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The fear of the Lord is the beginning of wisdom. Psalm 111:10

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- EDITORIAL -

It seems in order to reaffirm the main objectives of editorial policy practiced during the past year:

(1) To promote a vigorous Christian Apologetic by demonstrating the essential agreement of historical Christianity and the facts of modern science.

(2) To permit, within the framework of conservative theology, a discussion of both sides of scientific questions on which many true Christians are known to differ.

(3) To provide scholarly, conservative enlightenment for all readers on Christian-scientific matters.

The publication of many papers in recent issues has demonstrated a striking difference in point of view, but all these papers have exhibited a fundamental unity of Christian belief.

In the light of this policy it will be evident to all that the opinions expressed in various papers are not official points of view of the American Scientific Affiliation.

NEWS ITEMS OF A.S.A. MEMBERS

Committee Structure for the 1951 A.S.A. Convention to be held at Shelton College, New York City:

General Chairman:	James O. Buswell III
Papers and Program:	Heinrich D. Holland (Chairman) Wilbur L. Bullock R. Laird Harris J. Laurence Kulp
Arrangements:	G. D. Young (Chairman) Karl Turekian Mrs. Barbara Tryon
Field Trips:	J. Laurence Kulp (Chairman) Donald F. Beaumont Donald R. Carr

The Los Angeles area members of the ASA met at Prof. Stoner's home in Altadena on October 30th for the purpose of planning the year's meetings. It was decided to have three meetings before June, 1951, at which times the following subjects would be presented and discussed: (1) The extent of observable changes in animals, (2) Biblical numerics, and (3) Mosaic health rules in the light of contemporary knowledge.

Frank Allen, Ph.D., LL.D., F.R.S.C., professor emeritus in Physics of the University of Manitoba and one of the senior members of the ASA, is busy writing up his researches of a lifetime on the human senses. His latest paper is entitled, "The Neural Oscillatory Effect in Colour Vision" and appeared in Acta Opthalmologica, Vol. XXVII, 1949.

Dr. Alfred C. Eckert, Jr., chairman of the ASA tract committee has completed arrangements with Good News Publishers for the cooperative publication of a tract, "Ten Prominent Scientists Look at Life." The ASA is to provide the ten scientists and the members are asked to make their nominations known to Dr. Eckert at once.

The second edition of MODERN SCIENCE AND CHRISTIAN FAITH came off the press in October, 1950. Van Kampen Press experienced a busy period in filling the great number of back orders which had accumulated. Copies may be obtained through the Secretary, Dr. Mixter, at $4.00 each (A discount of 40% is allowed ASA members for personal or gift copies).

Delbert Eggenberger: "For the past year I have been -- at Elim Evangelical Free Church -- Church Treasurer, member of the Missionary Committee, Budget Committee, Publicity Committee, and Executive Committee. I have also been Secretary of the South Side Fishermen's Club for three years.

"For several years, I have been a member of the American Chemical Society, Sigma Xi (full member), American Association of Physics Teachers, and the Physics Club of Chicago. My biography is in Who's Who in America (March, 1950 Suppl.)"

A list of publications follows:

Electrical Conductivities of Long-Chain Quaternary Ammonium Chlorides Containing Hydroxyalkyl Groups. J. Am. Chem. Soc. 69, 2095 (1947)
Conductivities of Aqueous Solutions of Dodecylammonium Chloride. J. Am. Chem. Soc. 70, 436 (1948)
Conductivities of Quaternary Ammonium Chlorides Containing Two Long-Chain Alkyl Groups. J. Am. Chem. Soc. 70, 977 (1948)
Effects of Electrolytes upon the conductivity of Aqueous Solutions of Dodecylammonium Chloride. J. Am. Chem. Soc. 70, 980 (1948)
Effect of Organic Non-electrolytes upon the Conductivities of Aqueous Solutions of Cationic Colloidal Electrolytes. J. Am. Chem. Soc. 70, 983 (1948)
Conductivities of Alkylammonium Chlorides in Aqueous Solutions of Their Homologs. J. Am. Chem. Soc. 70, 2918 (1948)
Effects of Inorganic Electrolytes Upon the Conductivity of Aqueous Solutions of Dodecylammonium Chloride. J. Am. Chem. Soc. 71, 2145 (1949)
Electrical Behavior of Dodecylammonium Chloride in Water-Organic Solvent Systems. J. Phys. & Coll. Chem. 52, 1494 (1948)
Solubilities of the Normal Saturated Fatty Acids in Water. J. Org. Chem. 14, 1108 (1949)
Electrical Conductivities of tris-(hydroxyalkyl)alkylammonium Chlorides. J. Am. Chem. Soc. 71, 672 (1949)
Solubility of Higher Alkyl Quaternary Ammonium Salts of Fatty Acids. J. Am. Chem. Soc. 72, 4135 (Sep.1950)
Transit Time of Electrons between Electrodes of Simple Geometry (Abs.) Bull.of Amer. Phys. Soc. 22, 16 (Dec. 1947)
Transit Time of Electrons in Simple Diodes as a Function of Current Density (Abs.) Bull. of Am. Phys. Soc. 25, 12 (Mar. 1950)
Gamow's Theory of Element Building. J. of the Am. Sci. Affil. 2, No. 3, 23-26 (Sept. 1950)
Conductometric Studies of Bactericidal Mechanisms. Ann. N. Y. Acad. Sci. 53, 105-111 (Aug. 1950)

From William C. Eichelberger: "I thought that you might be interested to know something of the recent accomplishments of a fellow member of the A.S.A., Mr. D. Lee Chesnut of Schenectady, N.Y. He is a prominent scientist with the General Electric Co. and has turned down a big promotion in the company because of his Christian principles and standards. He has done some work (I don't know how much) in connection with the atomic bomb and atomic energy. Ten days ago I had the privilege of hearing him give an illustrated lecture on "The Atom Speaks" before a church group. It is a lecture which Mr. Chesnut has developed in the course of the past few years on the correlation of Biblical events, Biblical prophecy and modern science (physics in particular). To me (and others also) it was a marvelous and amazing comparison of the Bible record and his postulations as to how the world might have been created, based on modern atomic theory, atomic bombardments, and mutation of elements. If mere man can do this, why question the Creation, for "with God all things are possible." Then he carried the correlation down to the present day of atomic bombs and hydrogen bombs, linking their terrific devastation to that predicted in II Peter 3:10. So why should Christians fear the development of atomic bombs if they are part of God's plan, leading up to Christ's second coming? Mr. Chesnut is publishing this lecture in a book, THE ATOM SPEAKS by the Eerdman Press. It is supposed to be out before Christmas. I certainly want a copy of it and I commend it highly to anyone, and especially to a member of the A.S.A. The lecture is interspersed with pictures and drawings to illustrate the nuclear physics involved and with verses from the BIBLE to show correlation to pertinent passages."

Donald H. Porter: "I received the Ph.D. degree from Indiana University last June in the field of Mathematics. I am at present an Instructor in the Department of Mathematics of Indiana University.

"I spoke to the Inter-Varsity Fellowship of Indiana University last July, giving a review of MODERN SCIENCE AND CHRISTIAN FAITH."

John C. Sinclair: "By way of news, I am teaching Biology at the California Baptist Theological Seminary again this year. Many of my students are prospective missionaries so am introducing basic biological principles through a survey of human physiology.

"For this next semester, at least, I will be working full time for the College of Medical Evangelists. They are opening up a new Biochemical Research laboratory in the Los Angeles General Hospital, Unit I; and I was asked to operate it for them. Dr. Harry A. Davis, M.D., is my immediate supervisor. We have a research grant from the L. A. County Hospital to study Blood volume in surgical shock. We hope also to stucy Steroid metabolism with the aid of a Beckman IR-2 Infra-Red Spectrophotometer. An Univ. of Calif. at Los Angeles graduate in chemistry is working with me, Mr. L. Isenberg.

"I am attending Montecito Union Church in Highland Park, and teaching their class of eighth grade boys. Last Friday night Rev. Ray Harris (non-denomination chaplain at L. A. Co. Hosp.) asked me to share his speaking engagement at the Torrence First Baptist Church. I gave my testimony of Christ and spoke briefly on my theory and implications of the Theory of Evolution.

"My Pregnanediol work was published in 'Journal of Clinical Endocrinology' 10(1) pp 101-107 (Jan. 1950). My part is acknowledged at the bottom. I am enclosing a contribution made to the Daily Bruin. Perhaps some of our Christian college papers would like to carry it."

Monday, May 8, 1950
U. C. L. A. Daily Bruin
Los Angeles, California

WHAT NAME?

Editor Grins and Growls:

Last semester in Botany I, Dr. Addicott made a statement that has set me thinking! In his lecture on evolution he said that he believed that some day man would discover how to make a simple, self-reproducing system; a system that would give us some idea how life originated way back in antiquity.

Somehow I feel that Dr. Addiccott is right, that sould some brilliant colleague of ours learn how to manipulate chemical and physical phenomena so that a simple form of life is created, we will be a step closer to knowing how life as we know it originated.

In other words, just as it will take some brilliant person to conceive of such a system, so it is probably that some intelligent being manipulated chemical and physical phenomena in the original creation of Life. So then when some brilliant person makes a simple form of life, and thus proves the possibility of the origin of life through the ingenious manipulation of an intelligent being, what shall we name that (first) intelligent being? God?

Barbara and Lansing Tryon: "The most important news from this corner is Steven Frank, four months old. Lansing is working at Columbia for Larry Kulp - main interest is C^{14} age studies. You can guess what I am doing."

Roger J. Voskuyl: He was formerly Dean of Wheaton College. He is a member of the A.S.A. Executive Council, and has been elected to the presidency of Westmont College, Santa Barbara, California. He succeeds James Forrester who is also a member of the American Scientific Affiliation.

THE PLAN IN THE FIRST CHAPTER OF GENESIS

By R. T. Fulwood

General Outline

I. Gen. 1:1: ORIGINAL CREATION, or beginning of the earth's career.
The duration of this first condition not given.

II. Gen. 1:2: A RUIN (tohu): Dissolution, or chaos.
The duration of this second condition not given.

III. Gen. 1:3:
to 2:3: RE-CREATION, or resurrection from ruin in six days.

* * * *

THE SIX DAYS WORK AND THE REST DAY

(Beginning at verse 3)

First three days: MATTER, or Physical Divisions:		Second three days: MOTION, or Organized Powers:	
1st Day:	LIGHT	LIGHTS (organized)	4th Day.
2nd Day:	AIR divides WATERS	AIR & WATER LIFE	5th Day.
3rd Day:	(a) EARTH APPEARS (b) VEGETATION	(a) EARTH LIFE (b) MAN	6th Day.

7th Day: COMPLETE HARMONY, or REST

* * * *

Probably the majority of those who are more or less familiar with the account of creation in the first chapter of Genesis do not suspect the existence of the precise, clearly defined plan which it contains. A long period of study of this chapter has revealed some very interesting features of this plan which it is the writer's purpose to present as clearly as possible, and having thus condensed as much as he was able, he would suggest that the article be read over the second time in order to arrive at a clear understanding of the deep significance of the plan.

The Hebrew equivalent of the word "create", meaning to bring into existence a new thing, is used on three occasions only in the entire chapter, viz:--in the first verse, in verse 21 (Fifth day) and in verse 27 (Sixth day), or at the introduction respectively of Matter, the animate Soul and the human Spirit. On other occasions the word "made" is used, signifying the working with material previously existent.

There is a definite distinction in character between the subjects of the first three days, which are masses, stationary in relation to their surroundings, representing Matter, and those of the second days which are multitudes of separate units,

either organisms or comprising organizations but all moving, and representing Motion, or Force. This grouping is a further evidence of method or plan in the chapter.

Another marked feature is the order in which the subjects are presented and the correspondence between the first and fourth, second and fifth, and third and sixth days regarding the nature of the subject treated ("Light" and "Lights", etc.). By referring to the outline above and reading across the page this will become clear. This is carried out so completely that even the form of a supplementary addition on the third day of the first group is repeated on the third day of the second, the words "And God said," introducing a new subject, occurring twice on these two days, only, appearing but once on each of the other days.

The above features are merely external evidences of careful arrangement but they are doubtless sufficient to show that this account is no haphazard collection of assorted legends as has been claimed.

Seven Hebrew words, in the first verse, state the original creation.

"In (the) beginning God created (the) heaven and (the) earth." By omitting the word "the" which does not appear in the Hebrew language we have the same number of words in English. This is an isolated statement, denoting an aoristic point in time: possible ages upon ages prior to all the succeeding portion of the account. "Seven" among the Hebrews, and in its usage throughout the Bible, indicates the completion or "perfection" of the matter in hand and the inference is therefore perhaps fairly warrented that a finished or completed condition of the earth at that time is signified by these seven words. This view is not only warranted by the text but is in perfect analogy with the spiritual doctrine developed later, there is no contradiction of it by any other scriptures and it is in complete accord with the discoveries of science. God is light, and his work perfect from its beginning. He does not create ruins, nor work in darkness, which condition we find the earth in in the second verse. This condition and method are the work of the Adversary.

The second verse reads: "And the earth was without form and void;
"and darkness was upon the face of the deep. And the Spirit of
"God moved upon the face of the waters." This would indicate a lapse from its previous complete state, if the above inference is correct. In any event there is no indication as to the duration of this desolate condition. It may have lain thus for long ages. Geology indicates such lapses in its history.

The six days work in restoring the earth to its present condition really begins with the third verse of the chapter. These days are divided, by the nature of the subjects, into two groups of three days each, followed by the one day of rest which should have been included in this chapter.

