

THE FOURTH MEETING

The Age of the Universe

Scene: Cheverus College

Dean Smalley

Good evening. Once again I would like to thank Father Rector and all our friends here at Cheverus College for their gracious hospitality. Tonight will be the concluding meeting on the second day of creation which deals with the origin of the universe, and our topic for this evening is the Age of the Universe. I will begin as usual by reading the Scriptural account of the second day:

And God said, "Let there be a firmament in the midst of the waters, and let it separate the waters from the waters." And God made the firmament and separated the waters which were under the firmament from the waters which were above the firmament. And it was so. And God called the firmament Heaven. And there was evening and there was morning a second day (Gen 1:6-8).

Dr. Arthur Schonfield

At our preliminary meetings the speakers agreed to use easily available and popular books in their various presentations to encourage student participation. One of the best known popularizers of science lore is Isaac Asimov, and I would like to begin tonight by reading from one of his many books, this one entitled *The Universe*. Asimov begins with the age of the earth. Even as late as the beginning of the nineteenth century most scientists were still under the spell of the fundamentalist interpretation of the Bible and assumed that the earth was only around 6000 years old.

“But the first half of the nineteenth century had seen an important revolution in attitude. In 1785, the Scottish geologist James Hutton (1726-1797) had published a book entitled *Theory of the Earth* in which he studied the slow changes that the earth's surface underwent - the layering of sediment, the erosion of rocks, and so on. He suggested the ‘uniformitarian principle’ which held that whatever changes were going on today had been going on at essentially the same rate throughout the past. According to this principle, it would take enormous stretches of time to produce all the thicknesses of sediments that could be found, all the erosion that could be observed, all the buckling and other forced changes to which the earth's surface had been subjected.

“Hutton did not persuade his readers at the time, but between 1830 and 1833, another Scottish geologist, Charles Lyell (1797-1875), published *The Principles of Geology*. In this book Hutton's work was summarized, popularized, and backed up by additional evidence. This eventually turned the trick, and geologists began to interpret the earth's history in terms of hundreds of millions of years.”¹

It is important to remember Hutton's "uniformitarian principle," namely that whatever changes are going on today also occurred at the same rate in the past. Towards the end of the nineteenth century the physicists entered the picture with Antoine Becquerel's discovery of radioactivity:

“As uranium gives off its radiations, its atoms change their nature, becoming other kinds of atoms which also give off radiations and change nature again. Eventually the uranium changes no further.

“The rate at which uranium changes in this manner follows a simple rule, well known to chemists as a "first-order reaction." This means that if the rate of change is determined over a short interval of time, it can be predicted, quite accurately, over any longer interval. It could be shown, for instance, that half of any quantity of uranium would break down and change to lead in 4.5 billion years. This tremendous time interval is called the "half-life" of uranium 238 (the most common form of the uranium atom.).

“Suppose now, that you consider a rock containing uranium compounds. Inside it, the uranium is constantly breaking down into lead. If the rock remains solid and unbroken, the lead atoms formed cannot possibly escape but must remain intermingled with the uranium. The uranium compounds may have been pure to begin with, but they become increasingly contaminated by lead. Since the rate at which nuclear reactions proceed is not effected by the puny changes in temperature and pressure encountered on the earth, we know that the exact quantity of lead accompanying the uranium depends on the length of time the rock has remained solid (and on the quantity of lead present originally) and not on any unpredictable environmental changes to which it may have been subjected.”²

By this new method it was soon established that our earth is approximately four and a half billion years old. From the age of the earth let us go on to the age of the universe, which lies in the domain of astronomy.

In 1979 the scientific community and the world in general, celebrated the centenary of the birth of Albert Einstein. Of the many television programs about Einstein at that time, my favorite was by Nigel Calder, whom we have met before, entitled *Einstein's Universe*. Here is Calder's presentation of Edwin Hubble's discovery of the Expanding Universe:

“In the 1920's and 1930's, Edwin Hubble sat at the 100 inch telescope on Mount Wilson night after night, year after year. For his painstaking research into the motions of

galaxies, he invented ways of estimating distances of galaxies and used Doppler's effect to judge their speeds. The light of a distant galaxy was always red-shifted - reduced in frequency - indicating that the galaxy was moving away from our own Galaxy, the Milky Way at high speed. This was remarkable enough; it implied a general expansion of the universe. Even more remarkable was the rule he discovered about the relationship of speed and distance. In 'Hubble's Law' the speed of the galaxies was in simple proportion to their distance: double the distance and the galaxies were going away twice as fast. By 1929, Hubble had established his law out to a distance of six million light-years...There was a big snag. Hubble estimated the maximum age of the universe since the expansion - the 'Hubble time' - at two billion years. Assuming that gravity had slowed down the galaxies since the expansion began, the universe had to be younger than that. But there was already solid evidence that the earth was several billion years old and many stars seemed much older. How could the earth be older than the universe?

