

# DARWIN

## His Work & Influence

BY

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DARWIN HIS WORK AND  
INFLUENCE A LECTURE  
DELIVERED IN THE HALL  
OF CHRIST'S COLLEGE CAM-  
BRIDGE BY E. A. PARKYN,  
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## P R E F A C E

**T**HIS Lecture to the University Extension Students, who met at Cambridge last summer, was fittingly delivered in the Hall of Christ's College, of which Darwin was himself a member, having resided within its walls from 1828 to 1831. The object of the Lecture was threefold—viz., to show (1) How the *Origin of Species* came to be written, more especially by pointing out the forces and influences acting upon its author, which ultimately produced so great a result; (2) The significance and importance of that work, and its relation to Darwin's subsequent labours; (3) The connection between Darwinism and Evolution in a wide sense. That so large a subject should be dealt with in a space so small may be justified on the ground that a further important object I had in view was to arouse in the minds of my hearers interest, thought, and further inquiry.

E. A. P.

LONDON, *January* 1894.



# CHARLES DARWIN

## I.

AT the present day *Evolution* is a word constantly used, and presumably conveys some meaning to those who use it and to those who hear it. The exact meaning of the word is perhaps not always very clear to the user or to the hearer. The reason for its widespread use, however, is not difficult to find. It is chiefly due to the labours and imagination of one man—Charles Darwin. Not that the idea usually associated with Evolution—viz., a gradual development, was unknown before Darwin. Far from it. Even from the time of Aristotle such an idea appears to have occurred again and again more or less vaguely to the minds of men,—in some cases far more definitely than is generally imagined. *Harvey*, the illustrious discoverer of the Circulation of the Blood, more than two centuries ago enunciated a view of animal development under the name of Epigenesis remarkably in harmony with the modern doctrine of Evolution.

Towards the close of the last century four men, at about the same time, independently expressed the opinion that the present condition of the Animal Kingdom was the result of Descent, rather than of special creative acts. They were Treviranus, Erasmus Darwin, Goethe, and Lamarck. Of these *Lamarck* undoubtedly held most strongly the belief

in the gradual evolution of the animal world. He moreover suggested the influences which might cause such modifications of structure as to enable us to understand how changes great enough to make such development possible had occurred. Lamarck's explanation was no doubt a very incomplete one, and was largely discounted by the paucity and poverty of the facts and experiments he brought forward to support it. Nevertheless, his celebrated work—*La Philosophie Zoologique*—in which his views were embodied, is, I venture to think, entitled to a more respectful consideration than naturalists have given it.

Darwin was therefore born into a world which may be said to have possessed the evolutionary idea, but in a half-dormant state. A few held strongly the truth of Evolution as applied to the animal world, but, on being appealed to, were unable to support by clear and irrefutable facts the faith that was in them. This incapacity, no doubt, reacted powerfully on the minds of the best and most conscientious observers, and, if anything, retarded the spread of such views.

What was it then in Darwin's *Origin of Species*, when published in 1859, which soon dispelled doubt and carried conviction to the minds of so many who had previously been unable to accept the doctrine of Evolution? It no doubt was this—That then for the first time was presented a clear and easily understood explanation of how in the course of time profound changes might be produced in the structure of Animals and Plants, sufficient indeed to enable us to appreciate how the present condition of the Animal and Plant worlds may have arisen by a process of descent, and furthermore adduced and marshalled a wealth of facts, observations and experiments, in support of this explanation

such as had never before been brought to bear on any biological problem. This in a sentence is the significance of the *Origin of Species*. All Darwin's subsequent labours may be described as a fuller explanation, amplification or elaboration of the many points raised in that epoch-making work.

Let us then endeavour to discover how it was the *Origin of Species* came to be written, and then what effect it had on the author himself as interpreted in the light of his subsequent work, what its effect was on his contemporaries, and lastly its influence and bearing on the greatest of all questions, the Evolution of Mankind.

Charles Darwin was born in 1809 at Shrewsbury. His father was a son of Erasmus Darwin, who gained considerable repute by his poems and scientific speculations. His mother was the daughter of Josiah Wedgwood, the well-known Staffordshire potter. Those who are interested in heredity may see reason for not being surprised at the appearance of exceptional gifts in one descended from two such men as Erasmus Darwin and Josiah Wedgwood. There is only one thing I will notice which occurred during his schooldays, from nine to sixteen years of age, at Shrewsbury School, and that is his having read during that period the charming book *White's Natural History of Selborne*. Darwin says the reading of this book made him take much pleasure in watching the habits of birds, and he even made notes on the subject. Here we may say was the first stimulus to set out on that road which ultimately led to so fertile a goal.

Leaving school at Midsummer 1825, he proceeded in the following October to the University of *Edinburgh*, where he remained two years. To judge from his own account, he



gained little or no advantage from the instruction offered at the northern University. He says "the instruction at Edinburgh was altogether by lectures, and these were intolerably dull, with the exception of those on Chemistry by Hope." Many a medical student has, I fear, unconsciously echoed the sentiments he expressed, on adding, "Dr Duncan's lectures on *Materia Medica* at eight o'clock on a winter's morning are something fearful to remember. Dr Munro made his lectures on Human Anatomy as dull as he was himself, and the subject disgusted me."