Reference to the summary above will show that the entire range of Matter, viz:- the Ether, Gases, Liquids and Solids, in their ordinary, typical representatives which are Light, Air, Water and Earth, respectively, is comprehended in this first series of days. The supplement at the conclusion of this group is Vegetation, and it is a noteworthy fact that Vegetation is the combination in one organism, or unit of life, of all the physical divisions that have preceded it in these three days, in its chlorophyl, or coloring and assimilating force (Light), its breathing leaves (Air), its sap (Water), and its fibre, or mineral matter (Earth). It thus sums up and completes the subject of Substance, or Matter, and it would even appear that this elementary and purely physical, or material, form of LIFE is the ultimate object for which the various physical formswhich have preceded it exist, and their culmination; for the humble, fragile blade of grass, while almost infinitely inferior in appearance to these mighty masses of matter, is superior to them in its nature, having the power of growth and reproduction. And while it lays hold of and uses

them all in its internal economy, they combine to serve it externally, also, as the Light, or "radiant energy" as we now have it in the sun, by means of the Air causes evaporation of the Water which is carried over the land in clouds, falls in rain and moistens the Earth in order to produce food for the plant. Thus these various divisions converge into the plant as a focus, and having been combined, and converted into food for the animate creation through the wonderful transforming power of its minute cells they are expanded again by the process of growth. This is nothing less than the finger of God. "Adaptation to environment," "survival of the fittest," the theory of the transmission of life to this plant from some other by the agency of light, and other such hypotheses which have been offered to account for the appearance or development of life on the earth, fail to recognize to give any head to the marvelous arrangement of the mighty system which we see in practical operation every day for the perpetuation of life.

The plant being the focus through which inert material is converted into life fittingly occupies the central place in this six days work, at the termination of the third day; and there is a gradual expansion of development in the following three days which confirms the fact of the termination of the third day being a focal point. This will become clearer as the subject is developed.

It is plain that Vegetation completes this first series, or group of days, and this view is further confirmed by the fact that on the succeeding day - the fourth - the account returns to the subject of the first day, - "LIGHT," beginning another series; but it is now in the form of an organized system of "LIGHTS" in their relation to the earth.

"MATTER" having been summed up in this first series of days, and combined in the mystery of life in the plant organism, this subject may be considered as closed, and we are led to expect something beyond Matter in the second series. We find it in

MOTION or FORCE

Force, or Power, per se, is always invisible, but the effect of Power is motion in some form. The inert earth is dependent upon the sun for its enercy and all the power expressed in motion on the earth is derived from the sun. Therefore, on this fourth day, beginning a new series with "POWER," made visible through motion, as its theme, the scene of operations is transferred from the earth to the heavens, where the source of the earth's energy is located. Hitherto in the account the physical earth has been the theme, but now a new field is entered upon where invisible powers as exhibited by their effects claim our attention. These powers, it is true, are expressed through widely varying visible, physical bodies, but the hidden powers themselves are the true subjects of the second three-day group.

On the Fifth Day the moving soul is created with the power to Love and Hate (higher in quality than the mightiest mechanical power) and with the new power of automatic, or self-directed movement. The Hebrew equivalent for the word "create" (Bara) meaning to bring into being that which did not previously exist (as distinguished from "making" or adjusting, in different relations, previoulsy existent things) is used on three occasions, only, in the entire chapter, as has been stated above, and it is striking that these occasions should be the introduction of the Physical (BODY), the Emotional (SOUL) and the Intellectual (SPIRIT) factors, which comprise everything that is contained in the universe as we know it.

On the Sixth Day the embodied Spirit, Man, is created. Man is the epitome of the universe. As Vegetation, in a supplement to the first three-day series, sums up the several divisions that have preceded it, so Man in a corresponding supplement to the second three-day series sums up and combines in his triune being all that has preceded him in the entire six days. And as the plant has the power to lay hold of

the incorporate within its purely physical system the various material, visible elements surrounding it, so Man, the invisible although embodied spirit, is able to lay hold of invisible forces, surrounding him, to adapt them to his uses according to invisible laws, chemical and mechanical, and to conceive and create an entirely new combination of matter and force, such as the steam engine, to serve his uses.

The third division, as shown in the summary, is the seventh day which is set apart from the other six.

The first three-day group is static in character: its units or divisions, as a whole, maintain unvarying relations towards each other.

The second group of three-days is dynamic: its myriad variety of forms is in constant motion - and unrest, the animal world pursuing and being pursued: a condition shared by mankind morally.

Following this is the seventh day, characterized as a day of Rest: not extinction. Rest implies life, but life without disturbance, in complete harmony with its environment.

NATURE OF PHENOMENA PRESENTED ON THE SEVERAL DAYS

A brief review of the days will show a logical progression in the order of their subjects, and just the order that we might expect in a material world projected by a Spirit-God, i.e. from spiritual, or unseen, to material forms, as in the first three-days; and from invisible and unrecognized powers to conscious and recognized capacities and faculties as in the second group. The account is extremely brief and condensed, considering the vastness of the subject and apparently merely serves as an introduction to the Career of Man on the earth. But while the phenomena are presented very simply, as they would appear to the untutored human being in all ages, the successive developments and adjustments are entirely logical in their order.

1st Day-LIGHT: On this day light is brought in on the face of the deep, where, as stated in the second verse, darkness had been. Contrary to the popular notion it is not stated that light was created on this day; after its use in the first verse the word "create" does not appear again until the fifth day is reached. The light appears here without a visible source, and it is light, per se, apart from its source or its effects, that is the subject here.

Light is the most ethereal or spirutual of all the phenomena recognizable by our senses. We are cognizant of its presence or absence but its nature has not yet been satisfactorily analyzed. Light and Heat are classed together under the general term of "Radiant Energy," and the chief characteristic of light is radiation in all directions. It is thus pre-eminently a centre of influence; it reveals true conditions wherever it appears, and it is the visible indication of the presence of energy.

2nd Day-AIR: The "firmament," or expanse, is the elastic sphere of air, some forty miles in thickness, which envelopes the earth. (See the fifth day, where fowls fly in the "open firmament of heaven.")

The air is the great means, or medium, (a) of communication: while creating no sound itself, it is the means of communicating all sounds, particularly speech, by which we communicate our thoughts. (b) It is also the means, or method, of life of every organism, plant or animal, on the earth. (c) It is the means of producing vegetation by distributing moisture over the earth in the clouds.

Thus the Air is characteristically the great agent, means or servant.

3rd Day- (a) EARTH: On the first part of the third day no new feature is introduced, but there is a new adjustment of the earth and waters, the dry land being raised above the waters, which had theretofore buried it beneath them.

The solid earth is inert and stable. Acted upon, but not active and thus characteristically an "Effect" as distinguished from the former features.

The principles of Cause, Means and Effect are thus represented in their due order in these first three days.

3rd Day- (b) VEGETATION: Vegetation is the elementary form of organism, or life, wherein different parts contribute harmoniously to form a living whole or unit; and as noted above it is either composed of, or represents in its economy, the three forms of matter, viz: gases, liquids, and solids, and the hypothetical ether.

Reviewing the series briefly we find a

UNIFORM PROGRESSION FROM SPIRITUAL TO MATERIAL FORMS

Before the six days work was begun the watery waste, shrouded in darkness, lay before the Creator.

Then light, the most ethereal, spiritual element recognizable by the senses, is brought in upon it.

Then the Air, or typical gas, invisible but having density, divides the waters above from those beneath, the latter, of course, being those enclosed within the air sphere.

Then the Waters, or typical liquid, with still greater density, are gathered together and given their place in the scheme.

Then the Earth, proper, or dry land, the most solid, stable and dense of all these forms of matter, is resurrected, as it were, from beneath the waters.

Finally the Plant, the combination of these forms in an organism, springs up out of the earth.

Note the orderly progression from the non-material, yet visible, to the most solid material. Beginning with the visible representation of power, which is nearest in character to the Creator ("God is Light") who is a Spirit, and descending through gradually denser forms to a solid body.

The ingressive development is also noteworthy: The light is seen upon, or outside of the watery waste; then the air sphere enters and divides the waters; then the waters beneath the air sphere in their turn are parted and the solid ground is brought up from beneath them. Finally, out of the inert land itself, thus resurrected from burial, the Plant, or living organism appears: Life springs out of that which was dead and buried. The Plant continues as the type of resurrection life in nature, drawing its nourishment from that which is dead and decayed, giving it a new, living body and transforming it into wholesome food for higher types of life. Again: it flourishes through the summer, dies, apparently, in the winter, and rises again in new life in the spring. It appears here on the third day, which is the day or resurrection throughout the Bible (Hosea 6:2; Luke 24:7; Rev. 11:11, etc.) That it is a symbol of resurrection life is confirmed by the Great Teacher himself in John 12:24: "Except a corn of wheat fall into the ground and die it abideth alone; but

if it die it bringeth forth much fruit." He applies this to his own death in the 32nd and 33d verses of the same chapter. And a very beautiful symbol it is of resurrection life: leaving the earth behind, as it grows, it rises toward the light from heaven which it reflects, partially, in the varied color of its leaves and flowers and fruits, as the Christian partially and imperfectly reflects some features of the moral glories which together give us some idea of the great white light of the character of God.

4th Day-LIGHTS: On this day the present existing relations between the earth and the heavenly bodies are established. The earth bears its own witness of a glacial period, showing that these relations have not always continued just as we find them today. And if the six days work of the chapter be a resurrection of life, and of conditions which permit of life which have become extinct in a desolate, dead and buried earth, and we believe the record shows it is, then the restoration of light and heat to it by the sun at this time is in complete accord with the remainder of the account. It is not stated that either the sun, moon, or stars were created at this time. On the other hand, given a Creator, in the beginning, he must have absolute power to effect changes in that which he has made when and how he will, and cannot even be fettered by the "laws of nature" without making him inferior to those laws. Such a Creator is unthinkable. Laws are incapable of changing their operation, are without volition or consciousness and are thus inferior even to mankind, and a God who is incapable of suspending or changing his laws at will is no God.

"Light" as a subject was introduced on the first day, where it appears without a physical source, indicating that Light, per se, apart from its source or effects, was the subject there. In the description of this Fourth Day the effects or relations of the "Lights" toward the earth are dwelt upon at length, and the heavenly bodies themselves are passed over with slight mention. The "Lights" rule over the earth in that it is dependent upon them for light, heat, power and guidance, and its changes of season and "times" are determinded by its constantly varying attitude towards them. The relations between these heavenly bodies and the earth, the components of a vast complex organization, more accurate than the finest mechanism, are not maintained, as are the relations of matter in the plant organism of the preceding day, by visible, physical contact, but by great, invisible, counteracting Forces. And from this day forward, in the account, while differing physical forms are presented, it is their invisible forces, powers or being which are the subject, these being far higher and more important than the mere material through which these powers find expression.

On the Fourth Day Motion, or change of location, which is visible manifestation of power in action, is introduced. Tremendous in its sweep through space but on the other hand entirely involuntary, and impelled and controlled by blind, external force. Hence it is inferior in character to the almost infinitely more limited but self-impelled and directed motion of the animals which appear on the succeeding day.

5th Day--AIR AND WATER LIFE: On this day fish and fowl are created. Here we find an organism - not a mere mass of matter - in motion which is voluntary and self-controlled, the forces that move the body being lodged within it, and the controlling force denominated the "living soul." The method of motion of the birds and fishes, which swim in the air and water as the planets in space, is a complete contrast to the circular, orbital mode, in one direction only, without resistance, of the preceding day, being produced by a reciprocal, or forward and reverse movement of wings or fins, and progress being made by opposing force from within to resistance from without in the air and water. In its physical structure the animal is usually bilateral or "paired" in almost all its parts or organs, many species mate or live in pairs, and birds and fishes characteristically among animals migrate or move to and fro in large masses at certain seasons, as impelled by a common instinct. In its physical structure and movements the number "2" appears to be stamped on the animal, and this appears as well in its soul, or emotional qualities.

The invisible soul of the animal is in communication with the visible creation by five channels of perception, or sensation: with the light by the eyes; with the air by the ears and nose, and with the earth and its vegetation by touch and the mouth. The animal soul manifests through these channels, two great conflicting qualities, broadly speaking, which comprehend all lesser ones, viz: - Love and Hate, or Attraction and Repulsion. And as love is constructive and uniting in all its degrees of manifestation and hate is destructive and disintegrating, conversely, these opposed qualities show the animal to be a concrete representation of Force and Resistance, or Positive and Negative influence, or in other words a visible expression in an organism of duality, conflict and opposition.

6th Day--(a) EARTH LIFE: As remarked before, this Sixth Day, or third of the second group, is divided into two parts like the third day of the first group. On the first part of this day the land animals or four-footed beasts are made. There is, of course, no radical difference in nature between these and those previously created. They are a new adjustment, adapted to land travel with their four feet as the birds and fishes with their wings and fins are to the air and water, respectively. The method of progress on the surface of the ground is more limited than that of the birds and fishes, and it is among the land animals that man has found these which are readily subject to him and which he keeps in flocks and herds for his service.

Note the remarkable parallel between this new adjustment and nothing more, on the first half of this day and the same feature on the first half of the third day, regarding the earth and water. (See "3rd Day - (a) EARTH").

6th Day--(b) MAN: The creation of Man, apart from the animals and as superior to them, is the prominent feature of this day, and is emphasized by the two parts into which it is divided. The word "Create" occurs in this connection for the third time, as noted above, showing that this being is a new and higher order. There is no radical difference between the body of man and that of the animal. The animals also exhibit soul qualities, or emotions, very similar to those of man; but the animal soul is incapable of conceiving, or being influenced by, an object or purpose outside of the range of its five organs of sensation, or consciousness of visible surroundings. We can conceive of no mere animal voluntarily going to the stake to be burned for the sake of allegiance to an invisible being who has never been visible to it. Such things have been done by the embodied spirit, Man. Spiritual realities are invisible, and the invisible spirit alone can apprehend them. The man was created independent; not bound by the law of instinct as the animals, although he shares its operation to some extent with them. He is able to make new laws for himself, governing his own conduct and that of others, and even to modify the operation of physical laws by opposing one to another. The invisible spirit of man manifests itself thus in its perception of and active relation to the invisible realm of force and law.

