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# Evolution, The Story of Life

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# Evolution
# The Story of Life

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Submitted in partial fullfillment of
requirements leading to the degree of
Master of Science in Education.

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# TABLE OF CONTENTS

# DIAGRAMS

PAGE

DIAGRAM #1:

# INTRODUCTION

The prime objective of this paper is to present some of the theories concerning human development beginning with some of the earliest theories and progressing to some of a more recent nature.

A general definition of the word evolution means change. There is no doubt that there are many changes occurring about us every day. The evolution with which this paper is concerned is a special kind of change called organic evolution. This subdivision of evolution deals with changes undergone by living things.

## BACKGROUND

Many people believe that the whole idea of evolution started with a man named Charles Darwin. This idea was brought about because of his famous, and highly controversial book, written in 1859. This book was called "The Origin of Species by Means of Natural Selection" and was the first widely read book on evolution to be published in English. Darwin's book fostered an extremely high interest in the subject of evolution which prior to this time, was rarely discussed and of little concern.

Although Darwin was the first to write about these ideas, he was not the first to theorize upon the subject. The idea of evolution is probably as old as human thought itself. It can be traced as far back as the earliest recorded thoughts of man although it was sometimes highly speculative and clouded by superstitions.

## EARLY IDEAS OF EVOLUTION

The earliest interest in human development came from the ancient Babylonians about the year 4000 B. C.[1] Some of these ancient peoples were known to have charted five generations of horses showing the transmission of similar characteristics

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1. Winchester, A. M., Genetics, p. 20.

which the horses possessed. Other findings of the same period show artificial cross-pollination in date palms, indicating that as far back as 6000 years ago people understood the principles of human and plant development. The Chinese peoples of ancient Asia also did work in evolutionary development using rice. They developed different varieties of seed until a superior variety wasobtained. This in turn led to the development of better crops.

The ancient Greek philosophers of the Ionian school of 6000 B. C. were the first people to actually theorize on the development of man. This was probably an outgrowth of their many theories on the origin of life itself. Although there are many early theories of human development given by the ancient Greeks the following are the most widely known:

1. Thales - claimed that living organisms originated in sea slime and were generated through the action of heat, sunlight, and air. This, although one of the earliest theories, is the basis for Oparin's modern theory of Chemical Evolution. (This will be discussed in detail on another page.)

2. Anaximander - (611 - 547 B. C.) thought that everything arose out of sea ooze then proceded through a series of successive changes. Anaximander claimed that men were first formed as fish, eventually cast off their skins and took up life on dry land. This has proven to be one of the better guesses, and one that can now be supported by modern evidence.

3. Pythagoras - (500 B. C.) proposed the theory that man and animals originated from other similar men and animals. He proposed that a moist vapor descended from the brain, nerves, and other body parts of the male during coitus and that from this, similar parts of the embryo were formed in the uterus of the female.

4. Xenophanes - (560 - 480 B. C.) was credited with having discovered that fossils, such as petrified bones embedded in rocks represent the remains of animals that once lived. He also taught that all organisms originate from earth and water. He theorized that the presence of marine fossils on dry land indicate that ocean once covered the area.

5. Anaxagorus - (510 - 428 B. C.) theorized that all men, plants, and animals came from the earth's slime and were formed when tiny embryos were carried to earth by the falling rain. No idea is given though, as to where these embryos may have originated.

6. Empedocles - (490 - 444 B. C.) claimed that plants and animals were formed from live inorganic substances either by a process of generation from similar sources, or by self-organization and growth from dis-similar sources. Empedocles thought that animals arose as unattached organs and parts, which joined together in haphazard fashion. He stated that most of these conglomerates were freaks or monsters incapable of living,

but that occasionally there appeared several combinations of organs capable of life, survival, and reproduction. These successful combinations eventually populated the earth.

6. Epicurius - (341 - 270 B. C.) taught that under the moist influence of the rain and the sun's heat, worms and other animals, through a process of spontaneous generation, arose from the earth's manure.

7. Aristotle - (384 - 322 B. C.) claimed that animals originate both from other similar animals and from lifeless materials as well. Aristotle is sometimes called the father of the family trees because he classified the organic world in three states:

1. Plants
2. Plant-Animals
3. Animals

He constructed a genetic series leading from lower forms of animals up to man at the apex.

