
Tucholsky
Wagner
Zola
Scott
Sydow
Schlegel
Turgenev
Wallace
Fonatne
Freud
Twain
Walther von der Vogelweide
Fouqué
Friedrich II. von Preußen
Weber
Freiligrath
Frey
Fechner
Fichte
Weiße Rose
von Fallersleben
Kant
Ernst
Frommel
Richthofen
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Engels
Fielding
Eichendorff
Tacitus
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Fehrs
Faber
Flaubert
Eliasberg
Ebner Eschenbach
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Dostojewski
Ganghofer
Lichtenberg
Rathenau
Trackl
Stevenson
Doyle
Gjellerup
Hambruch
Tolstoi
Mommsen
Lenz
Droste-Hülshoff
Thoma
Hanrieder
Dach
Verne
von Arnim
Hägele
Hauff
Humboldt
Reuter
Karrillon
Rousseau
Hagen
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Gautier
Garschin
Damaschke
Defoe
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Roth
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Horaz
Musil
Machiavelli
Kierkegaard
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Kraus
Navarra
Aurel
Musset
Lamprecht
Kind
Kirchhoff
Hugo
Moltke
Nestroy
Marie de France
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Ipsen
Liebknecht
Nietzsche
Nansen
Ringelnatz
Marx
Lassalle
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Klett
Leibniz
von Ossietzky
May
vom Stein
Lawrence
Irving
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Knigge
Platon
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The Meaning of Evolution

Samuel Christian Schmucker

Imprint

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A FOREWORD

Before my window lies an enchanting landscape. It embraces a stretch of open rolling country, beautiful as the eye could wish to rest upon. The sun with its slanting rays is not giving it heat enough in these winter months to make it blossom in its radiant beauty, but the mind goes easily back through the few brown months to the time when the field not far away was waving with its rich yellow grain so soon to be food for those who planted it. Beyond this field lies an orchard where, in regular and orderly rows, stand the apple trees whose bright blossoms in the spring make the landscape so beautiful and whose fruit in the fall serves so richly for our enjoyment. A little farther on, a pasture is filled with sleek-coated cows, feeding quietly and patiently until the evening when they will return to their stalls to yield their rich milk. Still farther on lies a tract of forest. The varied shades of the beeches, the tulip poplars and the chestnuts make an exquisite contrast and give to the landscape its attractive background framed in by a distant hill. Behind this hill flows a mighty river carrying on its breast the ships by which we share [Pg 2] the over-abundance of our own blessings with our brothers on the other side of the sea, from whom in turn we receive of their overplus. Beyond this teeming river lies a level stretch of fertile land and then the mighty ocean. On one side of the scene runs a busy highway. Along this men pass and repass, some on foot, others drawn by their patient and submissive horses. Still others are carried by the new-found power of the sunshine imprisoned beneath the rocks in the oil that has been forming ever since the sun shone down upon the great forests of the far distant past.

In a pathway to one side, some children are playing. One of them has laid upon the ground a rectangle of stones divided into four and her little mind sees before her the house which is teaching her to get ready for the work that shall come to her in later life. Meanwhile her short-haired companion is prancing around astride a stick; he too, little as he suspects it, is getting ready for life.

It needs little reflection to realize that the scene has not always been what it is. The underlying ground has surely been there longest, its age vying only with that of the bounding ocean that beats

upon the shore and works the sand into fantastic stretches. The forest has been there long and so has the stream; the road perhaps ranks next in age; then come the [Pg 3] orchard trees, and most recent of all the waving grain. People come and go but form no stable part of this landscape. We know how the grain came to be there, and we understand the orderly arrangement of the orchard trees; the road too we can explain. How came the stream there, and how the forest trees? Have they always been there, or did they too have a beginning? Was there a time when there was no ocean? When was this time? How came they there?