Vegetation at the close of the first series of days is the organizer of physical forms, but mankind at the close of the second series dominates and organizes invisible forces, according to invisible laws, producing visible effects according to his will. The human spirit thus dominates its surroundings and by ruling and controlling them shows itself to be "first" or supreme, as the animal soul, by its continuous conflict, manifests its position to be "second."

Reviewing this second series we find that it sets forth the visible effects, in action, of successively higher

POWERS: FROM BLIND ACTIVITY TO CONSCIOUS PERCEPTION.

1. On the first day of this series (4th) day the source of all mechanical power on the earth is shown and we see the effects of its action, in combination

with the invisible power of Gravitation, in the regularly recurring changes of seasons, day and night and months and years on the earth, resulting from the motion communicated to it. Unconscious, unresisting obedience to external power may be said to characterize this action, or mode of motion of the earth.

2. On the second day (5th) an emotional power, the "living soul" is presented: a being conscious of tangible, visible objects, by the senses, but of nothing intangible or invisible; expressing opposed qualities of Love and Hate towards other beings; having the faculty of self-directed movement by the exertion of force from within upon outward resistance, motion and progress being thus produced by conflict; a method far higher than that exhibited on the preceding day, i.e. by blind force from without overcoming inertia.

3. On the third of these days (6th, second part) a spiritual power, Man, is created in the image of the creator ("God is a Spirit"). Here is a being conscious of himself as an invisible, individual "Ego"; perceiving invisible forces and laws surrounding him, and even apprehending the Creator himself; capable of controlling and guiding his own and other's actions, and of manipulating material and subjecting it to the action of invisible forces and laws to produce such effects as he chooses. This dominant, conscious force is the opposite extreme from the mechanical motion seen on the first of these days.

Finally it will be noted that the gradation is perfect: Automatic, unconscious motion in subjection to external force, followed by internal and external conflict, and this succeeded by conscious control or supremacy over forces and material. As in the first series of days the development was from what makes visible, or the light itself, toward material density and visibility, so in this series of successive powers the development is from unconscious activity, through consciousness of visible surroundings, to consciousness of invisible powers, and thus of the invisible Power - the Creator - God. The first series is objective development; the second, subjective development, and the purpose is the same in both series, viz: - The revelation of the invisible Creator in his material universe and to his created being, Man, in whom the material is united with the spiritual.

In mankind the highest power on earth - Intellect - is united with the highest type of physical organism.

These six days of work are followed by a Seventh, designated as a day of Rest, which is a day without an evening. It has a beginning but no ending. The temporal is thus united with the eternal, and on this day, which extends out into infinity, God rests. It is numbered as an earthly day, but it is "sanctified" or set apart from all the others and nothing is created or made in it. But why should the Creator, the source of all power, rest? And why does the infinite God mark out an earthly day on which to rest? It is a "7th" and thus be inference a "perfect" one and it goes beyond his six days creative work which culminates in Man. If we turn to later Scriptures they tell us of one who answers to this descritpion, in whom the temporal is united with the eternal in a perfect being who is called "Emmanuel" or "God with us," and we are told in Colossians 2:16,17, that Christ is the body of which this seventh, or sabbath, day is the prefiguring shadow; who was not created (as nothing was created on this seventh day) but of whom it was said "in the fullness of time God sent forth his son, made of a woman" (Gal. 4:4); and again "Wherefore when he cometh into the world, he saith, Sacrifice and offering thou wouldest not, but a body hast thou prepared me" (Heb. 10:5); and again "therefore also that holy thing which shall be born of thee shall be called the Son of God" (Luke 1:35); in whom the Creator found rest, as stated in John 1:32-34, "I saw the Spirit descending from heaven like a dove and it abode upon him;" and "Upon whom thou shalt see the Spirit descending and remaining -- this is the Son of God;" who was separated from other men, - "holy, harmless, undefiled and separate from sinners" (Heb. 7:26), as this seventh day is set apart from the other

days. In whom we find rest, as well as the Creator, as in Matt. 11:28, "I will give you rest." Concerning whom it is said "For it pleased the Father that in him should all fullness dwell; and having made peace by the blood of his cross by him to reconcile all things unto himself; by him I say, whether they be things in earth or things in heaven." (Col. 1:20) So that complete harmony and rest in God's creation are to be found eventually in Him.

The foregoing exposition of the phenomena in this chapter does not however, set forth the principal underlying theme, which, as elsewhere throughout the Bible, is spiritual truth. If we fail to consider this we shall miss entirely the Creator's thought in giving us this record.

SPIRITUAL SIGNIFICANCE OF GENESIS I IN THE LIGHT OF LATER SCRIPTURES

As in the microcosm - Man, the material portion of his being serves to give outward expression to his invisible, spiritual nature, so in the great universe, or microcosm, the material but serves to reflect the spiritual of which it is the visible shadow. The Spirit God is infinitely superior to his material, created universe, and to Him the material, vast as it may be, is but as shadow compared with the spiritual reality. Hence the prominence given to spiritual themes as compared with material in the scriptures. The creation of the material world occupies but one chapter: the spiritual history of mankind requires volumes. These volumes are divided into two sets of books known as the "Old Testament" and "New Testament." The Old Testament is bounded by an earthly horizon and is devoted to the Creator's dealings with his earthly people, the Hebrews, or natural descendants of Abraham, as the children of the first Adam. But the New Testament begins with the "Kingdom of Heaven" and its theme is the Second Adam, the "Lord from heaven" (I Cor. 15:45-47) and his heavenly people, the church, which is a new, spiritual body not mentioned at all in the Old Testament. The spiritual realities and powers set forth in the New Testament are not visible to the natural eye except by their effects, but are revealed only to the spirit by faith.

The analogy between the foregoing contrasted dispensations and the contrasted groups of days, on the first set of which different visible, physical divisions are set forth, while in the second three days hidden powers only as manifested by their effects are seen is obvious. And this is no mere arbitrary arrangement but is due to the inherent and inevitable unity and harmony of Truth, whether expressed in the physical or spiritual realm, so that we should expect to find the same order of procedure in both.

In God's revelation of himself we find Him distinguished as three persons: Father, Son and Holy Spirit. The Father, or first person of the trinity is revealed as the originator, source of life, "first cause" or power. In 1st John we read "God is light." Light in the material world is the manifestation of power in action and is a radiant source of influence whose presence reveals the truth of conditions, and the correspondence of the properties of light, as shown in the first day of our chapter, with the revelation of God as Father is obvious. Furthermore, the effect of light on this first day is to dispel the darkness which surrounded the chaotic earth, and the revelation of God has the same effect on man, morally, as shown by 2 Cor. 4:3-6 "God who commanded the light to shine out of darkness hath shined in our hearts, to give the light of the knowledge of the glory of God in the face of Jesus Christ."

The Son, or second person, is the dependent, obedient one, limited and controlled by the will of the Father; the one who does not act from himself, but serves, carrying out the Father's will, and "took upon him the form of a servant." He is the Mediator or means of communication between God and man (I Tim. 2:15); He is called

the "Word" (or means of communication - message); "the Word made flesh" (John 1:1,2); the "obedient servant" (Phil. 2:6-8) and the sustainer of all things (Heb. 1:3 and Col. 1:17). The analogy between the natural characteristics of the Air, on the second day, and these spiritual ones of the Second person is apparent. The air is a sphere, thus expressing limitation; it is that of which words are formed, which are the means of communication; it is the mighty servant, carrying the life-giving moisture from the oceans over the land; and finally it is the means of sustaining life in every breathing, living thing.

The air sphere being introduced into the waters has the effect of dividing them, sustaining the portion of them which is raised up and purifying it of its salt, so that it descends on the earth as rain, giving life to the vegetation and running water to mankind, for his uses; the remaining portion being left in its original condition. So Christ, introduced into this moral scene, divides mankind at once into two parties, well illustrated by the two thieves on the crosses beside him. Both were equally guilty, but one acknowledged him as Lord and is with him today in Paradise, raised up and purified, according to his promise, the other reviles and despises him, and is - where? So, also, in each individual soul the entrance of Christ by faith at once produces conflict of desires, the old, dead nature to continue in sin and the new, or Christ nature desiring to be free from it, as shown in Romans 7.

The Holy Spirit, the third person of the Trinity, pervades the material and works through it but remains ever invisible and his presence and activity are manifested whether in the material or spiritual realm, only by the transformations he effects in the subjects of his work. The third person of the Trinity is always spoken of as effecting resurrection, as in Romans 8:11; I Pet. 3:18. He is the great Organizer (I Cor. 12:11-13); the producer of fruit (Gal. 5:22). The resurrection of the dry land from beneath the waters on the third day and plant or living organism springing up from it "whose seed is in itself," producing fruit, manifesting by its growth the mysterious, hidden life force within it and transforming dead and decayed material into beautiful, living forms, together present a perfect analogy with the work of the Spirit in the Spiritual realm.

Thus the Father is the source of Truth and Life, the Son or "Word" declares the Father, or is the means whereby His character is made known to man, objectively, and the Holy Spirit works in the hearts of men subjectively to make the message effective and productive.

Returning, for a moment, to the second verse of the chapter, the earth is there seen in a state of complete ruin and desolation: darkness covers the face of the deep and the waters have submerged the earth, so that there is no place for life to exist. This is also a graphic picture of the spiritual condition of man away from God. How two new elements from above are introduced: the light from heaven dispels the darkness and the air, or earth-heavens, divides the waters, raising up a part of them and turning that water which had been death and a burial shroud to the earth into the means of life upon it by the rain-bearing clouds. On the third day the land is raised from beneath the waters and then the two life-giving elements from above are united by the agency of the third, the invisible life force with the two resurrected and readjusted ones from beneath (i.e. the purified waters and the earth) in one living organism - the Plant. This is the doctrine of resurrection life in symbol: The Holy Spirit, the great Organizer, unites the spiritually dead mortal with God himself in a new and living spiritual creation, "and this life is in His Son." Christ came as a Hebrew, at the close of their dispensation and in fulfilment of the promise to Abraham that in his "Seed" should all nations be blessed (Gal. 3:16). He grew up as a tender plant (Isa. 53:2) the humble herb of the field, and as the corn of wheat must fall into the ground and die in order to bring forth fruit, so His death is the source of all spiritual life for men, through His resurrection. Death is the food of life throughout nature, and every morsel of animal flesh we eat symbolizes that death

is necessary in order that we may have life. God teaches in His word that death was necessary to His Son that we might have spiritual life with Him. So nature's book is teaching us also, every day, a direct contradiction of the theory, built on hypotheses and not facts, of the "Ascent of Man." For we do not see the evolution, or transmutation, of one species into another going on about us in nature, but on the contrary in its four great kingdoms, the Mineral, Vegetable, Animal and Human we see a wonderful process of DEATH AND RESURRECTION going on constantly, wherein the higher form of life reaches down, as it were, and takes the lower up into itself, the lower dying out of its existence as a lower form and being incorporated with the higher in a new life, with a new identity. Thus--

The Vegetable takes up the Mineral;
The Animal takes up the Vegetable;
The Human takes up the Animal and Vegetable--

and there is one step higher, which we find in 2 Cor. 5:17: "Therefore if any man be in Christ Jesus he is a new creature (or 'creation')." In other words--

God takes up the Human in new, or resurrection, life.

The doctrine of the Book and the doctrine of nature agree. Who made both?

Plant life from the dead and buried earth, or the meeting point of life and death on the earth, at the close of the third day, is immediately succeeded by the shining forth of the Sun in the heavens on the fourth. So Christ - "being found in fashion as a man, humbled himself, and became obedient unto death, even the death of the cross. Wherefore God also hath highly exalted him, and given him a name which is above every name" Phil. 2:8,9. Having ascended to heaven, after His resurrection, He shines forth from there as the world's spiritual light. On earth it was the lowliest of the low, like the wheat which is not a lofty tree, but a lowly herb, yet produces the principal sustenance of mankind, but now in heaven He has all power in heaven and on earth, is the "Prince of the kings of the earth" and "his countenance is as the sun shineth in his strength". Rev. 1:5,16. So on this fourth day the earth's light and source of power is seen as a physical body from which the light emanates, and the earth's relationship with this body is defined as a subject one. The earth revolves around the sun as its centre and is bound to it by an invisible force. Here the Christian's relationship to the risen Christ is set forth. Having received new, resurrection life he is bound to Christ, the "Sun of righteousness" (Mal. 4:2) by a spiritual bond which cannot be broken, although he may turn away at times and become cold; yet the life has not departed as that in the earth is not lost during its winter's sleep. This relationship involves change, or vicissitudes, on the earth - cold and heat, day and night, etc., just as obedience to Christ involves trial to the Christian in this world. But as the vast storehouse of physical energy derived from the sun is available for man, and only needs the application by him of the proper means to render it useful, so spiritual energy is made just as free to the Christian by obedience and prayer.

As the animals on the fifth day make progress by opposing the force within to the resistance from without, and each has its own peculiar way of getting its food and manifesting activity, so the Christian rejoices in the power of this new life but finds resistance to it in all the world around him, including his own old nature, and that the only way to make progress, spiritually, is in the exercise of his new power against the resistance. He finds food for his new life in the Word of God, but this is not laid out for him in a convenient set of formulas which will call for no effort for their understanding. It requires the exercise of his new powers to get this food (just as all animals must exercise their powers to get theirs) and he becomes vigorous, spiritually, in proportion as he digests this food and exercises his "own proper gift" spiritually. He is called upon to live a life of love and

service, building up himself and his fellows, or in other words live a Positive life of faith, hope, and love, but on the other hand he may give way to hate and selfishness, destroying or tearing down himself and his fellows in a Negative course of doubt, synicism and egotism and his course will determine the measure of his eternal benefit or loss.