## LATER THEORIES OF EVOLUTION

After the great Greek civilization there came a period in which much of the known world fell under the direct influence of the ever-expanding Christian Church. Some of the early Christian Church leaders to theorize upon the subject of evolution were:

1. Basilius - (315 - 379 A. D.) who stated that the earth

produced both plants and animals as indicated in the Old Testament.

2. St. Augustine - (354 - 430 A. D.) who stated that the will of God could produce living things from seeds or inorganic materials as well. This theory, although not appearing as one which might have much significance, proved to be one of the most profound theories formed since that time. This theory, while stating that evolution was possible, suggested the possibility of a devine creator directing the design of all living organisms. It made the idea of evolution acceptable in the eyes of the Christian Church. Also substantiated by this theory was the idea that God created man from dust. This idea also gave weight to some of the early "earth's slime" theories.

After the Early Christian Era, there came a period of little interest in evolution. The Renaissance, with its rebirth of inventiveness and interest in science, then brought about a new interest in evolution. Following this period, these scientists added their thoughts on the origin of life:

1. Alexander Neckham (1157-1217) - who stated that he believed that birds originated from fir trees that came in contact with the salts of sea water.

2. Paracelsus (1493 - 1541) - a famous physician and alchemist believed that subjecting human sperm to complicated processes could produce the homonuculus, or little man. This

little man would eventually mature into an adult human being. Paracelous made no guess as to the origin of the producer of the sperm.

3. Harvey (1578 - 1657) - a famous English physician, believed that all living things came from eggs, but that by other special processes, other things could be produced from decaying material or lifeless matter. As an example of his theory he cited the worms and insects which were found on, and thought to be, spontaneously generated from manure.

4. Von Helmon (1577 - 1644) - a famous Brussels physician, claimed that mice could not originate spontaneously from wheat kernels, and that the spontaneous generation theory was highly improbable. Von Helmon was the first man to openly oppose, and speak negatively on the spontaneous generation theory.

5. Descartes (1596 - 1650) and Newton (1643 - 1727) held to the theory of spontaneous generation of living organisms from decaying material or lifeless matter. With the theories of Descartes, Newton and Von Helmon, two distinct schools of thought now were beginning to conflict. One held to the theory of spontaneous generation and the other did not.

6. Redi (1626 - 1697) - inspired by Von Helmon's claim that spontaneous generation was highly improbable, also attacked the idea of spontaneous generation.

He began to experiment and soon, through his famous experiment,[2] using maggots and meat, had accomplished his objective; that of disproving the theory that life can be generated spontaneously.

7. Lamark (1744 - 1829) - was best known for his theory of use and disuse of body parts in which the use or need of an organ may bring about a modification in that organ. Lamark supported the theory of spontaneous generation on the basis of observations made of mushrooms and parasites. Also attributed to Lamark is the theory of inheritance of acquired characteristics.

8. Leewenhoek (1633 - 1723) - used the early microscope which he invented, in the observation of microorganisms present in decaying matter. Leewenhoek also observed living sperms in the semen of various animals and concluded that the sperms furnished the life of the embryo, while the egg of the female provided a place for the nourishment and development of the embryo.

9. Buffon (1707 - 1788) - a French biologist theorized that decomposed animals and organisms recompose forming new organisms. This theory, having great appeal to those inclined to believe in superstition, was based, however, on highly unscientific evidence.

2. Gabrial, M. L. and Fogel, S. Great Experiments in Biology, p. 187 - 190.

It also seems to be the only one advocating reincarnation as a possibility for the origin of living things.

10. Needham (1713 - 1781) believed in the spontaneous generation theory. He experimented with gravy and thought that he had proved that spontaneous generation of life was possible. This experiment has since been discredited on the basis that; the instruments used contained bacteria which contaminated the experiment.

11. Spallanzani (1729 - 1799) was more widely known for his experiments with, and successful filtration of, sperm. Spallanzani disproved Needham's theory. He discredited Needham's proof of spontaneous generation by showing that Needham was careless in the sterilization of his equipment. Needham therefore, on his instruments, introduced organisms into the gravy during the experiment.