When the lisping lips of my young child asked me, "Papa, who made me?" I told him "God," and he knew enough and was content with his knowledge. After a while he grew older and his inquisitive spirit began to puzzle with the question of how God had made him. When his growing mind was ready for the new knowledge I took him to my side and told him the great mystery of life. I told him how he owed to his father and to his mother the beginnings of his life, how God gave him to us. Now a new era opened in his childish mind. As he grows on to greater maturity he cannot help wondering how the first man was made, how the trees, and the world came to be. He is no longer satisfied with the simple statement that God made them. His eager mind wants to know, if may be, how God made them.

So, in the distant past, in the childhood of our race, the question was asked, "Who made us?" and the an [Pg 4] swer was "God." Men formed their simple conception at that time of how He did it. As the centuries rolled by and the children of men have learned from creation the story of its origin a riper and richer knowledge has given them a broader and finer conception. No less does the reverent student believe that God created the earth, but he no longer thinks of God as working, as man works. He no longer feels that it is impious to attempt to read God's plan in His work; to see how this work has arisen, to see, if may be, what there is ahead.

This is one of the tasks to which science is now giving itself. The answer is uncertain and halting. A few things seem clear; others seem to be nearly certain; of still others we can only say that for the present we must be content with the knowledge we have. But if we

take the best we have and work over it thoughtfully and carefully, the better will slowly come, and in time we shall know far more than we now suspect. Meanwhile, it is the attempt of this book to give to people whose training is other than scientific some conception of this great story of creation. Without dogmatic certainty but without indecision it tries to tell what modern science thinks as to the great problems of life. It tries to describe the possible origin of animals and plants, their slow advance, the length of their steady uplift, the forces that [Pg 5] brought it about. It tries to tell a little of the men who have helped to develop the great idea of evolution, of the great men who persuaded the scientific world of its truth, and of the later minds that are modifying and enlarging the idea of the master evolutionist. It tries to tell what science perhaps vaguely hopes as to the future. What are we to be? Can we help the great advance?

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The Meaning of Evolution

CHAPTER I

Evolution Before Darwin

Ever since men have been able to think they must have puzzled out for themselves some way of accounting for their own beginnings. Every savage tribe with whom we have any intimate acquaintance has some story that accounts for the origin of the tribe at least, and often for the beginning of the world. These stories are handed down from generation to generation and are scarcely questioned in the thought of most men. In early Greece there was a succession of men whom the world calls philosophers. These men thought earnestly and deeply on all kinds of questions. Their method was not our method. The plan of making a long series of observations, before coming to any conclusion, was not the habit of their minds. They reasoned out on general principles what seemed to them must have been the origin of the world. It is not strange that among these should come, now and then, some one who in some [Pg 8] passage or other should show that there had come to his mind at least a glimmer of the thought that was later to develop into the great idea which the modern world calls evolution.

Among the earliest of these was Anaximander, who lived 600 years before Christ. He thought that the earth was at first a fluid. Gradually this fluid began to dry and grow thicker, and here and there, where it thickened most, dry land appeared. When this dry land had become firm enough to serve as his home, man came up from the water in the form of a fish. Slowly and gradually the fish, struggling about on the land, gained for himself the limbs and members he needed for his new situation and developed into a man. After him other animals came up in much the same fashion, then the plants, until the whole world was clothed with its present inhabitants.

One hundred and fifty years later Empedocles announced a new thought. He said that in the beginnings there were all sorts of strange, incomplete, and misjointed monsters which swarmed upon the earth, having sprung up out of the earth itself. Each was a chaos

of the limbs which afterward were to belong to other animals which needed them more. Slowly and gradually an interchanging came about by which appropriate limbs fastened themselves to the proper animals. The last of these misjointed creatures is the [Pg 9] one known as the centaur, half-man—half-horse. After a while, when all the members had found their proper places, the animals were complete. In one respect this opinion foreshadowed our later idea. It suggested that the more perfect animals had arisen out of the less perfect and that the change came gradually.