It appears, therefore, that he gained little from the instruction offered by the University. Nevertheless, his sojourn in Edinburgh was not without influence on his future career, for he was there brought in contact with men who aroused in him an interest in Natural History. One of these was *Dr Grant*, a well-known zoologist, who for many years was Professor at University College, London. Grant was even then an enthusiastic Evolutionist—an enthusiasm he maintained up to the time when I can remember him as a very old man teaching his class in London. Referring to Grant, Darwin says: "He, one day, when we were walking together, burst forth in high admiration of Lamarck and his views on Evolution. I listened in silent astonishment, and, as far as I can judge, without any effect on my mind. I had previously read the *Zoonomia* of my grandfather, in which similar views are maintained, and without producing any effect on me." But he is careful to add, "Nevertheless, it is probable that the hearing rather early in life such views maintained and praised, may have favoured my upholding them under a different form in my *Origin of Species*." Grant was much interested in marine zoology, and took Darwin with him on his excursions, and he dissected as well as he could

the animals collected. He deplores his incapacity in dissection, and his wretched microscope. Nevertheless, he made a little discovery, and read a paper on the subject in 1826 before the Plinian Society. He got instruction in bird-stuffing, and probably much interesting information, from a negro who had travelled with Waterton, and was then gaining his livelihood in Edinburgh by bird-stuffing, for Darwin says he was a very pleasant and intelligent man. In his second year at Edinburgh his experience was very similar. The official instruction apparently did more harm than good, for he says, "I attended Jameson's lectures on Geology and Zoology, but they were incredibly dull. The sole effect they produced on me was the determination never so long as I lived to read a book on Geology, or in any way to study the science." It was again from the unofficial person that he derived any benefit. "From attending Jameson's lectures," he adds, "I became acquainted with the curator of the museum, Mr *Macgillivray*, who afterwards published a large and excellent book on the birds of Scotland. I had much interesting Natural History talk with him, and he was very kind to me. He gave me some rare shells, for at that time I collected marine mollusca, but with no great zeal."

As he did not find medical study congenial, nor relish the idea of being a physician, his father thought he had better go into the Church. This change was the reason why he went from Edinburgh to *Cambridge*. He entered the University in the Lent Term 1828. Darwin's own comments on this change in his future career are interesting and humorous. Here they are. "Considering how fiercely I have been attacked by the orthodox, it seems ludicrous that I was once intended to be a clergyman.

Nor was this intention and my father's wish ever formally given up, but died a natural death when, on leaving Cambridge, I joined the *Beagle* as naturalist. If the phrenologists are to be trusted, I was well fitted in one respect to be a clergyman. A few years ago the secretaries of a German psychological society asked me earnestly by letter for a photograph of myself: and some time afterwards I received the proceedings of one of the meetings, in which it seemed that the shape of my head had been the subject of a public discussion, and one of the speakers declared that I had the bump of reverence developed enough for ten priests."

Cambridge seems to have exerted very much the same sort of influence on his future career as Edinburgh. According to Darwin's own account, he gained little or nothing from the official sources of instruction. What advantages he did derive from the three years' residence in this College were obtained from the friendship and acquaintance he was fortunate to gain with people interested in Natural History. To quote his own words, "*During the three years I spent at Cambridge* my time was wasted, as far as the academical studies were concerned, as completely as at Edinburgh and at school." He himself, however, gives unintentionally a little exception to this somewhat sweeping statement, which is also of interest as indicating at this period the cast of his mind. The quotation I am about to give would perhaps not strike a chord of sympathy in the average freshman face to face with the Little-go. "In order to pass the B.A. examination it was also necessary to get up *Paley's Evidences of Christianity* and his Moral Philosophy. This was done in a thorough manner, and I am convinced that I could have written

out the whole of the Evidences with perfect correctness, but, of course, not in the clear language of Paley. The logic of this book, and, I may add, of his Natural Theology, gave me as much delight as Euclid." This Darwin considered was the only part of the academical course which was of the least use to him in the education of his mind.

However little he may have owed to the academic teaching offered by the Cambridge of his day, there cannot be the least doubt that through the friendship he there formed with Professor Henslow (Professor of Botany in the University), he came under an influence which determined, and may almost be said to have directly carved out, his future career. Darwin himself recognised this most fully. The direction of his energies and interests into the channels of Natural History was due to Henslow's teaching, encouragement, and advice. The only exception to his general condemnation of lectures is made in favour of Henslow's, of which he says, "I liked them much for their extreme clearness and the admirable illustrations, but I did not study Botany." He then adds a picture which there is room for copying, perhaps, even at the present day—"Henslow used to take his pupils and several of the older members of the University field excursions on foot, or in coaches to distant places, or in a barge down the river, and lectured on the rare plants and animals which were observed. These excursions were delightful." To give Darwin's own estimate of *Henslow's influence*:—"A circumstance which influenced my whole career more than any other was my friendship with Professor Henslow. Before coming up to Cambridge, I had heard of him from my brother as a man who knew every branch of science, and I was accordingly prepared to reverence him. . . . Before long I became well acquainted

with Henslow, and during the latter half of my time at Cambridge took long walks with him on most days."

Towards the end of his time at Cambridge Darwin was persuaded by Henslow to begin *the study of Geology*, which he soon attacked in a practical manner, for on returning to Shropshire he examined sections and coloured a map of parts around Shrewsbury. In the succeeding summer he had the advantage, through the kindness of Henslow, of accompanying Professor *Sedgwick* on a geological excursion in North Wales. "This tour," says Darwin, "was of decided use in teaching me a little how to make out the Geology of a country."

There is one little incident during his last year at Cambridge which I think may be rightly judged as an important influence on his mind. At this time he read with profound interest *Humboldt's Personal Narrative*, and it stirred up in him an ardent desire to study and advance Natural Science, and also to visit scenes such as were described so graphically by the great traveller. Judging from the not infrequent reference to Humboldt in his works, one can plainly see that the effect thus produced was not merely fleeting, but left an indelible impression, and may be ranked as one of the forces which, acting on his mind, enabled him to achieve the great work of his life. Of patient and persevering observation and invincible determination to overcome obstacles, he had in Humboldt a splendid example.