12. Pasteur (1822 - 1895) was the last of the later theorists and by far one of the most important. Pasteur had much to do with the theorizing on the origin of life. Pasteur substantiated many of Spallanzani's earlier experimental findings in conjunction with many of his own. He, in experimenting to disprove the theory of spontaneous generation, conducted one of the most important experiments of all time.[3] In this experiment he purified wine through a process which we now call

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3. Gabrial, M. L. and Fogel, S. op. cit., p. 110 - 118.

pasteurization. In this experiment he boiled wine in a flask, both to destroy all the microorganisms and to create a vacuum. In this vacuum process no foreign organism could enter and spoil the wine through fermentation. This same wine can be seen standing today, still unspoiled. This famous experiment and process saved the French government untold monies, but more important still were all the advancements made in science as a result of it. As a direct result of this experiment, the theory of spontaneous generation, in relationship to the origin of life and evolution, had been seldom heard or discussed to any great extent, until recently.

## RECENT THEORIES ON THE ORIGIN OF LIFE AND EVOLUTION

In the present age of our expanding universe with its emphasis on space exploration, and with the advent of highly specialized fields of study in science, several new theories about evolution and the origin of life have come into prominence.

1. Cosmozoic Theory - This is the more recent theory of spontaneous generation which holds that living spores originally reached the earth accidentally from some other part of the universe. This theory, although possible, is highly improbable due to the fact that outer space is too intensly cold and dry for spores to remain alive there. This theory, provides no truly new ideas on the theory of life, but merely attempts to shift the scene for the origin of life from the

earth to a remote part of the universe. Basically it does not introduce any changes in the origin of life ideas which were previously mentioned in earlier theories.

2. Oparin's Theory of Chemical Evolution - This is another of the more recent theories on evolution. It maintains that various chemical elements present on earth combined and evolved to produce various complex organisms. The following is a general outline of the theory:

A) The earth is believed to have originated as a fragment of the sun.

B) A spectographic analysis of the sun's atmosphere and those of other stars show that; nitrogen (N) carbon (C) and hydrogen (H) exist not only as free elements, but also as compounds (methone - $CH_4$), (ammonia - $NH_3$).

C) Complex hydrocarbons have been formed in meteorites, showing that they can be produced without living organisms.

D) As the earth cooled, heavy rains showered down upon the heated surface gradually lowering the temperature of the earth and producing super heated steam in the atmosphere.

E) Gradually the earth cooled and large bodies of water were formed. These bodies of water provided an ideal

cradle in which life might begin.

F) From these ancient seas or cradles of life the combination of various chemical elements evolved to more complex organisms.

