chance to reproduce and pass their genes on to their progeny. However, not all distinctions between the sexes can be attributed to sexual selection. To explain natural selection, consider the imaginary example of wolves. Faster and slimmer wolves would have a greater chance of survival. Also, wolves in different habitats would develop differently. In the example of plants, plants that could better attract insects to cross-pollinate would have sturdier offspring. In some holly trees, for example, trees only bear male or female flowers. Thus, there is division of labor and cross pollination occurs. As for the insects, bees that have an accidental deviation in size or proboscis length that helps them better acquire nectar would have a better chance of surviving and passing on their genes. In addition, since plants rely on bees and bees rely on plants, it is very possible for the two to co-evolve, and even for there to be different species of plants based on what types of bees are in an area. The belief is strong that with all hermaphrodites, two individuals are needed to reproduce. This gives vigor and fertility to the offspring while close interbreeding reduces the two. Evidence for this is shown in plants, since plants fully expose their anthers and stigmas to the weather. Also, they are designed so that bees cannot collect nectar without cross-pollinating. However, this does not mean that inter-species crosses occur since foreign pollen will be destroyed by a plant. There are also often special features that prevent a plant from receiving its own pollen. Interestingly enough, although species crosses are often unsuccessful, crosses between different varieties of the same species are often encouraged. In large trees, cross-fertilization is also encouraged when trees have flowers separated by the sexes. This leads to a greater probability that pollen will be carried from tree to tree. While aquatic animals, unlike terrestrial animals, sometimes self-fertilize, this is not always so. Even self-fertilizing hermaphrodites sometimes inter-cross. Thus, the occasional intercross is most likely a law of nature. Isolation is also important in natural selection. In confined areas, natural selection will modify all individuals in relation to the same conditions. If immigration happens, competition between immigrants and natives ensues and new species could be produced or improved. Also these facts are true, production of new species is more favorable on large areas. This is because species that succeed have already beaten many other species and are therefore more likely to spread their genes. On a small island, this competition is much less severe. However, if large continents separate into islands and then remerge, new species could form and then compete. All in all, however, natural selection will always be a slow process in the eyes of human beings. Extinction also plays a role in natural selection. As some species are favored and selected, they increase in

number. This will also cause less favored forms to decrease in number and go extinct. Species that have the most individuals will have the best chance of producing favorable variations and surviving, while rare species will be modified less and may be more prone to extinction. In addition, varieties of species will compete most with similar species and if superior, will cause them to go extinct. Now we come to the question of how a small difference between varieties becomes a large difference between species. This is because intermediate forms are often not favored and are thus selected against. As intermediate characteristics are disappearing, differences between two varieties would become greater, allowing these species to survive in a greater range of habitats. When these varieties become distinct from each other, they become separate species. The greatest amount of life can actually be supported in a small area open to immigration. Such an area produces a lot of diversity in its inhabitants. There would be many different species with differences in habit and structure. The same concept occurs in naturalization. Oftentimes, an introduced species will adapt and vary in a new habitat. However, they will probably differ a lot from the indigenous species. The advantage of diversification of inhabitants is similar to the advantage of the division of labor in a body. It will produce the greatest number of individuals that are capable of supporting themselves yet living together. Diversification occurs in the following manner. Little variations in habit and physiology will lead to a divergence in character. These variations may take varying amounts of time. However, the variations will inherit the advantages of their common parent. If these two variations are both capable of success, the most divergent of the two will be preserved. Although the most divergent varieties will not always prevail, this is the general rule. Thus, the varieties will keep on increasing in number and diverging in their traits. Newly improved branches are likely to destroy earlier and less improved branches. In some cases, this will result in only a single line of descent and the number of descendants will not increase. Although intermediate forms are generally selected against, both original and modified variations can survive if they do not come into competition. However, in most cases, not only are the original variations eliminated by newer variations, but species similar to the original generations are also eliminated. This can lead to extreme differences in character between species after many generations. Thus, two or more genera could be produced from what had originally been two species. Also, even genera are not the limit to what diversification can accomplish. It is equally plausible that new families could be produced because of branching and natural selection. Overall, however, this happens mainly between large groups while many smaller groups will become extinct.

ORIGIN OF SPECIES CHAPTER 4 pdf

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