As the land animals, presented on the sixth day, are divided into "Cattle, the beast of the earth and creeping things," so men may submit themselves to their Lord for His discipline and training in His service, like the "cattle," or domestic animals (and are proportionately useful in the general scheme of things as they do so); or they may run wild, taking their own imperious way, like the "beast of the earth," leaving destruction and misery in their train, or they may simply grovel and wallow in earthiness like the "creeping thing."

On the second part of this day the Lord of the whole creation is seen as a man, but associated with him is a companion who was taken from his side during his deep sleep (Gen. 2:21-25), just as "the church of God which was purchased by his own blood" (Acts 20:28) is the result of His death, and is referred to as His bride, sharing in all he has. (Eph. 5:23-33; Rev. 21:9-17).

Finally there is Rest in all the work fully and well accomplished on the one perfect day, the seventh, referred to already as the one in which the temporal and eternal are united, as they are united in Christ in whom all God's purposes are to be consummated (Eph. 1:10; Col. 1:20).

There is also an historical outline contained in the chapter - ("Known unto God are all his works from the beginning of the world" Acts 15:18) - which has not been touched upon, as it would prolong this paper unduly to take it up now, but doubtless sufficient internal evidence has been developed of a logical, orderly progression of idea, corresponding with the development of spiritual life as set forth in later scriptures, to show that the Holy Spirit of God is the author of the whole book, according to its claim.

It has long since been remarked that the order of development shown by the researches of geology corresponds with the order shown in this chapter, viz: - that the earth was once a watery waste, later solidified, and that vegetable life appeared first, followed by fish and bird life (in the order named), then the quadruped and finally man. Also the simple processes of nature which we see in operation around us every day teach us the principal of new, or resurrection, life, on a higher plan, after death, which is in perfect harmony with the teaching of the Bible throughout. Therefore, this view has the advantage over the theory of evolution that it rests on present-day facts "which may be observed and verified as often as we like," and is not based on hypotheses and deductions, as the theory of evolution notoriously is. Furthermore, those who hold the view which agrees with the Bible teaching are not obliged to retire behind a curtain of many millions of years, like the spiritualist into his dark cabinet, "their wonders to perform," but can point to present-day processes of nature in confirmation of their faith. Finally, if nature set out on her career by a gradual process of developing lower into higher forms of life, at what point did she reverse the process, so that what we observe taking place every day, at present, is the exact contrary of this method: i.e. we see lower becoming higher forms by being lifted up by the higher, losing their former identity in the process, and being translated, as it were, into a new form of life. In other words they are raised by power from above, and all power on the earth is from above. The rain from heaven which sustains life on the earth was raised by power from above in the sun. The heat value in coal, oil, and wood was all derived originally from the sun, or in other words, from above. Furthermore, man is able to control, within certain limits, and very larely to modify the forms and habits of the animal and vegetable kingdoms beneath him, although if he withdraws his controlling guardianship

they very quickly revert to their original type. But their showing themselves to be plastic to a limited extent in the hands of a higher power, in accordance with the law which we see in operation everywhere, proves exactly the contrary of their being able to raise themselves. Yet Mr. Darwin, in his "Origin of Species" devotes the first half of his book to citing what everyone knows, and has known from very ancient times, of the possibilities of breeding to modify species "only so long, however, as man, the higher power, retains his control" as a basis for his argument in the latter half of his book that the species have been able to modify themselves along the same lines, or in other words, to raise themselves to a higher plane by power from beneath, or within themselves. Nature's laws do not contradict themselves after this fashion.

"Now of the things which we have spoken this is the sum:"

If man has come up from an indefinite past of millions of years, slowly advancing and developing, then he is bound for an equally indefinite future and has no positive knowledge of any authority to which he is responsible for his actions beyond the light of his own reason. As a matter of fact, this logical result of that position is now being taught in the principal universities as the only binding code of morals. If this be true, then the Bible is a collection of the most colossal falsehoods that could be imagined, for it makes the most definite and precise statements regarding man's past and his future, as well as his responsibility to his Creator-God, and claims the authority of the eternal God for these statements. It is time for the learned gentlemen who have been patronizing the Bible as a good book, and at the same time flatly denying its statements, to take their stand either with it or against it. One cannot consistently hold to evolution and the Bible at the same time, for there is nothing equivocal about its statements.

The teaching of evolution is shown to produce lawlessness, so far as any fixed standard of righteousness is concerned, and there is no doubt that the rising tide of lawlessness and crime witnessed in recent years is largely due to the discrediting of the Bible by its false friends, and the consequent loss of respect for its authority as the revelation of God, which in turn removes the restraint which it formerly exercised over the actions of men.

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THE FALL AND ITS RELATION TO PRESENT CONDITIONS IN NATURE

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While there is much evidence in nature that can be used to show the handiwork of a beneficent Creator, there is also much apparent evil of various kinds, and attempts to learn something of God and His ways by the study of the created universe must take account of it. Although this evil seems to be almost inextricable interwoven into the very warp and woof of present existence, as Christians, we cannot ascribe evil to God the Creator, nor can we believe that He will allow it to mar His creation forever. Somehow we must reconcile conditions with the revealed nature of God.

The Bible has a great deal to say about human sinfulness and its consequences. It clearly states that by one man sin came into the world and death by sin, referring, of course, to the event we call the Fall. However, leaving out of present consideration the question of moral evil or sin, which in this present world relates only to man, we must admit the presence of other evil which is apparently independent of human sin. We may consider this evil under three classes, namely, waste, futility, and pain.

There seems to be in many ways a prodigal waste throughout the universe. Consider, for example, its incredible vastness, almost completely empty, dark and cold, with all life that we know of concentrated on one tiny planet and able to exist only within a narrow range of conditions. Correspondingly in living nature an almost immeasurable prodigality is seen with thousands of seeds produced for every one that reaches fruition. From one point of view the rarity of a habitable planet in the universe can certainly be considered as an evidence of design, but from another it might be seen as the one chance hit among countless misses. It might be argued that a good designer would be more careful of his materials and apply it all in a useful way rather than waste most of it in apparent uselessness for the sake of the extremely small proportion which reaches what seems to us the intended application. And yet we might ask whether so much is really lost. Does not much return for another use with no loss but of time, and does time count with an Eternal Being? The way the earth is heated by the sun may seem wasteful with almost all the energy being dissipated through space, but in a sense this is of the nature of light and God is light. It is His very nature to impart of Himself towards all without limit or end or restraint. So, although a thousand may be frequently sacrificed for one, sacrifice is not waste if directed to the right end. The answer to the question, "To what purpose is this waste?" was found by pointing out that underlying the deed was pure devotion directed towards a worthy object. Perhaps much that to us appears as waste is really a manifestation of the truths; "God is love" and "God if light."

Closely related to the apparent waste is the futility of so much of nature. Life, it seems, has an inherent incompleteness. It fails of its promise and does not realize its purpose. Even after the thousand have been sacrificed for the sake of one, that one is ineffective, incomplete, and fails to reach its true end. Parts of the Creation show remarkable cycles, which are carefully balanced but do not lead to progress in any definite direction. This seems to have impressed the writer of the book of Ecclesiastes and he wrote, "All is vanity." The thought of vanity or futility appears again in the New Testament in the significant passage in Romans 8: "the creation was subjected to futility, not of its own will but by the will of Him who subjected it in hope." (R.S.V.) Here, while the disappointing character of present evidence is recognized, at the same time a note of hope is emphasized. To this we will return later but now pass on to notice the third aspect of evil, namely, pain. In this case, we are on more definite ground. There is undoubtedly much pain and suffering throughout the world, even aside from that experienced or caused by man.

Possibly many lower animals have experiences that suggest pain to us but do not cause them conscious suffering even though they may react to it mechanically. But no one can doubt that some animals do suffer and as we believe them incapable of sin, they do not seem to deserve to suffer. Yet it seems inevitable for them. They are in the midst of a fierce struggle for existence, and their life is maintained only at the expense of life. Most of them manage to survive only for a short time in a relatively hostile environment which practically impels them to inflict pain or loss on others. In confirmation, we have a positive statement of Scripture which assures us that this is not an illusion of ours, for Romans 8 says that "the whole creation has been groaning in travail together until now."

Such considerations raise the questions "Why?" and "When?", and particularly suggest a correlation with the Fall of Man. It may be helpful to mention at this point an analysis by C. S. Lewis in "The Problem of Pain." He says that in a fallen and partly redeemed universe we should distinguish: (1) The simple good descending from God, (2) The simple evil produced by rebellious creatures, (3) The exploitation of evil by God for redemptive purposes and (4) The complex good to which accepted suffering and repented sin contribute. This will probably be worth keeping in mind when considering the explanation of present conditions as we observe them.

The atheistic evolutionist presumably sees evil as inherent in nature. In his view it has always been so. The struggle for existence leading to the survival of the fittest is of the essence of the process of evolution. The loss and pain are not of any particular significance and sin in man is largely a carry over from his animal inheritance. An explanation along these lines which omits all thought of God and in effect denies the facts of sin and redemption is, of course, quite unacceptable to the Christian.

Another view evidently fairly widely held in earlier times was that all the obvious evil, strife, pain, and death in nature were directly occasioned by man's fall. The discovery of fossils with their undoubted evidences of the existence of carnivorious animals long before man raised a difficulty in this connection. From the record of the rocks, there is nothing to confirm the idea that the animal world was at any time wholly vegetarian, and it is clear that a world in which no animal died is so far removed from the present one as to be hardly conceivable by us. There would still remain the inevitability of some pain due to accidents, fatigue and various privations. It is also evident that for herbivorous animals to become carnivorous would require not only a change of appetite but also a drastic change in body structure and organs, as well as a complete rearrangement of the balance of nature. In spite of the apparent difficulties, some recent writers have felt that the wording of Genesis 1 and the general tenor of Scripture requires us to believe that the animal creation as originally made by God, and described as "good," was entirely free from the pain, struggle and death which are so evident today. The fossils are then explained as showing the condition of animals of an earlier creation corrupted by the fall of a pre-Adamic race of beings inhabiting the earth. The state of nature today in these respects in correspondingly said to have come about by the judgment of God admittedly involving a very widespread miraculous change. Presumably this theory requires that of the animals mentioned in Genesis 1, none died before Adam sinned.

C. S. Lewis, recognizing that animals existed before man much as they are now, and apparently not accepting the discontinuity and other difficulties of the preceding theory, suggests that Satan or some other evil being had been at work in the earth before man arrived. It would then be the direct act of Satan that had caused the animals to degenerate so that they lived by destroying each other. He it was who introduced the high death rate and the corresponding wasteful fecundity. Lewis sees the parallel situation in the vegetable world but he does not concede that these phenomena are evil in vegetation. The animals which were made by God to function on a higher plane, so to speak, were thus by Satan caused to revert to "vegetable"

behaviour. This act must have taken place somewhere between verses 25 and 26 of Genesis 1, a supposition not hinted at in the record.

It is suggested, however, that on careful examination the Biblical statements bearing on the subject do not seem to support the above views, as the following notes may show.

In Genesis 1, the work of the third day includes the separation of land from sea and the bringing forth of vegetation. The result is described as good in God's sight. Presumably there is included the whole work of preparation of the earth's surface to be a suitable support for plant life. The plants are self-propagating and appear to have included from the beginning the same general pattern of life cycle as at present. Such phenomena as the fading of blossoms to produce fruit, the dying of the seed in the ground in order to produce a new plant, and the perishing of one plant to give place to another evidently belong to the original scheme of things, and "death" in these senses cannot be attributed to man's sin. Later in the story vegetation is given to man and the animals for food. Although not specifically mentioned in the list of things over which man has dominion, the inanimate world and its vegetation are no doubt included in that which is to be subdued. This general thought is confirmed in the second chapter, where Adam is placed in the garden of Eden "to dress and to keep it," implying consciously directed cultivation in order to obtain from the soil that growth which he desired for his support and pleasure. The word for "keep" comes from a root meaning to "hedge" and seems to suggest the idea of guarding from harm, presumably by enemies without.

After the Fall, a curse for man's sake is pronounced on the ground. Man will eat of it (its fruit) in sorrow; wearisome work will be necessary to obtain the required growth for food and in the wild state vegetation will be characterised, to a degree at least, by thorns and thistles. Thorns are said to be undeveloped leaves and may represent the features of plants which show evil in the sense of causing direct harm to men rather than being useful, although they may at the same time be a necessary protection for the plant in a hostile environment. Thistles, on the other hand, may represent the many weeds which, being of little use, grow with great freedom and hinder man's efforts in growing the plants needed for his support.

It does not seem necessary to assume that thorns and thistles did not exist before the Fall. They may have simply become more widespread, and due to changed conditions, some plants may have developed thorns and other abortive structures. In part, at least, the changed conditions Adam had to meet in his work of cultivation were probably due to his expulsion from the garden into a less hospitable and fertile part.

Consideration should be given in this connection to the punishment of Cain, who was "cursed from the earth," and for whom the ground would not yield her strength. A common interpretation of this seems to be that Cain would be driven from the region where his parents and other relatives lived to a comparatively barren part. Certainly it is not suggested that Cain's sin was in any sense another Fall.

We might notice that for disobedience, the Israelites and others were punished by curses which included failure of crops from drought, insect pests, and other causes. The prophets looking forward spoke of days to come, when the fir tree would replace the thorn, and the myrtle the brier, and desert lands become fertile. Finally in the new Jerusalem, there is seen the tree bearing fruit every month and having leaves for healing rather than thorns to wound. But no doubt this last and much of the earlier prophetic writing is symbolic.