And now all (what I would call) the unacademic influence of Edinburgh and Cambridge—Grant and MacGillvray, Henslow and Sedgwick and Humboldt, not even omitting the intelligent, travelled negro bird-stuffer (with whom he used to talk at Edinburgh)—had prepared him, had so educated him as to make him desirous and capable of

accepting an offer which was the great determining fact in his life. I of course refer to the offer made to him to go out on board H.M.S. *Beagle* as naturalist. Here, again, we must not forget that he owed this offer to the kindly recommendation of Henslow. His father first opposed his going, but giving way on the intervention of his uncle, Josiah Wedgwood, Darwin went to London to see Captain Fitzroy, commander of the *Beagle*. Fitzroy, as an ardent disciple of Lavater, was at first disposed to decline Darwin's services on account of the shape of his nose.

The importance of the *Voyage of the Beagle* is, however, much best described in Darwin's own words. He says, "It has been by far the most important event in my life, and has determined my whole career; yet it depended on so small a circumstance as my uncle offering to drive me thirty miles, which few uncles would have done, and on such a trifle as the shape of my nose. I have always felt that I owe to the voyage the first real training or education of my mind. I was led to attend closely to several branches of Natural History, and thus my powers of observation were improved, though they were always fairly developed." And again, some years after, in a letter to Fitzroy—"I think the *Beagle* voyage far the most fortunate circumstance in my life. I often have the most vivid and delightful pictures of what I saw on board the *Beagle* pass before my eyes. These recollections, and what I learnt on Natural History, I would not exchange for twice ten thousand a year."

The knowledge, experience, and habits acquired through the constant collection, observation, dissection, and comparison, and the careful and vivid description of what he saw—so well-known to readers of *The Voyage of a Naturalist*—made during this voyage, gave him the material and power

for the great work which brought him so much fame in after years. He thus acquired the habit of energetic industry and concentrated attention to whatever he was engaged in. Everything about which he thought or read was made to bear directly on what he had seen, or was likely to see; and this habit of mind was continued during the five years of the voyage. "I feel sure," he says, "that it was this training which has enabled me to do whatever I have done in Science."

It was during this voyage that he came under the influence of the second great scientific force, counting Henslow as the first. I mean that felicitous writer and philosophic geologist *Sir Charles Lyell*. Darwin took with him on board the *Beagle* the first volume of Lyell's *Principles of Geology*, just published (1830), and read it carefully, and he says the book was of the highest service to him in many ways. The many successful geological observations made by him, and his palæontological discoveries, were no doubt due to the interest and teaching of Lyell's great work. A remark of Darwin's brings this out very strikingly. "The very first place which I examined," he says, "viz., St Iago in the Cape de Verde Islands, showed me clearly the wonderful superiority of Lyell's manner of treating geology, compared with that of any author whose works I had with me, or ever afterwards read." And again in a letter to his cousin, Fox (1835): "I am become a zealous disciple of Mr Lyell's views as known in his admirable book. Geologising in South America, I am tempted to carry parts to a greater extent even than he does." The influence of Lyell on Darwin personally, and as an unconscious and even unwilling forerunner in the spread of the doctrine of Evolution, can hardly be

over-estimated, but that is a point to which I shall have to refer later on.

After an absence of five years the voyage of the *Beagle* came to an end, and in October 1836 Darwin was once more in England. In the following December he went to *Cambridge*, and resided there until the following spring. His impression of Cambridge then he gives in the following words:—"Cambridge yet continues very pleasant, but not half so merry a place as before. To walk through the courts of Christ's College, and not know an inhabitant of a single room, gave one a feeling half melancholy."

After leaving Cambridge in 1836, until his marriage in 1839, he lived in *London*, being engaged in preparing his *Journal of Travels*. In 1837 the Chancellor of the Exchequer granted £1000 for publication of *Zoology of Voyage of Beagle*. During this time he was elected Secretary of the Geological Society, and saw a great deal of Lyell, who no doubt exerted a bracing and stimulating effect in the direction of making him persevere with his natural history and geological work. He also often met *Robert Brown*, the well-known botanist. "I never expected my Geology," says Darwin, "would ever have been worth consideration of such men as Lyell, who has been to me since my return a most active friend."

Darwin was even at this early period so chronically subject to ill-health that in 1842 he decided to leave London and settle in the country. Hence it was that in this year he *settled at Down*, a most retired spot in Kent, where he ever afterwards lived, and, sad to say, in the same bad state of health.

In the same year his work on *Coral Reefs* was published, of which *Sir A. Geikie* has said, "This treatise, the



most original of all the author's geological memoirs, has become one of the classics of geological literature. . . . No more admirable example of scientific method was ever given to the world, and even if he had written nothing else, this treatise alone would have placed Darwin in the very front of the investigators of nature."

On the publication of a *second edition of the "Journal of Researches,"* he wrote as follows to Lyell, and I quote it because it supports so well what I have said before—viz., that the great geologist was one of the chief forces which made Darwin what he afterwards became. Having expressed a wish to dedicate the work to Lyell, Darwin writes: "I have long wished, not so much for your sake as for my own feelings of honesty, to acknowledge more plainly than by mere reference how much I geologically owe to you. Those authors, however, who, like you, educate people's minds as well as teach them special facts, can never, I should think, have full justice done them except by posterity, for the mind thus insensibly improved can hardly perceive its own upward ascent. . . . Pray do not think that I am so silly as to suppose that my dedication can any way gratify you, except so far as I trust you will receive it as a most sincere mark of my gratitude and friendship."

The *eight years from 1846 to 1854* were chiefly occupied on one work, and that the one least known to the general public, because it is the most technical of all his publications. This was a *Monograph on the Cirripedia* or Barnacle family. I notice it here because it must undoubtedly be ranked as one of the great educational factors in Darwin's life. The immense detailed labour of this work was of great value as systematic training, and served to make good the absence of early training in biological science. He

found such prolonged labour quite enough, however, and felt a great relief when it was finished, and went so far as to say that had he known what an enormous amount of labour it would involve he should not have undertaken it.