Then came Anaxagoras, who was the first to believe that there was intelligent design back of the creation of animals and of plants. He thought there had originally been a slime in which were the germs of all the later plants, animals, and minerals, mixed in a chaos. Slowly order arose. Out of the mixture settled first the minerals forming the earth, with the air floating above it, and above the air was the ether. Out of the air the germs of plants settled upon the earth, and vegetation covered the mineral floor. Then from the ether came the germs of animals and of men. These settled among the plants and sprang up into the animals of the world, as well as the people.

The greatest scientific thinker of early Greece was Aristotle. He had lived by the seashore and knew better than any other man of his times the exquisite seaweeds and the still more beautiful marine animals. He was the first to think of them as a linked series, the higher developing out of the lower under the [Pg 10] pressure of what he called a perfecting principle. Out of the inanimate rocks had sprung the marine plants—the seaweeds. From these had developed first "plant animals" like the sea anemones and the sponges. These grew attached to the rocks, as plants do. With higher development came locomotion, with ever-increasing energy. At last man arose, the crown of all creation. Presiding over all this advance is the "efficient cause," God. Aristotle rejected entirely the earlier ideas that any of this work came about by chance. He was certain of the existence of plan and purpose in the development.

Just a little before the time of Christ the Latin poet, Lucretius, wrote a poem on "The Nature of Things." Here he describes how in the early years the beginnings of things in small, disjointed fashion

moved about among each other at first in utter confusion, each trying itself with the other. After many trials the proper members came together. When they had been thus placed the warmth of the sun shining down upon the earth helped the earth to reproduce the same sort of creatures. So living things came up and flourished. The poem expresses many beautiful ideas, but the underlying conceptions lack the unity and grandeur that marked Aristotle's work, which later was the potent influence in shaping men's minds. It died out after a while, only to awake in the Re [Pg 11] naissance with marvelous vitality, starting the world to think afresh great thoughts that would not die, but would grow from that time on with ever-widening scope.

Among the Jews and early Christians the stately and beautiful account in Genesis sufficed for all the needs of minds fully occupied with other questions. With the growth of philosophy among Christian minds again came the need of a satisfactory solution. St. Augustine was probably the greatest of the so-called "Fathers" of the church. His mind was eminently philosophical, and he was learned in the writings of the older Greeks. He believed the language of Genesis to mean that in the beginning God planted in chaos the seed that afterward sprang up into the heavens and the earth. He further says that the six days of creation were not days of time, but a series of causes, and that, in the order described as these six days, God planted in chaos the various beginnings of things. These in the fullness of time sprang up into the world as we know it now. The problem was not a question about which the church cared to trouble itself, and with the oncoming of the Dark Ages the whole matter dropped nearly out of the thoughts of men.

When the times began to lighten we find the schoolmen, among the greatest of whom was Thomas [Pg 12] Aquinas. Referring especially to the authority of his master, St. Augustine, he says that it would be easy mistakenly to believe that the author of Genesis meant to convey the idea that on each of the six days certain acts of creation were performed. It is quite evident, thinks Aquinas, that in those early times God only created the germs of things and put into the earth powers which should later become active. After the Creator had thus endowed the earth he rested from the work, which proceeded to develop under the influence of these first germs.

Nearly four hundred years later, when Europe had finally awakened out of the deep and refreshing sleep in which it had fortunately forgotten much of the past, a new era dawned and modern thought began. Immediately men commenced to busy their minds with broader problems than they had been discussing since the time of the Greek philosophers. The hand of tradition, however, was heavy on them still. They dreaded to run counter to authority, and did not dare think unrestrainedly. Descartes shows us how we can understand things better if we will imagine a few principles by which it will be easy to account for things as they are. Then he carefully elaborates these principles as they occur to him; but he has no sooner done so than he takes care to add, "Of course, we know the earth was not made in this way."