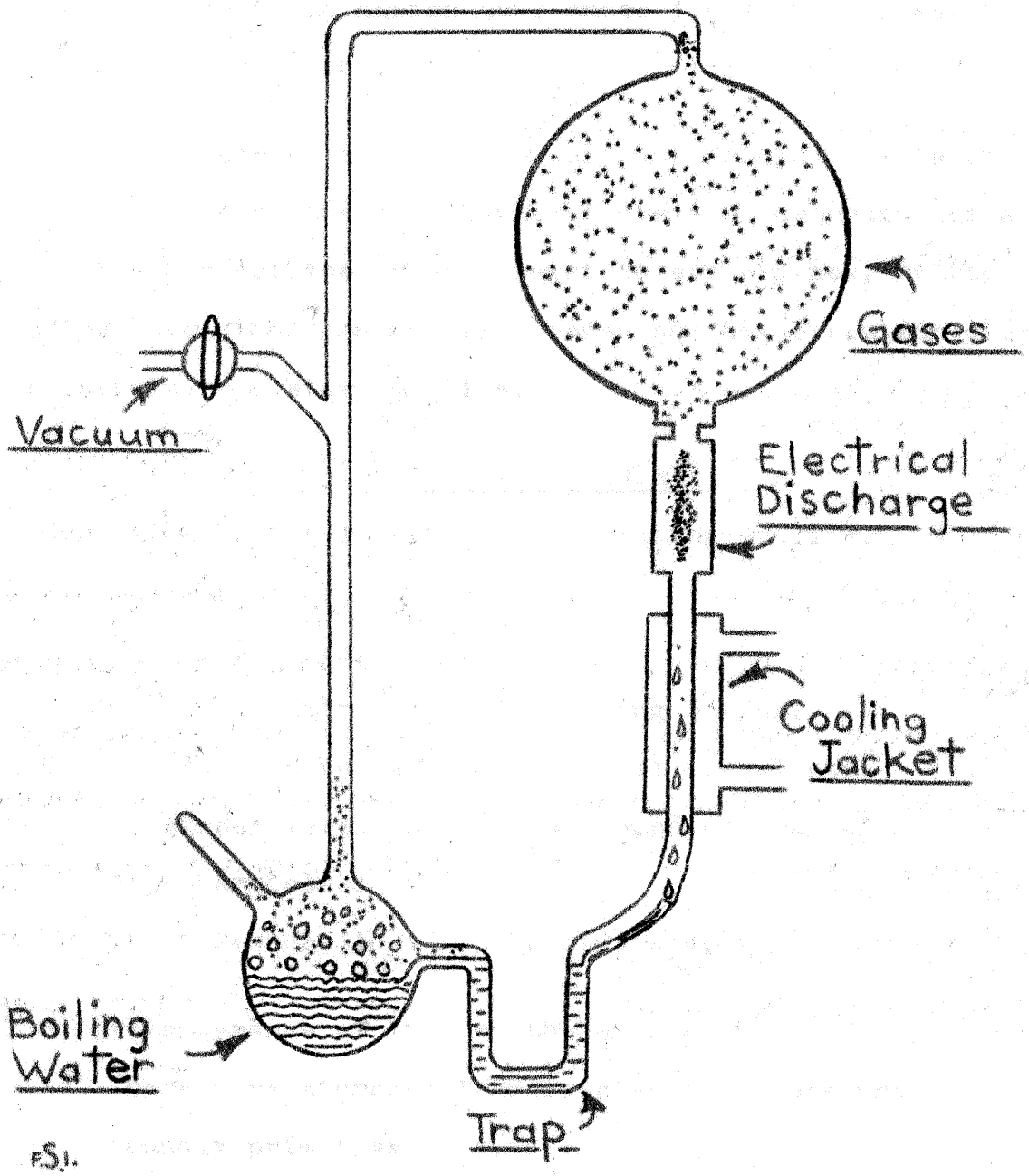
3. Frederick Wohler (1828) gave support to Oparin's Theory in an experiment which he performed. He produced an organic compound (urea) from essentially inorganic materials.

4. S. L. Miller synthesized amino acids (glycine and analine) by circulating water vapor, ammonia, methane, and hydrogen over an electric discharge, thus, creating not life itself, but a basic necessity of living organisms, amino acids. The reason amino acids are considered basic to life is that it is highly probable that amino acids may be synthesized into proteins, which are thought to be the source of all life. If this is true, and it is possible to synthesize or produce proteins, then Oparin's theory of chemical evolution would be highly valid. Oparin states that protein is by no means living matter, but hidden in its structure of chemicals is the capacity for further organic evolution, which under certain conditions may lead to the origin of living things. The gasses used, in Miller's experiment to support Oparin's theory were believed to have been present in the early atmosphere of the earth. Diagram #1 is an illustration showing how Miller performed his experiment, and the apparatus he used.

In summarization of S. L. Miller's experiment, it should

DIAGRAM #1:

S. L. Miller's Experiment in the Production of Amino Acids.




F.S.1.

Miller made amino acids by circulating methane ($CH_4$), ammonia ($NH_3$), water vapor ($H_2O$) and hydrogen ($H_2$) past an electrical discharge. The amino acids collected at the bottom of the apparatus and were detected by paper chromotography.

be stated that if Oparin's theory of chemical evolution is true, and that it was at one time possible for an organism to rise spontaneously, although not impossible, it would be highly improbable for it to happen now, under the earth's present atmospheric conditions.

Recent theories of evolution and the origin of life are for the most part theories having a chemical compound basis. The following outline is an attempt to explain how, by the chemical evolution theory, life began and how evolution played its part in this story of life.

HOW DID LIFE BEGIN?[4]

I Condition of the earth at the beginning of life.