On the whole, the consequences of the Fall in the inorganic and vegetable spheres seem to have been changes in conditions of degree rather than kind. The most important change seems to have been a decrease in soil productivity due to various

causes, possibly including climatic conditions. These results of the Fall can to a considerable extent be overcome by man by thought and work in what we consider purely natural ways, whether by his simple unaided labor, or by the use of modern machines and agricultural chemicals.

Turning now to the animal world, we read in Genesis 1 that marine animals and birds were brought forth out of the waters, and land animals and insects out of the earth. These are all described as good and are to reproduce abundantly. They are all placed under the dominion of the human race which suggests the need for control to prevent possible evil developments and, on the other hand, to develop potential but still undeveloped good. The opening verse of Genesis 3 deserves notice, "The serpent was more subtil than any beast of the field which the Lord God has made." Subtil almost invariably carries the thought of evil craftiness. The expression might suggest that the animal creation already showed definite imperfection particularly evident in the serpent.

When we pass on to God's curse against the serpent we should notice that He says, "Because thou hast done this," not "Because the man sinned." It seems clear that the serpent is much more than a snake and may not even have had any connection with the common reptile. Pember suggests that these and the succeeding words, "Thou art cursed above all cattle," imply a general curse on the animal creation, perhaps not through Adam's sin but because the serpent, as representative of the beasts of the field, yielded itself as an instrument to evil. This virtual ascription of moral responsibility to animals is not generally accepted though we might notice that God says in Genesis 9 that He will require man's blood "at the hand of every beast," and under the law any beast that killed a man was to be put to death. (Ex. 21) This provision could have been merely to prevent further harm, or to impress upon other people the sanctity of human life. In the New Testament it is positively states that it was by one man (Adam) that sin entered into the world, which seems to preclude the possibility of animals sinning. The passage (Romans 5:12) goes on to say that death came into the world through sin and death spread to all men. Death here as a consequence of sin would be referred to the human race only, not to animals which died long before Adam's sin. It must be confessed that we really do not know what animals are nor why they were made, and their relation with the spirit world is a difficult matter hinted at two or three times in the Scripture but not fully elucidated. A relation between evil spirits and animals is possible on occasion and in this case it may be that the animal was not changed at the Fall but the evil Spirit in some way suffered permanent degredation corresponding to the animal whose form it had assumed for a time.

However in the later passage in Romans the creation other than man is spoken of. Verses 18 to 23 of chapter 8 constitute an important statement in this connection and are quoted in full as translated by A. S. Way, "Ah well, as I estimate them, all sufferings that can betide in this life's span are not worth taking into account compared with the glory that is destined to be unveiled before our eyes. The eager yearning of all created things is waiting, waiting now for that unveiling of the vision of the Sons of God. All created beings have had to submit to a seeming purposeless existence - not of their own choice, but subserving some great design of Him who so had overruled all lives, - yet haunted ever by a hope that they also, even all God's creation, shall at last be emancipated from this thraldom to decay, shall at last emerge into the liberty of that glorious state which is the heritage of the Sons of God. All God's sentient universe, I trow, is sighing with one great voice, is suffering travail throes, from of old until now. Nay, nor that alone, - ourselves too, though our hands already grasp the firstfruits of the Spirit, yet are we sighing too, our very hearts are sighing whilst we strain our gaze afar to descry that ransom of our mortal frame, the Sealing of us as His sons."

Another New Testament passage bearing on the same theme is Hebrews 2 which points out that the world to come, in which the consummation of redemption is enjoyed, is to be subject to man. The many sons who are to be brought to Glory are not angels but men. Quoting from Psalm 8 it is further shown that this purpose of God is part of the inherent order and plan of creation. This plan is not yet visibly worked out because man's dominion was a vital part of it and man lost his dominion. It is, however, destined to be worked out and finally manifest in Jesus, made Lord and Christ. The writer also points out that the leader of this new creation Himself had to attain to His goal by a path which led through suffering and temptation, which in a measure were and are the lot of all flesh and blood. The necessity for this is not here ascribed to the sin of man but to the ultimate source of evil, the devil, the wielder of the power of death whom Christ destroyed by His death. The bondage under which man lies and with him all creation, is here associated with the fear of death. Clearly this thought is similar to the expressions in Romans 8 such as "subject to vanity or futility" and "bondage of corruption or decay." We should further notice that this plan of overthrowing death by dying and reaching perfection by suffering is "becoming" to God by whom and for whom all things are.

In view of the foregoing and other considerations, the following is proposed as a theory of the origin of various forms of evil in creation.

It does not seem necessary here to decide whether Genesis 1:1 described an original state of perfection or not, nor whether a catastrophe occurred after Geneses 1:1. However, it does seem clear that the conditions of Genesis 1:2 imply the presence of evil. This might have been due to a judgment of God on pre-Adamic sin (the catastrophe theory) or it might have been due to God's method of work in a sphere where sin was already prevalent. It does not seem relevant to the present discussion to inquire into these questions, but it is suggested as necessary to recognize that God's activity as described in Genesis 1:3 and on, is activity in a sphere basically under the control of the devil, and that this activity of God is conditioned by the sphere in which He works. In Lewis's terms the creation of Genesis 1:3 to 31 is not simple good descending from God, but complex good being brought about by the exploitation of evil. We must emphasize that in view of the nature of God and the nature of evil in so far as concerns that creation which comes within our comprehension, God does not, perhaps as we would say He cannot, obliterate evil and its consequences at a single stroke. He works by slow painful steps along a path overshadowed by death. It becomes Him to overcome death by dying and to reach perfection by suffering.

Thus where darkness is universal, perhaps under the undisputed reign of the rulers of this world darkness, God introduces light, not at once overcoming all darkness, but kept distinct from it as day and night. Eventually, but not now, it will be all light in the city of God, as God is light, without darkness at all. Meanwhile, although night brings a sense of fear, danger and difficulty, the succession of day and night which long antedates Adam, is part of that complex good suited to our present state.

Again the formless instability of the watery globe is changed by the appearance of areas of dry land on part of its surface. Without some land the higher orders of life seem impossible, but God has not yet done away with all the sea. At present, although the sea suggests a force destructive of the order which manifests life, and with its raging storms is often thought of as a symbol of evil, nevertheless there is again a complex good in the admirable balance between land and water in our present world. In the final state, redeemed creation has no more sea but only a river of life. The changing seasons, the weather and various climatic elements may be considered in a similar way.

Next, into the scene of emptiness, God brought life, first seen in vegetation. Because the sphere was one in which evil was present, vegetation, in itself good, was

in part manifest in imperfect and seemingly evil forms. These do not indicate that God created evil, but that in overcoming evil He works by that complex good, involving suffering and death. The thorny cactus is vegetable life best suited to the harsh conditions of the desert. The cycle of life and death in vegetation, and the apparent waste of reproductive power, are best suited to a world where many circumstances are unfavourable and forces of destruction are widespread. At the last, we see in the holy city the forest of trees with constant fruit and leaves of healing, no longer needing to withstand the changing seasons or other adverse conditions.

The same considerations suggest that the animal creation had its measure of suffering and evident groaning from the beginning. God did not create the evil, but He subjected His good creation to suffering which, though it might seem so, was not really useless. The suffering is like travail pains, definitely associated with and leading to something new and better. It is in hope.

So vegetables serve and make possible the animals, and both serve mankind. Both were originally placed under man who was given authority and responsibility for the well-being and improvement of the rest. The thorn which is absent from the cultivated plant illustrates the principle. Likewise the animal tamed and used by man shows more of the true animal nature than the wild. It is the same nature but seen in a sphere from which man has, in part, removed the evil. The vanity of the creation thus partly disappears when and as man fulfils his proper office. It will finally and completely disappear when the redeemed of mankind are glorified. In glory, animals are only seen directly related to man. The essential characteristics of lionhood and lambhood unite in the person of the Second Man without their present respective weakness or cruelty. Horses are seen serving their riders in carrying out God's purposes. Apart from and permanently opposed to mankind is the serpent, doomed to destruction.

Fundamentally, therefore, the evil in creation is due, not to Adam's sin, but to the fact that the creation is an essential part of God's plan to destroy the devil and undo his works. Man is, of course, also a part of this plan, and to an extent the evil in creation is with a view to man. The Fall which brought sin and death to the human race results in added suffering and loss to the rest of creation, in a negative sense because man is unable or unwilling to do it the good he otherwise might, and in a positive sense because he inflicts much additional unnecessary suffering by his actions. The ultimate attainment of the goal of creation is only in direct association with man as renewed in Christ. The groaning of creation is as in the pains of birth, after which the old order may pass away having fulfilled its end. There is no need to suppose the immortality of any individual animal. In fact such an idea is almost devoid of meaning. But the essential ideas, now manifested in distorted form in the various orders of creation may persist, and in the new heavens and earth be manifested in perfect form in association with and under the dominion of the sons of God. Perhaps this is suggested in the living creatures of Revelation 4.

In conclusion, we must admit that the whole subject is beset with difficult questions which we cannot claim to have answered, but perhaps we have been able to gain some new glimpses of the ways of God and the glory which yet lies before us. If on the one hand it is true, and it is, that the whole creation groaneth together, this implies a measure of unity extending even to the irrational and inanimate. On the other hand it is also true that it is God's purpose to sum up all things, not only all persons, in Christ, a consummation closely linked with the revealing in glory of the sons of God.

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WHY GOD CALLED HIS CREATION GOOD

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At the close of the third, the fourth, and the fifth days of creation God stated that what he had created was good. At the end of the sixth day he looked over all that he had made and pronounced it all very good. He did not say that it was primitive with potentiality for development, but good. These statements have been a point of attack for the critics of the Bible. The Christian, on the other hand, recognizes that God's evaluations are true and his decisions are final, so that the created world must be good even if it does not fit our convenience. But the discoveries of science help us to appreciate how God's statements were true.

The beneficence of water, oxygen and sunshine can not be doubted, but man does find foes and competitors among the creatures and organisms that make life difficult for him, and in his rage he hurls at them every epithet except good. It is true that there is a school of philosophers who say that we should acquiesce meekly and accept the world as we find it. Their spokesman was Alexander Pope, who stated in the "Essay on Man," "Whatever is, is right." Now Pope's plan was to place in polished form the ideas of the leading men of his day. These leading people in Western Europe during the eighteenth century were enjoying immense prosperity and so appropriating to themselves much more than they had earned. Little wonder that they could say, "Whatever is, is right."

God has the power to force all of his creation, including man, to do absolutely right. To explain why he does not do so would take us too far into theology. But the problem of this paper is to dissolve the discrepancy between God's evaluation and our evaluation of the universe. When we fail to agree with his statement it may be that we do not have the right definition of the word good, or it may be that the organic universe is not so good at present as it was when it was created.

Among created things that seem bad we find weeds, insect pests, predatory animals, pathogenic parasites, and defective strain of people, animals, and plants. As for weeds, many of them have uses. Dandelion furnishes a wholesome salad, medicine from the root, and honey and pollen from the flowers. These products of the flower are valuable to bees, coming at a time when workers need to be raised to gather later harvests of honey, notably that from clover. Weeds cover the soil, tending to prevent erosion, and add their decaying bodies to improve the soil. Man in his haste forgets that soil should be covered to protect it, and nature, looking to the centuries ahead, beneficently covers it with plants. But some of these plants conflict with man's plans to raise crops, and he calls them weeds. Many weeds are controlled with little difficulty at their original home but in a new region are more troublesome. The prickly pear cactus, Opuntia, is a useful feed plant, and I recall a farmer in Texas holding it over a little fire with a pitchfork, burning off the thorns so that he could feed it to his cow. It was taken from the United States to Australia to serve as pasture for the cochineal bug, Coccus cacti, from which dye is made. In the new country it spread and covered an area larger than England and Wales by 1922.* In 1925, 3,000,000,000 caterpillars of the moth Cactoblastis were distributed and they have practically eradicated the cactus.

This principle of increased reproduction following migration applies also to mammals, birds, and insects. At its home a species fitted well into the economy of nature but in a distant part of the world it thrived too well and become a pest. An

* Enc Britannica

example is the mongoose, Herpestes mungo, which in its native home of India is adroit at killing snakes. It was introduced into Jamaica to rid the island of rats; which it did rather promptly, increasing in numbers all the while, then started to devour birds. By this time the people wished they had not brought it in. Other examples are the rabbit in Australia, the English sparrow and Japanese bettle in America. God said they were good, but not necessarily good for all parts of the world.

Another seeming discrepancy in the Creator's planning is the existence of predatory animals. Some have conjectured that this was not the original plan, in other words that the lion did not eat the lamb in the Garden of Eden. This view is made plausible by the prophesy in Isaiah 11:7 that "the lion shall eat straw like the ox." If this is to be his food in the future perhaps it was his original diet. But on the other hand it is implausible that the lion was once an herbivorous animal in that his teeth are made for tearing flesh, not for grinding plants. If animals did not kill any living things, their food would be very limited. It they eat plants they take the life or at least decrease the vigor of the plant. Remembering that every seed contains an embryo plant, what multitude of lives are snuffed out by a grain-eating animal! Consequently if no life were taken the only food would be fruits, not including the seed, plants and animals that had died a nautral death, and milk, but not in an amount that would rob the calf. Consider also how general this habit of predation is; the wren is as much a bird of prey as the eagle.

But if God planned that one organism should be the food of another it need not make a problem for us. "A day less or more at sea or ashore, we die--does it matter when?"* Death is preferable to a prolonged, decrepit old age. Wild animals and birds seem to be happy and there is no evidence that they worry about impending death. They may not even suffer much when overcome by a predator. When David Livingstone was pounced upon by a lion that crushed his shoulder he testified that he felt no pain. His biographer** states, "Now everything became dreamlike to the lion's victim. He felt neither pain nor fear." Later, however, he felt excruciating pain from the eleven tooth wounds and the splintered scapula but not while he was under the power of the predator.