## II.

Having finished the Cirripede book, he wrote to Sir J. Hooker in September 1854, "I shall now in a day or two begin to look over my old notes on species": and this may well serve to bring us to the subject for which all the foregoing has been an introduction—the subject of SPECIES. As far back as July 1837, he opened his first notebook for facts in relation to the Origin of Species, about which he says he had long reflected, and never ceased working at for the next twenty years. And a letter to Lyell in 1838, is deeply interesting, as it gives the first clear indication of how he was beginning to think deeply on the subject of Species. "I have lately been sadly tempted to be idle—*i.e.*, as far as pure geology is concerned—by the delightful number of new views which have been coming in thickly and steadily, on the classification and affinities and instincts of animals, bearing on the question of species. Notebook after notebook have been filled with facts which begin to group themselves clearly under sub-laws." And again, in a letter to his cousin Fox about the same time, "I am delighted to hear you . . . have not forgotten my question about the crossing of animals. It is my prime hobby, and I really think some day I shall be able to do something in that most intricate subject, species and varieties."

*Up to the publication of the "Origin of Species" in 1859,* it was one of the canons of orthodox Natural History that

species were absolutely fixed and unchangeable, that the transmutation of species never occurred—species were immutable. This meant that there were certain forms of animals and plants having well defined characters which never changed. All the forms having these characters were grouped together as a species, and were believed to have come down through the ages unchanged. Species, again, were composed of smaller groups called *Varieties*, which, however, were not considered immutable, as indeed their very name would indicate. Within the limits of the specific characteristics these varieties were supposed to be capable of undergoing modification. A certain amount of modification was therefore admitted, but the point tenaciously held was, that the modification could never extend so as to change one species into another, the modification could never affect specific characters. If one of two forms previously ranked as belonging to the same species exhibited marked deviation from the specific limits, it was at once ranked as a different species. If, on the other hand, two forms previously placed in different species were found to exhibit close relationship, they were immediately placed in the same species. This delightful argument in a circle made it possible to avoid all the stumbling-blocks to a belief in the immutability of species, and being used again and again, blinded even the most acute minds to the fact that they were worshipping a fetish, and not a reality. It seems now amazing that the uncertainty and difference of opinion as to what were specific differences had not more attracted the attention and excited the imagination of naturalists. It had indeed attracted the attention of one man—*Lamarck*—of whom more anon. As showing the differences of opinion regarding specific differences, it may

be pointed out that in their computation of the number of species of plants, the estimates of competent authorities differed by tens of thousands.

It is difficult in these days to realise how tenaciously this belief in the immutability of species was held before Darwin's "Origin" was published. But such men as Lyell, Hooker, and formerly Darwin himself, regarded it at one time as unquestionable.

Notwithstanding all this, fifty years previously the immutability of species had been stoutly denied and ably reasoned against by Lamarck in his "*Philosophie Zoologique*." "The term species," says Lamarck, "is applied to every collection of similar individuals produced by other individuals like themselves. To this definition is added the supposition that individuals composing a species never vary in their specific characters, and consequently a species has an absolute constancy in nature. It is this supposition I propose to combat, because evident proofs obtained by observation show that it is unfounded." He then goes on to point out "The difficulty and often embarrassment of deciding whether a given form should be ranked as a species or a variety (the very term of which indicates mutability). In fact the wider our knowledge of the different organised bodies—the more embarrassing does it become to decide what ought to be regarded as species. In proportion as we accumulate the productions of nature, in proportion as our collections are enriched, so do we see almost every gap filled up and our lines of separation effaced. In fact, the larger our collections become, the more evident is it that everything passes by insensible gradations into something else, and that striking differences vanish, leaving only minute, even puerile distinctions.

Animals form a branched series irregularly gradated which has no discontinuity in its parts. In short, the more extended our knowledge of different forms, the less striking the differences, the less obvious the species."

Both Lamarck and Darwin then came to the conclusion, opposed to the opinion of their time, that species were not immutable. Having done so, they were both faced with the same question—viz., *How have existing species arisen from other forms?*—in other words, *How have species originated? What is the origin of species?* It is in the nature of their answers to this question that the difference in value of the work of the two men in solving the problem of Evolution lies.

*Lamarck* attributed the changes necessary for the transmutation of species chiefly to two influences—viz. (1) *The Environment*, i.e. the totality of surrounding external circumstances; (2) and the effects of *Use and Disuse* of parts. The changes produced by the environment and use and disuse of parts being inherited, might become gradually intensified until a new species might be formed. These two influences are now often spoken of as the *Lamarckian factors of Evolution*, and the present fashion is to largely discount their importance, if not to altogether ignore them.

*Darwin*, while by no means ignoring the influences first insisted on by Lamarck, naturally attributed the chief power in modifying species to that which is so intimately associated with his name—viz., *Natural Selection*, and in a subsidiary degree *Sexual Selection*. These are appropriately called the *Darwinian factors of Evolution*. And it was in showing with an extraordinary wealth of facts, observations, and experiments how Natural Selection affords an easy

explanation of modification of species, that the great value and originality of Darwin's work consisted.

I have said so much in the hope that it will enable us, to some extent at least, to understand the *importance of species*, and why so much attention and discussion have been devoted to these small groups of animals and plants. It is obvious that before the question of the Origin of Species was answered, before there was some certainty regarding the mutability of species, that of the origin of the larger groups of orders, classes, &c., was not one for consideration, since the less cannot include the greater. And therefore, apart from mere speculation, no definite knowledge could be obtained regarding the true relations of the animal kingdom as a whole. Answer satisfactorily this question of species, and you open up the whole subject, and have the key to the position. Hence the immense interest excited amongst their scientific friends when Darwin and Wallace at the same time independently announced the theory of Natural Selection, and the interest aroused amongst a much wider circle when in *November 1859*, the "*Origin of Species*" was published, a work which in the short time of twenty years revolutionised opinion. In the *Origin of Species* Darwin suggested a cause which, although acting slowly, yet acting with certainty, would by very slow degrees be easily able, provided there was sufficient time, to produce changes great enough to account for specific differences. That cause he called *Natural Selection*.