[Pg 13] A little later the philosopher, Leibnitz, believed in an orderly creation that had advanced by regular degrees, and that the lower animals had thus developed into the higher. He adds interestingly that there are probably on some other planets animals midway between the ape and man, but that nature has kindly removed such animals from the earth in order that man's superiority to the apes should be entirely beyond question.

By the middle of the eighteenth century men had begun to think more fearlessly. The great Emanuel Kant wrote in his younger and less timid years, "The General History of Nature and Theory of the Heavens." The great Newton had by his law of gravitation brought order into the heavens. Kant looked longingly for a greater Newton, who should find a similar unity in the animal world. He saw the wonderful likenesses between animals that the anatomist, Buffon, had recently pointed out. He believed there must somehow be blood relationship between all animals. He tried hard to conceive of some underlying natural cause by which all could have come about. As he grew older and his mind became more cautious he came to think the matter deeper than the human mind could ever fathom. He gave up the hope and believed the problem of animal origin and derivation would forever remain insoluble. He feared [Pg 14] there was not in man the power to conceive his own origin.

If we ever wonder why it took so long before the thought of evolution should have fully dawned upon the world, the answer is not

far to seek. No student of Natural History in ancient or medieval times had the faintest conception of the enormous number of animals and of plants in the world. The old Greek or Roman student of Natural History gives no evidence of knowing more than a few hundred animals. Men have named to-day, with systematic Latin names, hundreds of animals for every one that Pliny ever knew, and he knew more than any other man of early times of whom record has come to us.

In early days men who traveled into foreign countries brought back accounts of what they saw. The whole Natural History of ancient times was filled with the most absurd and ludicrous stories of all sorts of things to be seen in distant lands. Sir John Mandeville tells tales almost as imaginative and quite as amusing as those attributed to Baron Munchausen.

Upon the great awakening of the fifteenth century, with its new study and its wide-ranging travel, an entire change came over the human mind. Men who journeyed into far countries brought back with them not only accounts of what they saw, but, so far as might be, the things themselves. Collections of plants [Pg 15] and of such parts of animals as could be readily preserved soon began to accumulate in every great center of Europe. It was only a question of time when such acquisitions must be arranged and classified, but as yet there was no system by which this could be done. The great Swedish botanist, Linnæus, who lived in the eighteenth century, first taught us to give to each animal and plant two Latin names, the first of these to be the name of the group, known as a genus, to which it belongs, the second to be the name of that sort, or species, of animal. The cat, for instance, is *Felis catus*, the lion *Felis leo*, the tiger *Felis tigris*, and so on. Linnæus then arranged the genera (plural of genus) into families, and these families into orders and so classified the animal and plant world as far as he knew it. In his earlier years Linnæus thought of each species as being utterly apart and distant from any other. He believed it had been so from the first, each species having sprung in its complete form from the creative hand of God. In later life he came to show some evidence of the belief in development, but his great work is all built on the idea of the entire fixity of species.

About this time we find in the writings of Buffon, the French naturalist, many indications of an idea approaching our modern conceptions of evolution. He felt sure the pig could not have been a special crea [Pg 16] tion, because he had four toes, two of which, with all their bones and their hoofs, are quite useless to him. We now call these toes "vestigial," and know the pig's ancestors used them, walking on four toes and not on two, as at present. Buffon believed there were degenerations as well as developments, and considered the ape a degenerate man. He conceived these changes to be brought about by what he called the favors and disfavors of nature. He varied much in his opinions in various parts of his career and occasionally is smitten either with conscience or with fear of authority. Then he goes back and says it is all a mistake and each animal is the product of a special act on the part of the Creator.

A little later, in England, Erasmus Darwin, the grandfather of Charles Darwin, who was subsequently to establish the evolution theory, wrote a long and elaborate poem called the "Temple of Nature." In this we find a remarkable prevision of many of the principles which were afterward to be warmly advocated and disputed during the growth of the idea of evolution.