“For this good reason, the Big Bang was treated with considerable reserve until the 1950's, when Hubble's former pupils began to discover flaws in his scale of distances. Since then the Hubble time has been revised upwards; nowadays it is generally taken to be about 10-15 billion years ago, which accommodated the ages of the oldest known stars (about 10 billion years) and of the earth (now put at 4.5 billion years).”³

In 1917 Albert Einstein published his General Theory of Relativity, and without realizing it at the time, his equations actually predicted the Oscillating Universe:

“When physicists and astronomers play at being God they try to imagine an overall 'design' for the universe which encompasses the origin and fate of all the atoms, stars, and galaxies within it, yet avoids trivia like the origin of the sun and the earth. Nobody ever played this game more skillfully than Albert Einstein or botched it so badly. He lost his nerve at the critical moment in 1917 when the oracle of his mathematics confided to him a cosmic story that he found altogether too sensational to believe...Leaving the details aside, we can say that Einstein's pristine theory of gravity shouted an extraordinary possibility. The maximum diameter of the universe may depend on its total energy and nothing else...

“In amazingly simple mathematics, the theory fills out the story of what I call the Simple Universe. It starts very small and spontaneously grows in diameter extremely rapidly. Thereafter the rate of expansion of the universe diminishes steadily as it approaches its maximum diameter. Then it stops growing and begins to collapse. It shrinks faster and faster, until once again it is extremely small, and all its contents are destroyed in a Big Crunch. Einstein's equations provided a modern version of Genesis and Revelation.

“The most uncanny feature of this story is that not only the maximum diameter of the universe but the entire time-scale of events is fixed by the amount of energy in it...By Einstein's simplest formulae, [the universe] is due to expand to a maximum diameter of about 40 billion light-years. Its total lifespan from its explosive genesis to its comprehensive doomsday is, by this

reckoning, about 63 billion years. From other information we can estimate that we are living at a time one-sixth of the way through the universe's life cycle, when it is still expanding rapidly. These estimates were not available to Einstein in 1917, but the general story was there, in his equations.”⁴

This is basically the same as Carl Sagan's argument which I read the last time, only instead of presenting it in terms of the total mass of the universe, Calder is using the total energy. The two are interchangeable. The Oscillating Universe Theory is accepted by most scientists today, and it is now thought that the universe goes through periods of expansion and contraction about every sixty billion years. It is at least ten billion years since the Big Bang occurred, and we have about fifty billion years to go until the Big Crunch.

But suppose there is so much energy in the universe that it continues to expand forever, or in other words, what if there was only one Big Bang? What existed before that Big Bang? A prominent American astronomer when asked this question replied, "I refuse to speculate." This attitude however is certainly not scientific and Nigel Calder does not refuse to speculate. Here are his interesting and amusing comments on this most profound problem:

“What came before the Big Bang? According to strict logic, thou shalt not ask that question. If time began with the Big Bang, the word ‘before’ has no meaning. But the human imagination will not be bound by logic and the question is an entirely natural one to ask. Indeed it is the point of convergence of all scientific, philosophical, and religious thought. To put it bluntly: did God just say ‘Let there be light!’ (meaning gamma rays) and the Big Bang ensued? Or did the energy come from somewhere else? Like ‘before’ ‘somewhere else’ has no strict meaning, yet we can sense the intention of the question...