That this was not an exceptional case is set forth in the book, "Is Nature Cruel," written by an Englishman, J. Crowther Hirst. Writing to big game hunters and missionary doctors he secured the record of sixty-six men who were pounced upon by bears, lions, tigers, leopards, and panthers. Sixty-four of them felt no pain nor terror. If this be true of man with his intense emotions it should be more true of animals. God is merciful to them in the hour of death.

When we consider the bacteria that cause disease, however, who would have the complacency to say that they are good? We must recognize that most bacteria do not cause disease, but decay, thus returning to the soil the plants and animals that have died. It is certain that God created bacteria of decay for soil could not be fertile without them; and it may be that the pathogenic ones arose from these beneficent ones by mutation.

While this statement may seem like speculation, it is certain that comparable mutations have occurred. A mutation usually results in the loss of something, and if the bacteria of disease arose from bacteria of decay they lost the ability to grow by using compounds in the soil; instead of this they live within an animal or person and get food compounds already formed.

Mutations and other chromosomal changes have made many organisms inferior to the created type. Albino rats lack vigor as evidenced by the fact that they have

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* Tennyson, A, "The Revenge"

**Eaton, Jeanette; D. Livingstone Foe of Darkness, p. 68

been turned loose but failed to become established in the wild. The wild Drosophila is a better type of fly than any of its numerous mutant types, having more vigor and reproductive ability. In the beginning there were no children born deaf, blind, feeble-minded or albino for these mutant types had not yet occurred. The chromosome number, size, and gene content were still as the Creator had planned them. Had we been in the reviewer's stand looking over the parade of creatures we would have agreed that they were all very good.

By his patient and careful breeding for many centuries man has concentrated certain genes in his domestic animals and plants, developing the Jersey cow for butterfat and the Angus breed for beef, the sugar beet for sugar and the mangel wurzel for cow feed, etc. Man has the ability thus to control and improve by intelligent planning, being made in the likeness of God. In this respect also the organic world is good, being favorable raw material for man's breeding art.

The problem is not entirely solved in this paper for it is a big one, and bound up with the bigger problem of the origin of evil. Our failure to recognize the goodness of the universe comes mostly from two causes: either we do not know the meaning of the word good, or there have been changes for the worse since the creation. Here, as in many other studies, the discoveries of science help us to appreciate that God's Word is true.

I still can't see the good of a rattlesnake! - Ed.

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DISCUSSION:

Dr. Monsma: I noted that Dr. Tinkle distinguished between animal life and bacteria so far as their food habit was concerned. When he speaks of a herbivorous and carnivorous habit of animals he believes that animals before the fall, at the time of the creation, were carnivorous. When it comes to bacteria he wishes to assume that there were no pathogenic forms, but that by mutations pathogenic forms have come about later, after the fall, I assume, and it seems to me there is a little inconsistency there. I am just wondering why we can't assume that before the fall the animals were herbivorous and not carnivorous, and that they have become carnivorous due to mutations; that these teeth changes that he mentions and other changes, no doubt more radical changes too, have taken place by mutations since the fall. The reason why I suggest that is because in Scripture we do have an indication that man and animals ought to be herbivorous. We have no indication that God created carnivorous organisms until after the fall and after the flood. When we read Genesis 1:29 and 30, we read, "And God said, Behold I have given you every herb yielding seed which is upon the face of the earth and every tree in which is the fruit, and tree yielding seed, to you it shall be for food, and to every beast of the earth, and to every bird of the heaven, and to everything that creepeth upon the earth wherein there is life I have given every green herb, (notice the green) for food and it was so." That is immediately followed by this statement, "And God saw everything that he had made, and behold it was very good."

Mr. Turekian: Some dinosaurs were carnivorous, and were here before any indication of a fall.

Dr. Bullock: In that connection there is one verse that was brought to my attention some time ago and that is the sanction that God puts upon the carnivorous habit in the Psalms. In the 104th Psalm, for example, in the 21st verse we are told that "the young lions roar after their prey and they seek their meat from God." In other words they are getting sanction put on their carnivorous habit.

Miss Erdman: I appreciate Dr. Bullock's position because this is a matter that has been bothering me for an awful long time. I think that instinctively we turn from the idea of carnivorous animals as being good, at least it doesn't seem as though that is the kind of thing our God would approve. And yet as I have been thinking about it over this past year, the problem that Mr. Turekian has brought up of course is very obvious. Either the animals were carnivorous before the fall, or there must have been some sin on the earth before the fall. But there is another problem involved here too, and that is the balance of nature. If it were not for the carnivorous habit of animals, I wonder if you realize that man, within the space of probably about two days, would be run off the face of the earth simply because of the rapidity with which certain insects and bacteria, etc., would accumulate. I am sorry I don't have the figures on that with me now, but it has been demonstrated in some classes in which I have been that if it were not for the carnivorous habit in animals, man simply would not exist any longer. And this to me is at least another facet in the situation that ought to be considered, possibly pointing out that the carnivorous habit was ordained of God in order to keep things -- well, to make the earth a fit habitat for man.

Dr. Bullock: I'd like to give a first hand example of that. In the state of New Hampshire, for a good many years, there has been a bounty on bears and an overprotection of deer, so that at the present time there is a very serious danger of over population of deer, and by the way the overpopulation of deer hasn't served to the benefit of the hunters. The bear are actually being faced with extinction. So it is now being considered to remove the bounty of bears and actually protect the bear.... That is just one example that we have at the present time of the effect of the carnivorous habit.

Dr. Monsma: Like Miss Erdman, I am very much interested in the question because I think it is very important. I believe that what Miss Erdman has said, of course, applies to today, and I also believe what Dr. Bullock has said about conditions the way they are today. But, I believe that we should distinguish between today's conditions and the conditions before the fall. We are, after all, interpreting things upon the basis of Scripture and nature as has been said, and that is why I believe that we should take Scripture into consideration. Now, one of the greatest and most tremendous things that is related to us in the Scriptures is this matter of the fall. And we must take that into consideration in our interpretation. The effects of the fall are tremendous, and I'm afraid that sometimes we forget about that. As far as the cycle of nutrition in nature is concerned, well, I think that plants form a very important part, and bacteria too. In the main part of that cycle animals and man are on the subsidiary part depending upon that main cycle. Present conditions, I will admit, would not allow of all the organisms, animals and man being our basis, but we do not have the ideal condition at the present time. I think we should always take the tremendous effects of the fall into consideration; and we don't know exactly what the conditions were there but there is no indication in Scripture that there was anything of a carnivorous habit before the fall so far as I know it. The quotation that was read here from the Psalms, of course, in the first place, meat refers, I think, to food in general. In the second place, I am willing to accept that it is meat but that of course is a condition after the fall when the eating of meat has been approved and was put into that particular situation.

In this matter I am not trying to be dogmatic.... I believe you got from my paper. It is a big question in which we are just feeling our way, but there are some more things that need to be said. In the first place, the bacteria of decay are not ...They are sacrificed: they live upon dead material. So, that hadn't ought to make a discrepancy in my paper, it seems to me. It would be very hard for plants and animals in general to be sacrificed. The amount of food would be very, very much limited, you see. Of course, there are some animals that are sacrificed. Little water slaters, for instance. A little animal about the size and the build of the

sow bug which is perhaps more familiar. It lives in water. It lives on dead plants in the water. So there are some animals, of course, that live on dead material but most animals would find it hard to do that. And then about the lion and other carnivorous animals getting the teeth that they have through mutation. Mutation doesn't usually give us that sort of thing. Those teeth are too well formed. There is nothing defective about them as we usually find in a mutation. We must guard against the habit that if we think a certain change would fit our theory to say, "Well, a mutation gave that sort of change." Mutations will give us certain types of things but they don't give us just everything. And then, I do not believe in making such a big distinction between animal life and plant life. You go down to the smaller types of animals and plants and you finally get to the place where there is no distinction at all, and of course every biologist knows you find some organisms that are claimed both by the botanist and the zoologist. And, if animals do not bear excruciating pain and if they do not live in terror because of impending death, it seems to me that their becoming the food of another organism isn't so bad as we are inclined to think. We are inclined to mash a finger and, oh, how that hurts, and then we think if we break an arm or a leg or if we should have a worse accident the pain would be in proportion. In many cases it isn't at all. When I had my arm broken the doctor gave me a handful of pills to take when the pain became too great. I didn't take a one of those pills. But I have mashed a finger a number of times and it always hurts. We have to beware lest we make these predations in nature really worse than they are. I wouldn't insist too much on this point but it seems to me it's the general plan of God that certain organisms should be the food of other organisms.

Mr. Saarnivaara: We read in the Bible that after Adam and Eve had fallen into sin God said to Adam that he had to eat his food with the sweat of his eyebrow and that the earth would produce for him thorns and thistles. It seems that these words of the Bible indicate that some definite changes took place after the fall in nature. Possibly thorns and thistles existed before the fall, for we read that God created every kind of plant, but it is probable that when God cursed the earth after the fall such a change took place that the thorns and thistles and other weeds and also harmful bacteria and other things belonging to that category began to increase and disturb the happy life of men and perhaps even animals, so that some changes in the nature took place after the fall. For we read that God cursed the earth because of man. And because God cursed the earth we may conclude that after this curse the earth became different from what it was immediately after creation, so that the words of God--everything that He created was good--do not directly apply to the conditions after the fall. They apply to the conditions before the fall. And the second thing is that in the flood or deluge great changes took place again. We read in the Bible that God destroyed the face of the earth. He did not destroy the whole earth but the face--the surface part of the earth was destroyed and changed. And only after the fall we read of the seasons of the year and of cold and heat. It is quite obvious that this earth became less fertile and its climate became more rigorous after the flood. Therefore, two changes have taken place after God created this earth. The first change through the curse of God after the fall into sin, and the second change through the judgment of God through the flood. Therefore, calling good the works of God and everything that He created does not apply to the earth as it is now. It applies only to conditions immediately after creation. This earth is in a cursed condition in a two-fold sense and because of that there are so many troubles and things for us until...we know that God is the standard of what is good and what is bad. And if God created carnivorous animals and said that they were good for the sake of the balance in nature and for other reasons, of course we have nothing to add to the statement because God determines what is good and what is bad.

Mr. Turekian: There is nothing original, that I can see, about that change of the face of the earth. I think Dr. Kulp said it for us, that a flood of that dimension would have hardly any effect on the face of the earth. And possibly there was

weather before the flood too because it seems that we had at least several ice ages with varying weather. I think most geologists will agree that there was a variation of weather of some sort over the face of the earth before the flood.

Dr. Mixter: Regarding mutations being good or bad. Most of them are bad, but a small percentage apparently are good for this reason: natural species which can be crossed are different in mutational differences of a greater or lesser amount and those natural species existing in nature are apparently very well adapted to it. The differences between different species of cotton and between different species of fruit flies are really mutational differences. Now we have not seen enough mutations over enough periods of years to actually see one species change into another as the result of mutations, but we can find that they do differ in the mutations which they possess. The differences that they possess are differences of good qualities, so I think it is unsafe to argue because most mutations found in the laboratory are not valuable that none of them have been or could be.

Dr. Tinkle: We have to guard, however, against one possible error there. The differences that we find between varieties and species that have come from the same cource are not all mutations. Some of them are segregations, and if these original forms were created heterozygous then that gave an opportunity for several differences to arise--quite a number of them in fact--limited in extent but not all of these differences then would be mutations, but some of them segregations just as we find differences in the progeny of a cross. Cross two different kinds of peas--the different shape of the seed, the color of the seed, the color of the flower, and so on; then in the second generation you will find diversities that are segregations.

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THE PALEONTOLOGY OF THE HORSE

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One of our contemporary historical geology texts contains this statement: "The horse was a native of North America from early Eocene to late Pleistocene time and underwent most of its development here. Skeletons assembled from successive horizons reveal a gradual evolution in teeth, limbs, feet and size hardly equaled for any other stock of animals." (Dunbar, 1949, p. 468). Horse evolution has long been cited by evolutionists as a classic case of directional progression. On the other hand, non-evolutionists have been inclined to question the validity of the fossil sequence upon which the case is based; or at any rate they have wondered how unconsciously subjective the arrangement has been. Therefore it is worthwhile to make a brief survey of the following situations:

1) The postulated ancestry of the horse.

2) The relative ages of the strata containing equid fossils

3) The trustworthiness of this postulation.

The Postulated ancestry of the horse. Due to the capricious nature of fossilization, especially the fossilization of vertebrates, very often a group which is most interesting proves to be the one which is represented only by scanty and scattered remains.

Witness the known occurrence of only three specimens of birds in all the rocks of Jurassic age--one of them represented merely by a feather! One hesitates to draw conclusions from such evidence because there are few boundaries to check the free play of imagination. It is with relief, then, that a paleontologist turns to consideration of the perissodactyls, the mammalian order to which the horse belongs, for there is no dearth of fossil horse material. Romer declares, "Among all vertebrates there is perhaps no group whose fossil history is better known than that of the order Perissodactyla, the 'odd-toed' ungulates" (Romer, 1936, p. 319). Several of our great museums are store-houses of skeletal material which is sufficient for much research, although the specialist constantly meets problems which make him wish that these collections might be augmented. It is true that complete skeletons are rare, but there are enough skulls and long bones and partially complete skeletons to afford evidence of the many types of horses which have existed.

Not only is there an unusual abundance of horse remains but also a widespread distribution of those sites where such remains have been found. Thus our knowledge of the history of this group is not limited to one locality but encompasses a considerable span of space and time.