> "Hence without parents by spontaneous growth,
> Rise the first specks of animated life.
>
> * * * * * * *
>
> Thus as successive generations bloom
> New powers acquire and larger limbs assume."

[Pg 17] Erasmus Darwin recognized the struggle for existence, but he saw in it only a check against overcrowding, and not an active factor in the development as his grandson Charles came to see it. It is possible the elder Darwin's views might have been taken more seriously had he not clothed them with the form of verse. In these days it seems quite ludicrous to think of giving to the world a new scientific concept or a new phase of philosophy in verse.

The beginning of the nineteenth century gives us the first really great contribution to the idea of evolution. Under more favorable surroundings, this idea would have budded and become the parent stock of our modern theories. The chill frosts of adverse criticism by those in authority in science nipped the budding idea and so set it back that only of late years have men come to realize its strength and power. The Chevalier de Lamarck, serving in Monaco, was attracted by its rich flora to the study of botany. Coming later to Paris, he became acquainted with Buffon and was led by him to publish a Flora of France, using the Linnæan system of classification. He was appointed to the chair of zoölogy in the Jardin des Plantes, and was given especial charge of the invertebrate animals, comprising all the members of the animal kingdom except those with backbones. After seventeen years of work over these forms, dur [Pg 18] ing which he wrote several books describing them, he finally published the great work on which his fame depends. This was the "Philosophie Zoölogique." In this treatise he taught that the animal kingdom is a unit and that all its members are blood relations; that the members vary with varying conditions; that this variation results in continued advance. In all of these points Lamarck is at one with modern thought. His idea of the method by which the variation comes about has been accepted and rejected; modified, reaccepted, and again rejected.

Lamarck's conception of the cause of progress was somewhat as follows: The desire for any action on the part of an animal leads to efforts to accomplish that desire. From these efforts came gradually the organ and its accompanying powers. With every exercise of these powers the organ and its corresponding function became better developed. Every gain either in function or in organ was transmitted to those of the next generation, who were thus enabled to start where their parents left off. The general environment constantly gave the stimuli that led to the adaptive changes.

American zoölogists have been especially inclined toward Lamarck's ideas. Until Weissmann startled the scientific world with his sharp denial of the possibility of transmitting to offspring any growth ac [Pg 19] quired by the parents, all seemed well. There is a tendency now to insist once more that slowly and gradually, in some perhaps as yet unexplained way, external factors do influence

even egg cells, and gradually acquired characters do reappear in the offspring.

The blighting setback these views suffered came from the criticisms of Baron Cuvier. This genuinely remarkable man had built up the study of comparative anatomy. To him students flocked from all sides. Among these one of the most brilliant was Agassiz, the Swiss naturalist, who later came to this country, filled with Cuvier's ideas. This great teacher believed that species are fixed. He knew better than any man of his times the wonderful similarity in structure between animals of a given class. He attributed this not to any real blood relationship between the animals. They were alike because they had been made by the same Creator. This great Artificer worked along four main lines, and hence animals could be divided into four groups. Many who have studied text books on zoölogy written in this country by Agassiz and his followers will remember the four classes—Radiates, Articulates, Mollusks, and Vertebrates. Agassiz was such a wonderful teacher and so genial and so lovable a man that his opposition to evolution held back the advance of the Darwinian idea in America as Cuvier's influence [Pg 20] had held back the Lamarckian idea in Europe. For the brilliant Cuvier simply laughed before his students at each "new folly" of Buffon and of Lamarck. Under this ridicule the influence of both men withered and died.

A little later the great poet, Goethe, turned his attention to the problem of evolution, giving an interesting account of the metamorphoses of plants. He declared, also, that the human skull is a continuation of the backbones of the neck, and that these bones have been transformed into the present skull. But his great genius as a poet drew his attention into other fields. Haeckel points out that if Goethe had known Lamarck's work his genius would have gained for the "Philosophie Zoölogique" the interest and respect of the reading world. But Cuvier laughed it out of court, and only in comparatively modern times, since Darwin's work has set the world thinking anew, is Lamarck's career recognized at its true value. Lamarck should have been the founder of the evolution theory. But the time was not quite ripe, and it remained for Charles Darwin to announce his idea, sustained and fortified by years of careful observation and thoughtful reflection.