“One solution to the problem offers itself. If ours is a Simple Universe or something like it, that will eventually recollapse into the Big Crunch, then you can quite easily imagine a new universe being born out of the ashes of the old one, in a new Big Bang...and so on *ad infinitum*. There are technical problems about such a yo-yo universe [the Law of Entropy], but it has an agreeable sort of plausibility. At the very least it gives a hint to the curious that the question of what came ‘before’ our universe may not be quite unanswerable. Yet the answer may be ‘nothing.’ As John Wheeler has remarked, it costs nothing to make a Simple Universe, in the sense that the energy put into its creation is fully recovered in its collapse. Conceivably universes are two a penny, and ours is just one among many that arise spontaneously.

“To pretend that there is no religious element in this curiosity about the cosmos would be idle. I have before me the writings of a Catholic theologian who explicitly favors the interminably expanding universe, which he sees as being in keeping with ‘faith in the Creator, and in a creation once and for all.’ Hindus and Buddhists, Marxists and many agnostics would prefer the yo-yo universe: the Easterners because it accords with their idea of endless cycles, and the others because they tell themselves that it removes the problem of initial creation to a comfortable distance - out of sight. Their preferences are, of course, beside the point when it

comes to evaluating the scientific evidence, but I mention them because they help to illuminate the passion and dedication with which scientists try to predict the long-term future of the universe. Religion as such may not come into it, but the religious urge to find meaning in life certainly does.”⁵

Fr. Robert A. Staats

The Anglican Archbishop Ussher, using the Hebrew text of the Bible, claimed that the universe was created in 4004 B.C. Ussher also thought that the "days" of the Hexameron should be understood in the strictly literal sense of a twenty-four hour period. But his interpretation of biblical time, still held by many fundamentalists, including Catholic fundamentalists, has been rejected by the Magisterium of the Church. Here is a decision of the Biblical Commission handed down in 1909:

“*Yom* - Whether the word *Yom* (day), which is used in the first chapter of Genesis to describe and distinguish the six days, may be taken in the strict sense as the natural day, or in a less strict sense as signifying a certain space of time; and whether free discussion of this question is permitted to interpreters.

“*Answer*: - In the affirmative.”⁶

As might have been expected, some conservative Catholic biblical scholars have tried to interpret the phrase "a certain space of time" in terms of millions of years, and thus construct a concordance or harmony between the biblical six days and the scientific discoveries on the age of the universe. But from our discussion of the literary form of the Hexameron, we have seen that such an attempt is futile.

Bruce Vawter is recognized as **the** authority on the book of Genesis in the Church today, and he is the author of the article on this subject in *A New Catholic Commentary on Holy Scripture*. Let me read his comments on "concordism" from this excellent article:

“Prompted by the laudable intention of defending the inerrancy of the Scriptures, another form of interpretation called concordism, appeared with the advent of modern scientific discovery. Concordism tried to safeguard inerrancy without turning its back on indubitable scientific facts by positing a harmony between biblical and scientific thought. It is true that the Biblical Commission in 1909 made a gesture towards the concordists by stating that there was nothing contrary to faith in taking *Yom* (day) to refer to an indefinite period of time. However...the Commission on the same occasion rejected the basic premise of concordism in its affirmation that ‘it was not the mind of the sacred author in the composition of the first chapter of Genesis to give scientific teaching about the internal constitution of visible things and the entire order of creation, but rather to communicate to his people a popular notion in accord with the current speech of the time and suited to the understanding and capacity of man.’...

“The basic error that lies behind these sallies into bad science and bad exegesis is a confusion as to the nature and the purpose of inspiration. The words of Genesis 1 are divinely inspired, but they are the inspired words of an ancient Israelite speaking to the men of his age as one of them in their language. For him to have anticipated the discoveries of modern science, divine revelation would have been a necessity, and there is not the slightest indication that any such revelation was given, just as there is no reason that it should have.”⁷

This point concerning the proper interpretation of the Hexameron is so important that it is worth repeating. Here it is again given in a slightly different manner by the Benedictine Ignatius Hunt in his popular *Understanding the Bible*:

“The purpose of the priestly account in Gen 1:1 to 2:4a in setting forth God's creative work in a six day mold was not to teach that God actually created everything in six twenty-four-hour days, nor was it to teach that he created six ‘periods’ of thousands of years (a concordist explanation that is even further from the sacred writer's intention!), but to show that God is the maker of everything and that man should observe the Sabbath. The six twenty-four-hour days are an artificial device used by the writer to stress Sabbath observance...To set forth a rigorously scientific account of how creation actually took place was obviously not the author's purpose, and hence does not fall under inerrancy in that way. We show fairness and reasonableness in judging modern writers. Is there any reason why this same fairness and reasonableness should not be shown to the biblical writers, who were no less human?