Based on this cumulative evidence, the following horse series with its concomitant changes is in good standing at present: The first true horse of North America is named Eohippus because of its occurrence in Eocene strata, although it now appears that the European Hyracotherium is the same genus and that that name should have priority. This little animal was about a foot high, the size of a fox terrier, with a short, slender face and eye orbits in the center of the skull so that the face length was one-half of cranial length. Its limbs were relatively long and slender and were unique in that the front feet bore four toes each, whereas the hind feet bore only three. Vestigial toes brought the number to a total of five for each foot. The teeth, always of significance in vertebrates, were low crowned and in most species were bunodont, a condition in which the surface is smoothly undulating rather than ridged or folded. From this it may be inferred that Eohippus was omnivorous in diet, just as from his feet we infer that he was a forest dweller rather than a plains animal. A short gap or diastema existed between premolars 1 and 2, and all the premolars were simple and triangular. Romer comments, "/Eohippus/ seems surely the beginning of the horse line but is probably close to the stock from which came the other odd-toed ungulates as well" (Romer, 1941, p. 143).

In Middle and Upper Eocene strata a slightly different horse is found, namely, that which is called Orohippus. This animal was much like Eohippus, but larger. The central digit of the foot is relatively and absolutely larger than that of Eohippus, and the splints of the non-functional toes of the hind feet have disappeared. The gap between premolars 1 and 2 persists, but the latter premolars (3 and 4) have lost their simple shape and have become molariform.

In Epihippus of still later Eocene time the premolars 3 and 4 have become morphologically identical with the molars, and there is no gap between 1 and 2.

The ensuing Oligocene epoch witnessed the appearance of Mesohippus. This horse was about the size of a full grown collie dog or a sheep. Distinctive features are the presence of only three toes both front and back, all of which touch the ground; the reappearance of the diastema; the molariform appearance of the second premolar, and the beginning of ridges on the crown of the cheek teeth (a condition known as lophodont dentition).

In later Oligocene times (Upper Oligocene strata) Miohippus exemplifies these same characteristics but in a larger body (about three feet high at the shoulder).

Miocene time is notable for a great and important change in the dentition of the new forms which appear. This change is the introduction of hypsodonty, or a high-crowned condition. The height of crown in Oligocene forms was only approximately half that height attained by Miocene forms. It is believed that this transition accompanied a change of habitat, and that from this time on the horses became dwellers on the plains where the rough grass demands high crowned teeth.

Parahippus is the horse in which hypsodonty is first suggested. Also in Parahippus teeth for the first time have some cement covering the crown. The diastema is well developed. This horse, not quite the size of a small pony, had the central of its three toes very pronounced, but its side toes were barely touching the ground. Merychippus of the Miocene attained pony size. Its dentition was definitely hypsodont (high-crowned) with cement playing an important part and with the pattern of the cusps essentially as in horses of today. The side toes were even more reduced than in Parahippus and failed to touch the ground, so that weight was now being borne by the central toe. Accompanying the new dentition was an enlargement of the jaw which lengthened the face relative to the cranium, thus displacing the orbits to the posterior. (Merychippus is thought to have given rise to another pony-sized form, Hipparion, which migrated to Europe in the next epoch).

It is postulated that the main line of equine evolution continued in North America during Pliocene time. Pliohippus continued the trend toward larger size, and according to Edinger there is no sharp demarcation between this and the Merychippus group. However, the average member of the genus was the size of a large pony. The upper teeth are notable for a strong curvature anteriorly. The length of its jaws approximated the modern status. Some species became truly mondactyl (one-toed) but retained splints of the side degits. By the beginning of the Ice Ages of the Pleistocene epoch true one-toed horses were almost universally present.

Equus, the one-toed horse, had and has members that are larger than any of the preceeding forms, though our familiar Shetland pony illustrates that not all members of the genus were outstanding for size. The teeth of Equus are larger, higher and more complicated than those of his fore-runners. For some reason yet unfathomed all horses became extinct in North America at the close of the Ice Ages and were re-introduced by man.

This series of horses is considered to be a phylogenetic series, that is, one in which each type is ancestral to the next. Of course this ancestry cannot be proved, but if the sequence is a valid one, it seems overwhelmingly probable that it is a phyletic sequence. And if it is a phyletic sequence, then one must admit that a certain amount of spontaneous change has taken place within this group. Tilly Edinger, who has done extensive research on the brain cases of these various forms, says, "Ours is not a series arranged by human judgment, but a phyletic series from consecutive geological periods; it represents the progressive evolution of one brain" (Edinger, 1948, p. 158). Thus she demonstrates her faith in the validity of the sequence as a phylogenty.

Relative ages of the strata containing equid fossils. In order to ascertain whether various horses did appear in the fossil record in the sequence which has been indicated, we must determine the relative ages of the strata containing them. This problem of equating units of time as they are represented by rock layers belongs to the realm of stratigraphy. Stratigraphic studies are, therefore, basic to the construction of any portion of a geologic timetable. Rule 14 of Nomenclature and Classification for the Geologic Atlas of the United States, reads, "The fundamental data of geologic history are: 1) local sequence of formations; and 2) the chronologic equivalences of formations in different provinces. Through correlation all formations are referred to a general time scale . . ."

Geologists admittedly have made many errors in correlation. Grabau tells us that "before fossils were extensively studied, similarity of superposition and lithic identity were taken as the guides to synchroneity..which..led to many erroneous correlations" (Grabau, 1913, p. 1121). It is implicit in this statement that the key to correlation lies in the fossils themselves, but there are methods of correlation which are valid and which are independent of fossil evidence. Schuchert explains the underlying principle of stratigraphy which he calls the Law of Periodicity: that there are cycles of earth movement, of sea invasion and land emergence, of erosion and sedimentation and cycles of organic evolution. Thus at no one place on the earth is there a continuous record of sedimentation of life since the beginning of time. Rather, the record in any one place is somewhat piece-meal and interrupted by gaps. A widespread emergence with ensuing erosion thus gives convenient demarcation for a unit of time and serves as a basic for correlating the strata deposited immediately before or after the emergence.

The non-paleontologic methods of correlating strata may be summarized thus, following Dunbar: 1) lithologic similarity; 2) similar thickness; 3) similar position in a sequence of formations some of which are known to be equivalent; 4) continuous tracing between outcrops; 5) lateral gradation and intertonguing of one into the other when the formations are lithologically dissimilar.(Dunbar, 1949, p. 12). All of these are locally useful and fully utilized by the geologist. Nevertheless there are many occasions when none of these criteria are appropriate and in such cases the paleontologic methods must be used. These are 1) occurrence of identical faunas, and 2) fossils that are dissimilar but are known to occur together elsewhere and therefore indicate the same age (Dunbar, loc. cit.).

Dunbar defends the paleontologic method of correlation by saying, "We now know, of course, that different kinds of animals and plants have succeeded one another in time because life has continuously evolved; and inasmuch as organic evolution is world wide in its operation, only rocks formed during the same age could bear identical faunas" (Dunbar, 1949, p. 8). Thus, since paleontologic correlation rests upon an evolutionary concept, we may not use such correlation to determine authentic horse phylogeny.

Actually, although the paleontologic method is most widely used for dating rocks, most geologists agree that it must be used with caution. Schuchert points out that very dissimilar faunas of the same general types of animals may be equivalent in age (Schuchert, 1923, p. 23). Nearly forty years ago Grabau cautioned that although "..most modern stratigraphers believe in the possibility of essential chronological equivalency of formations characterized by the same faunas..such equivalency is not necessarily indicated by the similarity of faunas, and..a given fauna may appear earlier and continue longer in some sections than others" (Grabau, 1913, p. 1125). He further declared that chronologic equivalence "has been repeatedly assailed by emminent geologists," (p. 1124), and cites Huxley, Geikie and H. S. Williams. More recently James Gilluly, past president of the Geological Society of America, made the following significant comments:

> If several species that arose in different centers eventually come to live in a particular area, it is not only conceivable, but has been shown by careful collecting, that there order of superposition may be different in different parts of the area. In other words, 50,000 year..units (are) far too short for distant correlations. When we take into account the entire fauna we never find such reversals, but the fauna as a whole does not, of course, change so quickly as the individual species constituting it. These reversals, therefore prove that even in theory it will never be possible to be certain of the precise equivalence of beds in widely separated regions... The finer the sub-divisions the paleontologist recognizes,

the more likely he is to find such reversals to superposition. This point is philosophically crucial, for all our geologic histories are based on paleontology and it can therefore never offer us a chronology capable of indefinite refinement" (Gilluly, 1949).

What, then, of the stratigraphy that is pertinent to the horse? There is evidence that early in the Cenozoic Era there was considerable disturbance of the earth's crust along the belt of the present Rocky Mts. which caused the structure of the Rockies to be defined and at the same time brought many of the great basins of the West into being. Streams flowing down from these mountains locally deposited layers of sediment on the plains to the east, but to the west, sedimentation was mostly confined to filling of the basins. Hence the Cenozoic layers of sediment west of the Rockies occur chiefly in structural basins such as the Uinta basin of Utah and Colorado, and the Bighorn, Wind River, Bridger and Wasatch basins of Wyoming. No layer designated as Eocene is found east of the mountains.

In mid-Cenozoic time there came a gentle warping along the Rocky Mountain axis which eventually caused the streams to cut down through their own deposits so that these ancient layers are now exposed to view. It is in these Cenozoic deposits that the fossil horse is found. Correlations from east to west of the Rockies can be made only by use of paleontologic methods, because no strata are continuous between the two areas. Furthermore, for the same reason, even inter-basin correlation west of the Rockies must be made by comparison of faunas. Thus in order to achieve an unpredjudiced picture we must lay aside the time-designations given to these various layers. We turn, then, to an examination of the geographic locations from which the fossil horses are known.

Little Eohippus is found at Greybull, Wyoming, in the Bighorn basin. Orohippus is known from the Bridger Basin, and Epihippus from the Uinta basin.

Mesohippus has a wider geographic distribution. Species are known from Montana, but are relatively abundant in the South Dekota Badlands. Here Mesohippus occurs in four successive horizons (Chadron; lower, Middle and Upper Oreodon zone of the Brule). In the immediately overlying horizon (Leptauchenia zone of the Brule) Miohippus has been discovered. Miohippus, in turn, is known also from the Lower Rosebud formation of South Dakota which is stratigraphically above the Brule formation. Above the Rosebud is the Harrison formation of Nebraska in which the same species of Miohippus occur. (Other Miohippus fossils lie in the John Day basin of central Oregon). In both the Lower Harrison and the Lower Rosebud primitive species of Parahippus make their appearance.

Members of the genus Parahippus become very abundant in the next highest layer (Upper Harrison), and it is further found in the Sheep Creek beds which overlie the Harrison, and finally in the stratigraphically higher White River beds. The same species are known from Nevada, Oregon and California. The Sheep Creek individuals are associated with primitive species of Merychippus, whose more representative species are found in the Pawnee Creek beds of northeast Colorado which appear to be stratigraphically above the Sheep Creek beds of Nebraska and below the Little White River beds. Merychippus species are also known from California and New Mexico.

Pliohippus has a geographic range which surpasses those of the proceeding forms. It is known from the Upper Snake Creek beds of Nebraska where it is just above a layer that contains a species of Merychippus. It is found also in association with Parahippus in the Little White River beds of South Dakota, and occurs in the Fort Niobrara formation of Nebraska which succeeds the Little White River. Additional species were fossilized in California, Texas, Oregon, Nevada, and Colorado.

Equus, the genus to which our modern horse belongs, left his early remains in Osborn's Loup River formation, which comprises glacial deposits of the Great Plains.

In summary, Eohippus, Orohippus, Epihippus, and Equus are stratigraphically isolated either in basins or otherwise, and therefore their relative ages cannot be determined without resorting to paleontologic methods of correlation, a procedure which we have ruled out a priori in this case. The remaining horses which have been mentioned all have representatives in South Dakota-Nebraska strata whose order of deposition can be determined fairly easily. Therefore at least this portion of our originally cited sequence appears valid:

Mesohippus is succeeded by Miohippus; Miohippus is partly contemporaneous with Parahippus but is eventually replaced by it; Parahippus subsequently is joined by Merychippus which then takes the ascendency while Parahippus continues. Pliohippus is found in beds above Merychippus and above those in which the final forms of Parahippus occur.

Obviously it cannot be proved definitely that any one of these forms was not contemporaneous with any or all of the others. This is a negative argument, albeit an important one. If, however, all these forms were contemporaneous, it is an almost unbelievable coincidence that they just happened to become fossilized in a deceptive sequence, for as Scott says, "Between Hyracotherium and Equus there is an immense difference in all parts of the dentition and skeleton, so great, in fact, that without the intermediate steps of modification, hardly anyone would be so bold as to assert that Equus had descended from Hyracotherium" (Scott, 1941, p. 911).

The trends represented by these successive forms are unmistakable: the increase in size, the development of a monodactyl condition, the appearance of hypsodont, curved teeth, the lengthening of the face. Surely there is reason to fit the Eocene horses into the picture, since they readily fall into line with these trends, and it appears equally valid to regard Equus as the culmination of the processes of change.

Our discussion thus far has dealt with the postulated main line of equid evolution, showing that certain genera which probably descended from one another have manifested trends of development. This same phenomenon can be observed on the level of the species. The Sheep Creek beds of western Nebraska have already been mentioned. Here in different horizons of a layer of sandy shale Osborn found fragments of five individuals of the species Merychippus isonesus. Each of these had distinguishing characteristics of sufficient magnitude that Osborn considered them five separate varieties. The bottom-most individual he assigned to the variety M.isonesus primus, and used secundus, tertius, quartus, and quintus to designate the others in the order of their superposition. Each one was larger than the one which occurred just below it, although the limb bones in M. isonesus quartus were the same weight as those of M. isonesus tertius. The limbs of the second, third and fifth varieties form a series of increasingly robust limb shafts. In M. isonesus secundus the ulna and radius are compressed but not fused. In the overlying variety these bones are actually fused for a short distance. These and other successive changes in this series vividly demonstrate that horses were constantly in a state of flux and that their changes exhibited a significant amount of pattern even in minor trends, or minor portions of major trends.