I have already referred to the direct personal influence of Sir Charles Lyell on Darwin's scientific development. I may here point out that Lyell's work as a geologist was decidedly preparative, though unconsciously so, to Darwin's teaching. By showing and emphasising that geological

changes, even those which appear to us of stupendous magnitude, had been brought about gradually by slowly-acting causes, he prepared the way for similar views regarding changes in animals and plants—in other words, that the great differences between animals and plants had been produced by the accumulation of a great many small changes.

It is an interesting fact that both Darwin and Wallace were led to the idea of Natural Selection from a perusal of *Malthus'* remarkable *Essay on Population*, first published in 1798. The argument of Malthus was simple enough. The population increases in geometric ratio; the supply of food in arithmetic ratio only; hence a struggle must arise, and the chief check acting either directly or indirectly on growth of population is deficiency of food. Malthus' argument applied only to human beings; Darwin extended it to the whole animal and vegetable worlds. Here it is not difficult to see that such a struggle for existence must be perpetually going on, and very keenly. Many more animals and plants are born than can possibly be supported, hence arises a struggle amongst them for existence, in which those having any advantage over the rest will have a better opportunity of surviving. Or, to put it in another way, animals and plants tend to increase at a rapid pace, yet the number remains stationary. Consequently enormous numbers must be destroyed. Hence there must be a struggle amongst them for existence. Hence any individual with a variation better adapting it to its surroundings is more likely to survive and leave offspring which may inherit this advantage. In a phrase, there will be a *Survival of the Fittest*. If such advantageous variations are transmitted and gradually intensified, marked changes may gradually be produced. From analogy to the manner

in which, by selective breeding, marked changes are produced in domestic animals by man, Nature may be said to select those forms which, varying advantageously, thereby survive, breed and become altered. Hence the phrase *Natural Selection*, which does not suppose, as has been imagined, any conscious selection on the part of nature, but simply that existing conditions are, as it were, taken advantage of. It may not be out of place to give in his own words *Darwin's definition of Natural Selection*. It is as follows: "This preservation of favourable individual differences and variations, and the destruction of those which are injurious, I have called Natural Selection, or Survival of the "Fittest." "It may metaphorically be said that Natural Selection is daily and hourly scrutinising throughout the world the slightest variations; rejecting those that are bad, preserving and adding up all that are 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 lapse of ages, and then so imperfect is our view into long past geological ages, that we see only that the forms of life are now different from what they formerly were." "*What Natural Selection cannot do* is to modify the structure of one species without giving it any advantage, for the good of another species: and though statements to this effect may be found in works of Natural History, I cannot find one case which will bear consideration." Very little thought will show the importance of this last remark. If it could be proved that animals or plants varied not for their own advantage, but only for the benefit of some other organism, a very serious difficulty would arise in accepting



the theory of Natural Selection, as the very basis on which it rests would be undermined.

The *ultimate result of Natural Selection* will be, that by preserving and accumulating beneficial variations each creature tends to become more and more improved in relation to its conditions. This improvement leads to the gradual advancement of the organisation of the greater number of living beings throughout the world—or in other words, to the gradual process of Evolution.

From the foregoing it will be clear enough that Natural Selection depends on organic beings being variable. Selection can only act by seizing upon any variations which occur in animals and plants, and then transmitting those variations to their offspring. Whatever form therefore Selection may take, the importance of variation is equally manifest. *Variation* may indeed be said to be the starting point of the whole argument. It is the keystone of the arch of Darwinism. A fact of the very first importance, we must be absolutely assured of its existence; for, without such assurance there can be no certain belief in Darwin's theory. Convinced of the Existence of Variation and added thereto a belief in heredity, and Natural Selection follows as a necessary corollary. Hence it was that Darwin published his *Variation of Animals and Plants under Domestication*, which, though begun in 1860, after the publication of the second edition of the *Origin of Species*, was not published until 1868. It consists of two large volumes, and contains an enormous number of facts illustrating Variation. The book shows well enough the great importance Darwin himself attributed to Variation, and how much he appreciated the necessity of convincing his readers of its reality and extent.

The immense advantage of long thinking and pondering over his theory for twenty years before publishing it, is brought out by the *poverty of the criticisms* as regards their novelty, passed on the *Origin of Species* after its publication. Darwin was himself much struck with this, as is shown by a letter of his to Lyell in September 1860, in which he says—"Few things have surprised me more than the entire paucity of objections and difficulties new to me in the published reviews."

The enormous extent of *Variation in the Vegetable Kingdom* is very strikingly brought out by one fact not generally known. It is that a flower garden, as we know it, is quite a modern invention. The first, or one of the earliest gardens in Europe, was the little Botanical Garden still existing at Padua, formed in the year 1545. All the vast variety of flowers—both in form and colour—we see to-day have no doubt arisen from a very few simple forms during the last 350 years—in other words, through an extraordinary amount of Variation.