“...Our concern in all these matters is to take the Bible as it is, not to make it what we would like it to be. The Bible...is not a science manual, just as it is not history in the modern sense of “history for history's sake.”⁸

Ignatius Hunt concludes with our specific problem for tonight, the age of the universe:

“The creation account in Genesis loses nothing of its everlasting importance and meaning when understood in its genuine literal meaning. Its impact may strike the reader of the twentieth century as forcibly as the reader of the sixth-fifth centuries B.C. With the benefit of intervening Christian revelation and our recovery of much of the oriental background, we may even profit more from the account today than the readers of old.

“Speaking before the Pontifical Academy of Science on November 22, 1951, Pope Pius XII referred to the material universe as being between five and ten billion years old!”⁹

One of the reasons Pius XII gave as the scientific basis for this conclusion, was the recession of the spiral nebulae or galaxies. These nebulae, he said, are known to travel at speeds of up to 25,000 miles per second. We can imagine a backward flight of the galaxies like a motion picture in reverse, returning to the common spot where the cosmic processes began. Thus knowing the speed at which they travel plus their distance from the common point of convergence, the astronomers have estimated that these processes began some five to ten billion

years ago. Now I know that these figures must sound a little shocking to my conservative colleague, so let me read directly from Pope Pius XII:

“The examination of numerous nebulae pursued especially by Edwin Hubble at Mount Wilson Observatory, led to the significant result - however much tempered with reservations - that the distant systems of galaxies tend to move farther apart from each other with such velocity that the distance between two such nebulae doubles in 1300 million years. If we look back on the time required for this process of the "Expanding Universe" we see that from one to ten billion years ago the matter of all the spiral nebulae found itself compressed in a relatively small space, at the time the cosmic processes began.”¹⁰

As we can see, these figures are derived from Hubble's original estimate of the age of the universe, which Dr. Schonfield has shown to be in error, and has since been revised upwards by Hubble's disciples to around twenty billion years. The Holy Father concludes this part of his allocution with these comments:

“Although these figures may seem astounding, nevertheless, even to the simplest of the faithful, they bring no new or different concept from the one they learned in the opening words of Genesis: ‘In the beginning...,’ that is to say, at the beginning of things in time. The figures we have quoted clothe these words in a concrete and almost mathematical expression, while from them there springs forth a source of consolation for those who share the esteem of the Apostle for that divinely inspired Scripture, which is always useful ‘for teaching, for reproof, for correcting, for instructing.’”¹¹

In conclusion let me say again that any interpretation of the Bible which conflicts with established scientific data, is no true interpretation. The scientific community is unanimous in assigning an age of around twenty billion years to our universe. In 1951 Pope Pius XII accepted the then current scientific estimate for the age of the world, and that should be enough for most Catholics.

Mrs. Maria Stepan

I would like to begin tonight by commenting briefly on Nigel Calder's quote from a Catholic theologian who, he says, explicitly favors an interminably Expanding Universe as being in keeping with "faith in the Creator." We Catholics are not committed to any particular scientific theory concerning the end of the world, but only to the fact that the world is not eternal and will one day end. As I mentioned before, we know from our faith and from Holy Scripture that the world will not end in either a "heat death" or a Big Crunch, but will end as it began, by miracle. St. Peter writes:

“But the heavens and the earth which are now, by the same word are kept in store, reserved unto fire against the day of judgment and perdition of the ungodly men. But of this one thing be not ignorant, my beloved, that one day with the Lord is as a thousand years, and a

thousand years as one day. The Lord delayeth not his promise, as some imagine, but dealeth patiently for your sake, not willing that any should perish, but that all should return to penance. But the day of the Lord shall come as a thief, in which the heavens shall pass away with great violence, and the elements shall be melted with heat, and the earth and the works which are in it, shall be burnt up” (II Pet. 3:7-10).

Also the world will not end fifty or a hundred billion years from now as Calder claimed, but Our Lord in the Gospels clearly intends us to understand that it might end in our own life time.