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CHAPTER II

Darwin and Wallace

We have seen in the last chapter that whenever men have actively thought they have attempted to explain the origin of plants and animals as well as of themselves. No one who wrote previous to the time of Charles Darwin had expressed any idea concerning this matter with force enough to convince any large portion of the thinking world. If Lamarck had fallen on better times, if the great Cuvier had not laughed him to scorn, if Goethe had found him out and made him known to the world, evolution might have come into its own sooner. None of these conditions arose, and it remained for Charles Darwin to give to the world in clear and cogent form the thought of evolution. He gathered so much material before he expressed his opinions, and looked at the matter from so many sides that, when he published his results, he had foreseen most of the objections which were subsequently to arise in opposition to his announcement. Charles Darwin is recognized to-day as the father of the evolutionary movement.

[Pg 22] It has been sometimes said in recent years that Darwinism is dead, and there is a sense in which this is true. Unmodified and unassisted natural selection is not to-day considered by most scientists a sufficient agent for producing evolution. But everyone connected with the subject acknowledges Darwin as the master, and says that it was his work which converted the world to a belief in evolution. We can have no better preparation for an intelligent understanding of this subject than to consider carefully the life of this remarkable man and the circumstances under which he came to his epoch-making conclusions.

Evolution has taught us to attempt as far as may be to account for man on the basis of his heredity or of his environment. It is interesting to note that both of these factors in Darwin's case were entirely favorable. In the latter part of the eighteenth century Erasmus Darwin had given to the world an astonishing poem in which he anticipated not a little of the thought which his more famous grandson was to make so widely known. Josiah Wedgwood had learned to

make for England her most famous pottery, no quality of which was more widely recognized than the sterling patience with which it was made. Erasmus Darwin, with his scientific proclivities, and Josiah Wedgwood, with his sturdy common sense and patient workmanship, united to give Charles Darwin his [Pg 23] inherited tastes, for he was a grandson of both. Born in 1809, on the banks of the Severn in England, Charles Darwin was the delicate son of a practicing physician of modest but sufficient means. Owing to his lack of early vigor, Darwin spent much time in the open air, and in his excursions about his home was chiefly interested in collecting beetles. This taste, which lasted through all his young manhood, is the one early indication of the traits that were later to develop. At first in the day-school and later in the preparatory school Charles Darwin was anything but a satisfactory student. Even a kindly desire later to make the most of him makes it impossible to find traces of any especial fondness for earnest study. He himself believed his education to have been nearly useless, although he doubtless underestimated its value. At the age of sixteen he went to Edinburgh at his father's desire, to study medicine. The sight of the dissecting-room nauseated him completely, and he refused to continue working in it. Later an operation which he witnessed in a clinic at the hospital sickened him so thoroughly that he declined to attend further operations. It became evident that the young man was not adapted to the life of a physician. The next move was to educate him for the church, and for this purpose, at the age of nineteen, he went to Cambridge. Here it soon appeared that he was no [Pg 24] better adapted to the ministry than he was to the practice of medicine, and his university career went on in very desultory fashion. Most of his work was distinctly neglected, but two of the men he met there were to influence largely his future life. Henslow, the botanist, was unusually fond, for a professor in those days, of work in the field. Charles Darwin's tastes coincided with those of Henslow, with whom he formed an intimate friendship. He was always welcomed as a companion on the field trips. Though he studied little of botany in the classroom or laboratory, he was constantly with Henslow or with Sedgwick in the field. Sedgwick was the professor of geology, and of him Darwin was particularly fond, and under him did much the largest amount of his study. When he came up for graduation he ranked tenth of those who "did not go in for