Variation, then, is a fact—a very patent fact—beyond all manner of dispute. But the *causes of Variation* are clouded in mystery and very little known. Darwin necessarily attacked this subject, but felt the difficulty as much as anyone of giving any very satisfactory answer to this most important question. It is impossible to discuss so complex a subject in a lecture like this. I must content myself by asking your attention to one point only, which is interesting as linking Darwin with Lamarck, and also in opening up a very important phase of Evolution. I refer to the influence of *Environment*. I referred just now to the importance attributed to the Environment on Animal development by Lamarck, so much, so that it is not unfre-

quently spoken of as one of the Lamarckian factors of Evolution. From his observations on Animals and Plants under domestication, Darwin formed the opinion that even very slight changes in the conditions of life (that is to say, slight alterations in the Environment) are often sufficient to cause Variation : of these excess of nutriment is perhaps the most exciting cause. He also concluded that the influence of Environment accumulates, so that variation may appear only two or three generations after exposure to them. The bearing of this last point on heredity will at once strike you, and is no doubt one worthy of far more attention than has yet been bestowed on it. In a letter to Dr. M. Wagner in 1876 Darwin makes an admission directly bearing on the point we are now considering. "In my opinion," he then wrote, "the greatest mistake I have committed has been in not allowing sufficient weight to the direct action of Environment, *i.e.*, food, climate, &c., independently of Natural Selection."

Whilst then assuming that the environment may produce variation in an organism, the extent to which that variation will survive and persist will largely depend on how far it renders that organism better adapted to its environment as a whole. If the variation makes the individual more in harmony with its surroundings, it will aid in its preservation and perpetuation ; if, on the contrary, the variation renders the individual less fitted to its environment, it will favour its destruction. It is an obvious truism that the preservation and survival of any organism depends on its being adapted to its environment. When that adaptation is perfect, the organism will remain stationary, and Natural Selection is at a standstill. But, as a matter of fact, the environment is perpetually changing ; adaptation is continually being dis-

turbed, and hence Natural Selection is constantly in action.

Now the beauty, accuracy, and completeness of the many adaptations in nature have been a theme for the wonder and admiration of naturalists and philosophers from time immemorial. To take a few familiar examples—the eye for light, the ear for sound, a Bryony or Virginia creeper for climbing, the flower and the insect which fertilises it, the colour or shape of an insect which, by simulating some other object, protects it from its enemies, the wonderful instincts of ants, bees, birds, &c. Before Darwin brought forward his theory of Natural Selection the common explanation of all such adaptations was that the adapted objects were especially designed, or created for the position they were found to fill. The innumerable difficulties such an explanation encounters are so trite that I need not detain you by enumerating them. *The explanation by Natural Selection, however, encounters no such difficulties.* It is able to account for and give an explanation of even the most difficult cases. I dwell on this point, because so much of Darwin's later work demonstrated and clearly explained this adaptation in difficult and not easily understood instances. I am thinking of his work on *Orchids*, the *Forms of Flowers*, *Cross and Self-Fertilisation in the Vegetable Kingdom*, *Climbing Plants*, and the *Power of Movement in Plants*. It is indeed, no doubt, the completeness with which Natural Selection is able to explain all the innumerable adaptations of Nature which has done so much to make it take so strong a hold on the imagination of the scientific world.

Darwin had seen from the first conception of his theory, as far back as 1838, that it would, as a necessary corollary, include man. On so important a point it is desirable to

give his own words. "Although in the *Origin of Species* the derivation of any particular species is never discussed, yet I thought it best, in order that no honourable man should accuse me of concealing my views, to add that by the work 'light would be thrown on the origin of man and his history.' It would have been useless and injurious to the success of the book to have paraded, without giving any evidence, my conviction with respect to his origin." After the *Origin of Species*, therefore, he made use of the material in his possession to write his famous book, *The Descent of Man*. One motive in doing this was because it gave him an opportunity of fully discussing *Sexual Selection*, "a subject," he says, "which has always interested me." He adds in this conjunction the interesting remark—"This subject (Sexual Selection) and that of variation of our domestic productions, together with the causes and laws of variation, inheritance, and the intercrossing of plants, are the sole subjects which I have been able to write about in full, so as to use all the materials which I have collected."

*The Descent of Man* was published in 1871, and whilst received with marked favour by the biological world, brought down on the author's head a tremendous amount of hostile and bitter abuse (it would be an abuse of language to call it criticism) from theologians and others not conversant with science, though perhaps not quite so virulent as that called forth by the publication of the *Origin of Species*. Darwin's attitude in the midst of all this hostility, unjust criticism, and often personal abuse, was an example for all time to those who may find themselves in a similar situation. It has been admirably expressed by the late G. H. Lewes in the following words:—"We must call attention

to the rare and noble calmness with which he expounds his own views, undisturbed by the heats of polemical agitation which those views have excited, and persistently refusing to retort on his antagonists by ridicule, by indignation, or by contempt. Considering the amount of vituperation and insinuation which has come from the other side, this forbearance is supremely dignified."

*Sexual Selection* is so peculiarly a Darwinian factor of Evolution, and plays so important a part in the "Descent of Man," that a word or two further regarding it is called for. It very briefly amounts to this—That as a result of the relation of the sexes amongst animals the marked peculiarities of one sex, such as striking beauty of form or colour, or greater strength,—in some cases of the male, in others of the female—may be transmitted and transmitted to that sex alone, and thus through inheritance marked changes may be produced, and aid in the transmutation of one form into another. With his usual care and industry Darwin collected and marshalled a vast number of facts and observations to support his view.

### III.

Darwin's work then leads up to that transcendent question, the *Evolution of Man and of Mankind*. There may be said to be *three problems for solution*—viz. (1) The Evolution of Man from some lower animal form; (2) The Evolution of the different races of Mankind; (3) Social Evolution. To all these the principle of Natural Selection has been applied, and Darwin did not shrink from carrying his theory out to its logical conclusion.