We heard Dr. Schonfield present the so-called "uniformitarian" model of the geological column, first formulated by Hutton and later developed by Lyell, which claims that sedimentary layers of rocks were built up in the past at the same slow rate they are today. They were then able to claim that the earth was several hundred million years old, thus providing Charles Darwin with the time frame he needed to give his shaky theory of evolution some semblance of scientific respectability. But in the May 1994 issue of *Daylight*, a Catholic creationist journal published in England by Anthony Nevard, there is a fascinating article by a French geologist, Guy Berthault, entitled: *The laying down of marine sediments - a revolutionary perspective*. Guy Berthault is a Catholic and a member of *Circle Scientifique et Historique* (CESHE), a Catholic creationist group based in Belgium. Here is Guy Berthault:

“Rock strata appear as layers of rocks, one layer upon another, like several carpets spread out on top of each other. If the layers were really built up in this manner, then the top layer would be younger than the bottom layer. Stratification joints were attributed to the hardening of the upper layer during a period of time when the supply of sediment was interrupted. The fossils embedded in the rock layers were generally found to be deep-sea creatures at the bottom, then fish, followed by reptiles. This appeared to confirm the idea that the layers represented periods of time, and the progression of fossils reflected the progress of biological evolution. Only the complete absence of any intermediate forms marred this convincing interpretation of the layers of strata, or as it is known, the geological column.

“If this picture is right, and layers really are laid down one upon another, then how long does it take for each new carpet of sediment to be laid down on the sea floor? Basing his estimates on the principle that present-day very slow rates have always obtained, the solicitor Charles Lyell in 1830 produced a geological time scale of eras, periods and stages representing the passage of hundreds of millions of years. This interpretation displaced the Flood geology and paved the way for Darwin's ideas of evolution over vast aeons of time.”¹²

Berthault then describes a two year course of laboratory experiments which took place in the hydraulics laboratory of the Engineering Research Center at the State University of Colorado:

“As the water with its burden of coarse and fine sand progressed along the laboratory

channel, laminated layers began to be built up. The drop in fluid velocity immediately ahead of the advancing deposit caused the coarser material to drop out first, to be overlaid by finer sand. Thus laminae built up and progressed along the channel in the direction of the flow. The laminations could be shown to be caused by variations in the current speed. The layer on the bottom was not laid down first then followed by the next highest layer, and so on, as required by the evolutionary column. On the contrary, the laminated layers were formed upstream slightly earlier than the lowest layers downstream.”¹³

Berthault concludes his paper:

“But what of the succession of fossils in such a rapidly formed geological column? As the sediments are suddenly deposited, they engulf creatures at the level at which they were living. So the succession represents the different eco-spheres, from the deep sea trilobites up through fish to land based creatures, embedded at virtually the same time in a massive world-wide flood.”¹⁴

When Berthault presented the results of his experiments at the Third National Congress of Sedimentologists held at Brest, France in 1991, he was given a tremendous ovation by the 350 sedimentologists present, and received no adverse criticism. One remarked how refreshing it was having listened to interpretations all week, to hear of real experimental science.

Because Berthault has shown so convincingly that the geological column was laid down quickly, and not in millions of years, he has given us a powerful argument for the traditional date of the Noachian Deluge. There is nothing authoritative from the Magisterium regarding the age of the universe or the Flood, but Catholics can now confidently give the ages of the universe and of the Flood as stated in the Roman Martyrology, which is taken from the Greek translation of the Bible known as the Septuagint. I can't resist giving the whole entry for December 25th:

“In the year from the creation of the world, when in the beginning God created heaven and earth, five thousand one hundred and ninety-nine; from the flood, two thousand nine hundred and fifty-seven; from the birth of Abraham, two thousand and fifteen; from Moses and the coming of the Israelites out of Egypt, one thousand five hundred and ten; and the anointing of King David, one thousand and thirty-two; in the sixty-fifth week according to the prophecy of Daniel; in the nine hundred and ninety-fourth Olympiad; in the year seven hundred and fifty-two from the founding of the city of Rome; in the forty-second year of the empire of Octavian Augustus, when the whole world was at peace, in the sixth age of the world, Jesus Christ, eternal God, and Son of the eternal Father, desirous to sanctify the world by His most merciful coming, having been conceived of the Holy Ghost, and nine months having elapsed since His conception, is born in Bethlehem of Juda, having become Man of the Virgin Mary.”¹⁵