A) The earth was hot and bare.

B) Rocks lay bare.

C) Water concentrated into seething oceans.

D) The atmosphere was in a chemical turbulance.

E) Volcanoes were erupting and laced the sky with many particles.

F) The sun shone in a fierce radiance.

II First appearance of life on the earth.

A) There were microscopic particles that were profoundly primitive.

1. There were no cells and no organisms at this time.
2. Protein molecules had not yet made an appearance.

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4. "How Did Life Begin?" in Science Digest, p. 75 - 80.

B) Volcanoes

1. Shot dust particles of infinite variety and of many elements into the atmosphere.
2. These intermingled with molecules of methane, ammonia, hydrogen, sulfide and droplets of water.
3. These particles continued to rise and were intensely radiated by the primitive sun.

C) Chemical reactions in the atmosphere.

1. Ammonia, methane, and hydrogen sulfide were transformed into new organic or carbon compounds.
2. Glycine the simplest of the amino acids was the first by product at this time.
3. Amino acids were subjected to the sun's radiation and some were rained down on the primitive earth.
4. Some of these amino acids landed in the nourishing protective oceans.

III Growth in the oceans.

A. The oceans were soon like a thin soup; about 10% of the oceans consisted of organic compound-amino acids.

B. These compounds floated in the oceans and reacted to produce more complex compound-alchols, aldehydes, keytones, and others.

C. The chain of amino acids grew longer and many varieties of proteins arose. Here we had the beginning of

the protein molecule.

D. The protein molecules formed colloidal or jelly-like solutions in the ocean water. These colloids separated and were then seen as divisions of organic substances.

IV Changes in the earth.

A. Violent physical evolution of the earth had begun.

1. The earth had cooled.

2. Warm seas were still filled with complex substances and stagnation formed along the earth's seacoasts.

3. The cooling of the earth started great upheavals on its surface. Volcanoes erupted and great masses of earth's material were shot skyward.

B. Thunderstorms raged endlessly.

1. There was extremely high humidity.

2. Great hurricanes struck the earth.

3. Giant tides swept against the earth sending spray high into the stmosphere.

V Selective Processes come into play.

A. Strong colloidal substances became removed from the weak.

1. This selection gave rise to highly developed substances.

2. Energy, obtained from the sun, helped to transform the colloidal substances into living organisms.

3. Volcanoes helped to get the substances high enough into the atmosphere to get the sun's radiation.

B. Change in substances came about.

1. Radiation transformed the colloidal substances into thin plastic sheaths.
2. The centers of these sheaths were later to be transformed into the nuclei of the cells.
3. The plastic sheaths were permeable so that the nuclei could obtain nourishment and grow.
4. This growth continued until the nuclei became so large that they had to divide. Thus, we had fission taking place.
5. These cells then returned to the seas and continued to develop.
6. Again the tides sent these organisms high into the sky where radiation again changed the cell, by producing an outer sheath which imprisoned the components forever.
7. The cells then returned to the oceans as a permanent organisms, able to withstand outside forces.

VI How long did it take?

A. If we believe the concept that the earth was created six billion years ago, about 5.8 billion years would seem to be about the length of time involved in the evolutionary development of life.

1. Millions of years passed before the time inorganic substances became changed to organic compounds.

2. Again many more millions of years passed before we had protein molecules and even more millions of years passed before the first primitive cells appeared.

B. For about 1.5 billion years these primitive cells advanced along the evolutionary ladder, becoming more and more complex.

C. Finally, about 2.5 billion years ago, cells had advanced to the point where they were developed enough to leave fossils.

D. From this point on to the present, progress up the evolutionary ladder proceeded faster and faster and became increasingly complex, until it came to man, the ultimate miracle of evolution.

## SUMMARY AND CONCLUSION

Since the earliest recorded thoughts of man we can find evidence of man's burning curiosity to find out more about himself and from whence he came. This paper has attempted to bring together some of this thinking, not to prove or disprove the various theories of evolution and the origin of life, but merely to present them as food for further thought. In conclusion, as long as man continues his curious quest for more knowledge of his existence, we know that there is really no end yet written to the fascinating story of life - Evolution.

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