1. *The Origin of Man from some lower form* is of

course a necessary consequence of a general theory of Descent. It was no doubt from a quick realisation of this that so much acrimonious discussion followed the publication of the *Origin of Species*. The theory does not, as is often imagined, entail the descent of Man from an ape or monkey, as we know those animals to-day; but that man and monkeys have descended from some common form, and in the course of descent the branches have diverged, the termination of one such branch being man, of others the different tail-less, man-like apes. This common origin does indeed make the tail-less apes the nearest relatives of Man, but it does not make them his ancestors. It may be said that going so far as this there ought to be striking resemblances between them. Now, anyone acquainted with anatomy and physiology knows that indeed the resemblances are most remarkable, and that beside them the differences are comparatively slight. To take a single example. The differences between the *Brain* of a Man and of one of the highest apes, such as the Chimpanzee, are much less than those between the brain of a Chimpanzee and one of the lower Quadrumanous monkeys, such as the Lemur.

But it may be said it is not on anatomical and physiological grounds that the differences are to be sought, but in the region of mind and morals. It may be said at once that the *absence of language* alone causes a gulf which it is impossible to span. This is of course a difficulty Darwin saw he had to meet and get over. It is a question in dealing with which care and circumspection are desirable. *Language*, what is it? You reply the communication of thought, feeling, ideas to others by means of articulate sounds. How far can we be sure that animals are not possessed of language in this sense? Very little observation

is required to convince anyone that many animals can and do convey to their fellows their feelings and desires. And he indeed will be bold who is prepared to deny that the varied sounds emitted by animals play no part in this conveyance. Is there a greater gap between the language of such animals and the few harsh sounds employed by the lowest savages, than between the language of those lowest human beings and the elaborate speech of an educated European? The sounds emitted by animals are many, in some extending over a considerable range. Highly civilised man emits sounds of very varied range differing in intensity, pitch and quality, but above all in the extraordinary extent and variety of the combination to form speech. But the question which naturally arises is, *Where does sound end and speech begin?* Who is ready dogmatically to draw the line? Any such should be careful lest he find himself hereafter very much in the position of those who in days gone by were so ready to dogmatically draw the line between different species. In face of our extraordinary ignorance on the subject regarding the lower animals, and the small amount of time and labour which has been expended in investigating the subject, we should at least be circumspect and not too ready to dogmatise. That organs anatomically similar, such as the vocal organs of man and apes, should be functionally fundamentally different is assuredly a physiological paradox. The action of that vocal apparatus is dependent on the organ of breathing, and the manipulation of respiration is no doubt partly dependent on the position of the body. The development of speech may possibly therefore be to some extent a correlative of the erect posture so characteristic of man.

But if, now approaching the subject from another point of view, it be said that the development of language is the



outcome of a general mental development, is in fact only a phase of the much larger question of the mental differences between animals and man, then, on the evolution of the mental superiority of man being satisfactorily explained, the difficulty of language will at the same time be disposed of. This, in one sense, may be said to be a question which does not concern the mental altitude of civilised human beings. It is a question of explaining the mental differences between the highest animals and the lowest and least civilised man.

That many animals are not destitute of intelligence is a truism, and Darwin has collected in his *Descent of Man* a large number of interesting and well authenticated facts showing that the same emotions and mental characteristics, such as *Curiosity*, *Imitation*, *Attention*, *Memory*, *Imagination*, and even *Reason*, and a *Sense of Beauty*, are observed, in some animals as in man. The love of a *dog* for his master is proverbial. *Maternal affection* is observable on all hands, and is strikingly developed in monkeys. Dogs again manifest *Jealousy*, *Emulation*, and even *Magnanimity*. Perhaps *Wonder*, certainly *Curiosity* and *Fear* are shown by monkeys. Monkeys and dogs have shown *Imitation*, and with the former the power of *Attention* has been found to be essential if a monkey is to be trained successfully as a performer. *Baboons*, *dogs*, and even *ants* show that they possess *Memory*. You must predicate *Imagination* to account for the dreaming of *dogs*, *horses* and *cats*. Darwin has recounted some extraordinary cases of retriever dogs which are explicable only on the assumption that the animals were possessed of *Reason*. If the *Australian savage*, who can count only up to four, is endowed with *Self-consciousness*, shall we deny the same character to the chimpanzee who could count up

to ten? Assuredly we can interpret all these facts in no other way than by concluding that in all these so-called higher mental attributes, the differences between Man and Animals is one of degree and not one of kind.

Now, the mental aspect of the subject was by no means overlooked, undervalued, or undealt with by Darwin. On the contrary, his contribution to the psychological side of Evolution was undoubtedly of great value. In him we see a mind of great natural power, stocked with information to an unprecedented degree, approaching a subject unfortunately only too often overclouded and obscured by the verbosity and metaphysical pedantry of the professed psychologist. Darwin's explanation essentially consists in the application of his principle of Natural Selection. His masterly discussion of *Instinct* in the *Origin of Species*, and the light he was able to throw on even the most difficult and obscure cases by the aid of Natural Selection, formed a fitting commencement. In the *Descent of Man* he deals with the mental characteristics of Man and Animals, and, pursuing the subject with singular vigour and breadth, applies thereto his fertile and ever fruitful theory. Mental variation favourable to its possessor may be inherited by its offspring. The continual survival of the fittest from a mental point of view must in time cause a gradual development of the mental faculties. In fact, assume Darwin's premises, and the problem is solved. The *Origin of Language*, he maintained, may be thus explained, as indeed all higher faculties—reason, the sense of beauty and even conscience. "I cannot doubt," says Darwin, "that language owes its origin to the imitation and modification of various natural sounds, the voices of the animals and man's own instinctive cries, aided by signs and

gestures." Again he says, "There is no more improbability in the continued use of the mental and vocal organs leading to inherited changes in their structure and functions than in the case of hand-writing, which depends partly on the form of the hand, and partly on the disposition of the mind, and hand-writing is certainly inherited."