After discussing uniformitarianism, we heard Isaac Asimov go on to radiometric dating, claiming that we can tell the age of a uranium bearing rock by the amount of lead in it, since uranium decays into lead at a known rate. He thus arrived at an age for our planet earth of four

and a half billion years. Pope St. Pius X in his marvelous encyclical *Pascendi Gregis* said, speaking of biblical Modernism, "The philosopher leads the way, the historian follows, then in due order come the internal and textual critics." The Modernist begins with a philosophy of evolutionism derived from Hegel; from this he confects a history of the development of the Bible, then the internal and external critics enter to make the Bible fit the *a priori* history. Something similar is happening here. First comes the philosopher of atheistic naturalism (miracles are impossible), then a history of the origin of the universe is invented to fit this philosophy, then they have to find or make up a "science" to fit this preconceived history.

Even the humanists will admit they have no satisfactory theory of planet formation. Current hypotheses claim that the heavy elements are formed at the core of stars which explode, and somehow rocky planets coalesce from the debris. Radiometric dating requires that the elements in these rocky planets be originally in a pure state. Imagine the heavy elements forming in the hot core of a star, exploding into space and then on the newly born rocky planets, uranium, gold, iron, etc., all existing in a pure state! This is impossible in such a scenario, and every now and then some scientist is honest enough to admit it. The late Wallace Johnson, an Australian Catholic layman, recently published a book entitled *The Crumbling Theory of Evolution* in which he attempts to summarize primarily for Catholics, the scientific case for creationism which has been developed largely by Protestant creationist scientists over the past few years. Johnson deals at length with the scientific arguments of the creationists for a young earth, but he thinks the most telling argument is one that surfaced after his book came out. Let me play a few minutes of a tape of a lecture he delivered recently in Brisbane, Australia:

"Creation in 4004 B.C. - what a laugh! Bishop Ussher and his Bible believers have long been figures of fun for our scientific age. But now the laughing should stop. Dr. John Eddy, solar physicist, has been making detailed observations of the sun. Observations which in some interpretations are throwing into doubt basic theories of the age of the sun. Well that much I got into my book * - the next bit I didn't. Here it is. Dr. Eddy, an evolutionist, says he expects that the sun is four and a half billion years old. However, he also says. I quote: 'I suspect that we could live with Bishop Ussher's age of the world and sun. I don't think [listen to this], I don't think we have much in the way of observational evidence to conflict with that.' Put another way he is saying that the theories of billions of years of cosmic evolution have not much scientific data to support them. The leader in the field of solar physics is as good as saying that the Book of Genesis is unshaken by the facts of science. If only that could be told to our students! " ¹⁶

Let me now examine Fr. Staats's presentation on the age of the universe. I am always amused to hear liberal Catholics enthusiastically endorsing the decision of the Biblical Commission on *Yom* (day) when they reject all the other decisions handed down at the same time. Also Fr. Hunt's claim that Pope Pius XII accepted a universe billions of years old is simply not true. Pope Pius was mainly interested in showing how a legitimate scientific theory should lead an unbelieving scientist of good will to God. He considered the Expanding Universe such a theory, even though it has built into it such a fantastic age of the universe; he was neither endorsing the Expanding Universe Theory nor the age of the universe that the theory supposes.

Let me read just one of the many qualifications he gave during the course of this allocution:

“It is very true that as far as creation in time, the facts so far ascertained do not constitute an absolute proof concerning simple creation, as are those reached from both metaphysics and from revelation. The facts pertaining to natural science, to which we have referred, are still in need of further research and confirmation and the theories built on them are in need of new proofs and development, in order to offer a secure base for argumentation which by itself stands outside the realm of the natural sciences.”¹⁷

A Catholic then is free as a matter of private opinion, to hold either Archbishop Ussher's 4004 B.C. derived from the Hebrew text, the Roman Martyrology's 5199 B.C. from the Greek Septuagint, or the tentative billions of years of Pope Pius XII (provided that you include his qualifications), but none of these opinions can be taught authoritatively as a matter of faith. I personally prefer the Greek text to the Hebrew, because the early Fathers complained that the Jews had deliberately falsified the prophecies pointing to Jesus in the Hebrew text. So while I can't affirm this preference with any great certainty, it is not just a sentimental preference since the creationist movement has produced solid arguments for a young earth.