The whole question of pattern in the development of successive genera is fascinating. Granted that our horse series is a phylogeny, we have then admitted that a certain amount of evolution has taken place, and further, that this evolution has not been haphazard but has proceeded along well-defined paths, including increase of body size, development of one-toed feet, and so forth. Such "straight-line" development has been called orthogenesis, and according to Romer "has played a prominent part in paleontological thought," being "usually coupled with the

supposition that some mysterious principle lies behind the observed phenomena"--"a deity, or 'Nature'" (Romer, 1949, p. 105, 107). Romer continues by pointing out that the history of the horse was long thought to be undeviatingly orthogenetic, but that now the family tree is believed to have many branches and that the succession which we have presented is only the unbranched portion of that family tree. Then, since the definite trends which we have cited in this succession cannot be ignored, he offers this summary of current thought upon the subject, following closely after Simpson (Simpson, 1949).

> Orthogenetic phenomena, then, are probably much less common than they were thought to be. But even in cases where straight-line phenomena are present, there is no need to postulate any teleological principle to explain them. Phyletic lines of this sort are reasonably to be considered as due to orthoselection, process of increasingly improved adaptation to a relatively stable environment. Under such conditions any deviation from the 'normal' line would be negative as to survival value, and would tend to be eliminated; the potential branches of the 'tree' would tend to be pruned by selection before they became marked enough to become apparent in the fossil record" (Romer, 1949, p. 107).

Thus the horses have given us strong indication that directional change has occurred. Incidentally, to call this change "progress" is only valid insofar as it can be demonstrated that Equus is better off in his environment than Eohippus was in his, and this, of course, cannot be demonstrated. Beyond this point the paleontologist cannot go, and he must turn to genetics for an explanation of how such changes may have arisen initially.

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DISCUSSION:

Dr. Mixter: Eohippus is North American. There was an equivalent specimen in Europe called Hyracotheriam, which Miss Erdman referred to. That apparently became extinct rather early. This sequence is all North American, and this portion of it, as she emphasized, is found in superimposed strata so we're pretty sure that these specimens were descendents of one another.

Dr. Saarnivaara: Professor Frank L. Morse, says in his book, Creation, Evolution, and Science, which was published in Washington, D. C., in 1944, that the hoof of a modern horse has been found in Colorado deeper in conformable strata than Eohippus. Do you know anything about that? And how to explain it correctly?

Miss Erdman: I have heard rumors of Equus, (that is the modern horse), occuring in strata earlier or deeper in the earth than Eohippus, but in none of the literature with which I was dealing did I come across any reference to this. And I have never had any specific documentation for that. I would be very glad to know about it. I'd like to know who found if, if he was a competent geologist, if he knew his stratigraphy, and what the stratigraphic conditions were at the site of the discovery. And before we have those facts I don't believe we can make any comment; at least we can't make any definite commitment as to the occurence of Equus in much older strata. If we did find Equus in that much older strata it would certainly indicate that this horse sequence was merely a coincidental sequence, which as I tried to point out in my paper I think would be a very large coincidence. I am afraid that I can't give you any positive answer on that because of not ever having found the documentation for it.

Dr. Monsma, Chm.: Probably you have the documentation for it Dr. Saarnivaara.

Dr. Saarnivaara: I have read it in the book I mentioned.

Miss Erdman: You have read it in a book but, you see, if the book was quoting someone else, you would really have to know who he was quoting.

Dr. Kulp: This is quite trivial, but I wonder if Dr. Hartzler or Dr. Bender or someone from Goshen couldn't go in the library and get that book of Morse's and see if there is a reference. I certainly would say that if this is true, it is a very significant thing. But we have also read in some of the literature labelled "apologetic" and written by people who think that all geology can be interpreted in six thousand years, the statement that there was a shoe found in Mesozoic sandstone out in Nevada. There was no reference given there either, and that sort of thing you have to treat like flying saucers, I'm afraid. We should be very diligent to find any kind of available data like that, but the chances are that the specimen was taken out of a cave or some loose slump material. We must be very careful, but we certainly should go after it. If someone thinks they have some information, let's tract it all the way down and find out where it is.

Dr. Tinkle: I came across that same statement but it was several years ago and in a non-scientific newspaper; therefore, it requires much more search. But I am very much interested in it. But what I rose to ask about is that we have more of a discussion on size. Now there are some three toed horses that have been found but have considerable size. But again I have not read this recently and I cannot give the names or just where they are found, but I should like to have more discussion on that matter.

I have some reasons for wanting to know more about size. In the first place the loss of toes can readily be explained as has been explained through mutation. But if there was a gradual increase in size at the same time that there was a gradual

decrease in the number of toes through mutation, that's something that we don't find in our modern genetics. It usually doesn't work that way. It isn't often that mutation gives us added size and for a series of mutations, each one to give us an added size, would be something that is almost not found at all. And then, it may be that environment has something to do with size. Perhaps some of you saw the small horses that were taken from a canyon in California several years ago. It seemed that those horses had been trapped there a number of years ago, at least they could not get out. They could see them from the heights above. Finally they rigged up an expedition, let some men down in a cable basket and after considerable difficulty they caught three of these horses and brought them to the surface and exhibited them rather widely. How many of you saw them? I see two hands, I believe. Their backs were about the height of these tables. I saw two of them and I asked them about the third. They said the third one was taking care of a colt and, therefore, they did not care to exhibit it at that time. And then I asked them how the colt was getting along. And they said, very well, and they could see that it would be considerably larger than its parents, which indicates clearly that at least part of the small size of those horses was due to environment: they just had not gotten enough to eat. Now, it may be that the size of some of these fossil specimens was determined to a certain extent by their environment. That is something that is a little hard for us to check on at the present time. However, in cases where there are a large number of fossils we perhaps would not think that the small size was due so much to lack of food. I'd like to have a little more discussion on size.

Dr. Mixter: There is quite a discussion on size in Simpson's Tempo and Mode in Evolution. I'll give it to Dr. Tinkle.

Don Earl Boatman: I'd like to know on what basis they call the Eohippus a horse. It is my understanding that there were 300 major differences and I'm just a layman and trying to exercise some horse sense, but it seems to me that the person who would call that a horse is a jackass. Three hundred differences seems to me would disqualify the creature to be a horse. Now I'm hoping that someone can explain why they call this one a horse. That's for information.

Dr. Mixter: There were 300 minor differences as mentioned by Simpson. You see, he said that there was no appreciable difference between the two. This is the reason for thinking it's a horse. It's a backboned animal; it has hair and nursed its young by milk; it was attached to its mother by a placenta--part of the after-birth; it was a hoofed animal--it had hoofs on each of the three toes and four toes; it was an uneven-number-of-toes animal; it was a hippomorph, that is, horse-shaped in general curvature of the back, and so on; it was an equid, which means in many details of structure it was horse-like, "which is a classificatory way of saying that the vast majority of its multitude of morphological characters was already the same as those preserved in the modern horse." You can find statements in these books that if we only had Equus, the top one, and Eohippus, the bottom one, we might not connect them, that is, we would think they are entirely different genera or even different families. But it is because we have the gradual stages in between that we connect the two, and it's that sort of thing that has been found in a number of instances between species, between genera, that makes it look as though descent with modification the simplest explanation of their origin. And yet I maintain that the great gaps between the orders indicate that the first members of each of the orders was a creation.

Irvin Wills: I'd like to address a question to Miss Erdman concerning how complete fossil forms of these horses have been found. In other words, have you found complete fossilizations intact or in situ of say Eohippus, Eppihippus, or some of those?

Miss Erdman: I believe that I partly answered this question in my paper in referring to the abundance of horse material which is actually found, and there I stated that we do not to my knowledge have many if any complete skeletons of horses but that we have many partially complete skeletons, that is, certainly the significant parts of the horse, such as the limb bones and the skulls and the teeth which are probably the most important of all in dealing with vertebrates and particularly with horses. We have one specimen here which has a certain part of his anatomy preserved and here we'll have another specimen with a complementary part of the anatomy preserved, so that through comparing the types we are very readily able to compile a complete horse. In other words, if you have overlapping parts of two different specimens sufficiently complete to assure you that you are dealing with similar or the same animal, then it is perfectly valid to supplement one by means of the other, so that although we do not have any one complete series of intact complete skeletons we have enough material to make up such a series.

Dr. Mixter: Simpson's figures show 397 specimens of members of the family from lower Eocene, 54 from middle Eocene, 11 from upper Eocene. In the next stratum, Oligocene, 30 from the lower, 125 from the middle and 39 from the upper.

Dr. Monsma: It is always true however, isn't it, that when these specimens are studied there are two things that the investigators have in mind. One thing is the fact of actually finding the specimen and then the evolutionary idea, how does it fit in with it. I think that always plays a part and I suppose it should, in some way or other if we are studying the subject of evolution.

Robert Fischer: I'd like to ask a rather non-technical question. It's been suggested that the Christian in his own mind accepts creative acts of various types and yet in view of a quotation which was given about some of the previously considered missing links being found, an appreciable number apparently, it seems as though we are in a rather weak position and almost approaching a position of accepting creation merely to cover up our present ignorance. Is our position thus weak or are those really significant missing links definitely not being found.

Dr. Mixter: This is a very significant question. You see the evolutionist believes the gaps will be filled. We have said that the absence of specimens is in favor of the revelation we have which says that essentially there were no specimens filling the gaps. So it's a matter of believing whether they will be filled or not. Simpson said in 1944, that not only is there a gap between Eohippus and previous ancestral types, but this is true of all the thirty-two orders of mammals, and in most cases the break in the record is still more striking than in the case of the horse record for which a known earlier group does at least provide a good structural ancestory. Condylarthra look like horses in some respects so they could have been the ancestors. The earliest and most primitive members of every order already have the basic ordinal character, and in no case is an approximately continuous sequence from one order to another known." "In no case:" says this leading specialist in the subject. "In most cases the break is so sharp and the gaps so large that the origin of the order is speculative and much disputed. Of course, the orders all converge backward in time to different degrees. The earliest known members are much more alike than the latest known members, and there is little doubt, for instance, but that all the highly diverse ungulates did have a common ancestroy, but the line making actual connection with such an ancestory is not known in even one instance." He says there is a systematic deficiency of record and it looks to me as if this systematic deficiency is significant.

Dr. Monsma: It is interesting that you read this word speculation here. I recall a course I once took in the evolution of algae in which the teacher repeatedly stated, "Well, these are speculations--these are evolutionary speculations," and I think that these men will admit that too. When we are dealing with this evolution

we have what we called the other day "a great deal of imputation," and it falls within the realm of speculation. Now how much speculation is that? Is there too much speculation to warrant our adherence to the theory or is there an expected amount of speculation here? That does make a great deal of difference. Of course, our viewpoint does enter into the answer to that question, it seems to me, - our fundamental outlook on the thing.

Mr. Breneman: Regarding that matter of the gaps in the record, I would just like to make an observation which is advanced by those who believe must emphatically in evolution. You can take it for what you think it's worth. Experiments have been performed on some of the lower animals at least which show that when you put the animal under severe stress, such as extreme temperature, starvation or dehydration and lack of water, sufficiently severe to produce death in a very considerable percentage of the individuals, that this greatly increases the rate of mutation of the genes. Now, as to the missing record, one of the things that we always notice that whenever there is a non-conformity of the geological record that we see a sudden occurence of a new species on the two sides of non-conformity. Now, what has produced this non-conformity? There is probably no universal answer over the world, but a very common one, of course, is a rise in the elevation of the continent which produces wide erosion, a condition which does not make it very favorable for the preservation of specimens during that period of erosion, and such specimens as are washed down in the streams are deposited out in the ocean which later, when the continent submerges, becomes deeply buried in sea deposits that we cannot inspect. I just wonder to what extent those things have taken place--that these changes have been produced under severe stress of living conditions and the severe stress occurs at the time of elevation of continents during which the changes and mutations are taking place and when the conditions are not favorable for preserving of the record.

Dr. Tinkle: Whenever we get to talking about change through mutation there tends to be a dirth of duscussion on another type of change which I think we should not overlook, and that is change through segregation and recombination of genes. It brings about considerable change. Not if the animals or plants are members of the pure line, but we do not find pure lines in nature. Pure lines have been formed by man. Our strains of inbred corn are examples of practically pure lines. They are not entirely pure lines. But where animals or plants are heterozygotes then in future generations we can expect segregation and recombination of genes and it results in considerable change. We don't have to be believers in evolution to accept that. Genetics teaches us that. We've known that for a number of years. I mustn't take more time on it. I have an article on this subject that will be coming out some of these times in the Journal. I have expressed my ideas more at length there.

Dr. Monsma: I think we can perhaps close this discussion by calling attention to this fact that Dr. Mixter has pointed out, that changes can occur, and again Dr. Tinkle has pointed it out, but that these changes, according to these men are definitely limited to certain possibilities that have been put in the organism by the Creator and that they do not go beyond certain limits.

Dr. Kulp: I'd like to have a general question answered from biology. I'd like to know if there is any modern experiment to prove definitely that stress of temperature or pressure may increase the mutation rate. It has been shown that increase in radioactivity does.

Dr. Monsma: Are mutation rates changed due to pressure and temperature stress? Will someone answer that question for us before we leave this noon?

Dr. Kulp: Not temperature and pressure. I said, pressure or temperature.

Dr. Monsma: That's a logical change, isn't it? Any pressure of any kind--do they change mutation rates?

Dr. Tinkle: That is true in some cases. It's not only x-rays and ultra-violet light but also heat will increase mutation rate in certain organisms--certain seeds--and also the age of the seed has something to do with it. In Datura or the Jimson weed in which so many mutations have occurred they find that when the seed is old the mutation rate is higher. They have gotten this seed to live for as much as eight years, and seeds that are seven or eight years old will have more mutations than fresh seed.

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