Darwin meets those who may feel somewhat shocked at this idea of the animal origin of man with the following eloquent passage:—"The astonishment which I felt on first seeing a party of Fuegians on a wild and broken shore will never be forgotten by me, for the reflection at once rushed into my mind—such were our ancestors. These men were absolutely naked and bedaubed with paint, their long hair was entangled, their mouths frothed with excitement, and their expression was wild, startled, and distrustful. They possessed hardly any arts, and, like wild animals, lived on what they could catch. They had no government, and were merciless to every one not of their own small tribe. He who has seen a savage in his native land will not feel much shame if forced to acknowledge that the blood of some more humble creature flows in his veins. For my own part, I would as soon be descended from the heroic little monkey who braved his dreaded enemy in order to save the life of his keeper, or from that old baboon who, descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs—as from a savage who delights to torture his enemies, offers up bloody sacrifices, practises infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstition. Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic

scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope of a still higher destiny in the distant future."

2. The same principle has been called upon to explain the *Evolution of the Races of Mankind*. Their origin from a common stock is now generally admitted, since the difficulty regarding a sufficiency of time has been removed by the discovery of striking proofs of the great antiquity of man. Darwin, however, considered Natural Selection alone inadequate to explain clearly the origin of the different races; and the full elaboration and exposition of his theory of *Sexual Selection* in the second part of the *Descent of Man* was for the purpose of supplying the necessary explanation. Even here his usual candour does not desert him, for in concluding the discussion he says, "I conclude that, of all the causes which have led to the differences in external appearance between the races of men, sexual selection has been the most efficient."

3. *The Evolution of Civilised Races in the Scale of Humanity* is the last rung in the ladder of development. *Social Evolution*, which has been so fully dealt with by Mr Herbert Spencer, was but lightly touched on by Darwin. But just as the *Descent of Man* was a necessary corollary of the *Origin of Species*, so evidently was Darwin convinced that the gradual upward development and improvement of mankind was a corollary of the animal origin of man.

Just as the development of the individual organism is characterised by an increasing differentiation, and a corresponding greater division of labour, so with the social organism. And, generally, just as the extent of this differentiation and division of labour determines its height and

rank in the scale of life, so with the social organism,—the more complex it is, the greater the division of labour within it, the higher does it rank in the scale of civilisation.

In a word, the Social Organism may be compared to the Animal Organism, and must, like it, adapt itself to its Environment. All changes or variations which make this adaptation more harmonious will lead to an advance in the Social Organism, and to some extent the principle of Natural Selection and Survival of the Fittest must apply, as has been ably and interestingly worked out by the late Mr Bagehot in "Nation-making."

Social Evolution, then, like the evolution of the individual necessarily involves adaptation to the environment. So long as that adaptation is imperfect, Natural Selection and Survival of the Fittest will come into play, and must ultimately lead to an advance, an upward development. This is on the assumption, of course, that the environment undergoes no such radical cosmic change as to be directly inimical to the very existence of the species, *e.g.*, through a glacial epoch. To thoroughly appreciate this, the all-embracing character of the environment must be realised: it does not consist merely of what have been called cosmic forces, and on which so much stress was laid a short time ago at Oxford by *Mr Huxley*: it includes all humanity, with all its many complex characteristics, including ethical ideas amongst them. I speak with all diffidence in the face of so great a master, but to see any real contradiction to the Darwinian doctrine in the presence amongst mankind of *ethical theories* so largely represented by the words *sympathy*, *self-sacrifice*, and *duty*, can assuredly only arise from taking a limited view of the problem. Even assuming that ethics preserves individuals in a community, who, if left to

their own powers unaided, would quickly be destroyed in the struggle for existence; yet such views, by binding the community together, enables it in the struggle for existence to triumph over communities in which the ethical ideal is not so highly developed. And so the growth of Ethics aids the higher development of the race as a whole. There is, if I may say so, a want of appreciation of the fact that the struggle is transferred from the individual to the community. In other words, the struggle and consequent selection is now between aggregates of individuals instead of between the individuals themselves.

Social Evolution, then, like the evolution of the individual, is a process of adaptation to the environment. The more harmonious this correspondence the more advanced the evolution, in the sense I have already explained, of greater differentiation and greater division of labour. The ideal may be said to be reached when the adjustment between the social organism and its environment is perfect. Then the ease and facility and comfort—the happiness of mankind will be complete. This does not necessitate, as is sometimes urged, a state of stagnation. This perfect adaptation I would call a dynamical one. The environment, as always before, still undergoes perpetual change, but the adjustment is now so perfect that the social organism immediately responds, and, moreover, exactly responds to every surrounding change which acts upon it. I lay stress on this point all the more, because it enables me to enforce what seems to be often forgotten—viz., the absolute interdependence of organism and environment. We are accustomed in thought to completely dissociate them, but as a matter of fact they are inseparable. One cannot really exist without the other. And it is in a thorough

realisation of this—of the interdependence and the perpetual action and interaction of them one upon another—that we must look for a solution of the difficulties which apparently beset the complex question of Social Evolution.

If such an optimistic view, then, is tenable, it assuredly opens up a vista which should have an inspiring and hopeful effect on mankind. However disappointing or retarded social progress may at times appear to be, yet we may always rest assured that the main result is an upward development. And if we realise that man in the use of those capacities, which are said *metaphorically* to render him independent, and within the restricted views of a life, or even of several generations, *apparently* enable him to some extent to control his own destiny, he may have the satisfaction of feeling that he is taking an active part in aiding the human race to advance towards that perfection which is the ultimate goal of Evolution.

Dawn not Day!

Is it shame, so few should have climbed from the  
dens in the level below;

Men with a heart and a soul, no slaves of a  
fourfooted will?

But if twenty million of summers are stored in  
the sunlight still,

We are far from the noon of man, there is time  
for the race to grow.



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