Let me conclude my presentation by turning again to Fr. Peter Fehlner speaking here of the "days" of the Hexameron, as six literal days of twenty four hours:

“...In the work of creation, the six days of Genesis, the Church has always understood God to be the principal Agent, although each of His actions during that period may not have been creative in the strictest sense, but only in the broader sense of miraculous. He may have used instruments already created, or acted Himself on pre-existent matter, as in the case of Adam's body "from the slime of the earth." In any case, although individual creatures once created may have acted before the end of the sixth day when God "rested," they did so directly under the creative power of God, and only after completion of the entire Work did the world begin to function with a relative autonomy in the sense of secondary, principal causality.

“The importance of this distinction can be illustrated with the popular objection to the creation of the heavenly bodies in a single day of 24 hours. It is claimed in the objection that the formation of these bodies would have postulated a duration of enormous length since such is the time required for light from these bodies to reach the earth at present, and that light was observed by the first man on his appearance (according to Genesis). This objection, however, begs the question. It assumes as certain what in fact the proponents of evolutionary theory should prove, that the processes now observed in the transmission of light from the heavenly bodies to earth - and the duration needed to traverse the distance between them - are the same by which they were made to shine initially. Where the Creator is the principal Cause, there is no reason why He cannot do all this without the aid of natural processes and with or without the duration pleasing to Him and appropriate to His ends (24 hours as Genesis tells us).”¹⁸

Let me begin my presentation on the age of the universe with the phenomenon we have heard so much about during these meetings, the "red shift." We have seen that both the Expanding and Oscillating Theories are based on this phenomenon. These theories assume that the red shift is a Doppler shift. But what if the red shift is not a Doppler shift? The assumption that the speed of light is always constant is based on observations of light traveling for only relatively short distances. What if the light coming from the distant galaxies has slowed down on its long journey? This would also explain the red shift, and would mean that the universe is not expanding, but rather static. It would also mean that the galaxies are not as far from us as had been thought, and of course, it would remove the basis for the currently accepted age of the universe. This is what is known as the "tired light" hypothesis, and is espoused by a minority of astronomers, among whom is Gerald Hawkins who is well known for his astronomical discoveries concerning the Stonehenge monument. Let me read a brief excerpt from a standard text, *Exploration of the Universe* by George Abell:

“Are the Red Shifts Really Doppler Shifts?”

“Not all scientists accept the interpretation of the red shift as an indication of an expanding universe. They argue that the observed red shifts in the spectra of distant galaxies may not be Doppler shifts at all, but may be caused by some unknown effect on light as it travels over large distances. It has been suggested, for example, that photons may lose energy or ‘tire’ as they traverse space; since the energy of a photon is inversely proportional to its wavelength, the ‘tired light’ hypothesis could explain the red shifts of the lines of the spectra of remote objects.”¹⁹

The "tired light" hypothesis should be capable of experimental verification, what with the space shuttle, laser beams, etc., and especially these amazing atomic clocks that can measure time to less than one billionth of a second.

Let me go on now to the creationists and the age of the universe. Here again is Dr. Henry Morris from the section of *Scientific Creationism* intended for use in the public schools:

“...The creation model does not, in its basic form, require a short time scale. It merely assumes a period of special creation sometime in the past, without necessarily stating when that was. On the other hand, the evolution model does require a long time scale. The creation model is thus free to consider the evidence on its own merits, whereas the evolution model is forced to reject all evidence that favors a short time scale.

“Although the creation model is not necessarily linked to a short time scale, it is true that it does fit more naturally in a short time chronology. Assuming the Creator had a purpose centered primarily in man, it does seem more appropriate that He would not waste aeons of time in essentially meaningless caretaking of an incomplete stage or stages of His intended

creative work.

“In any case, the creation model permits us to look seriously at those natural processes which seem to favor a young earth and a recent creation. We shall see later...that there exist many such processes. Unfortunately, most people do not know this, since we were all indoctrinated as children in school with one model of origins exclusively. Only those processes which seem to favor an exceedingly old earth and old universe were included in our instruction. Teachers should now be careful to include a fair presentation of both types of processes - those which seem to support the evolution model by their consistency with a very old earth, and those which seem to favor the creation model by pointing to a recent origin of the earth and the universe.”²⁰

That the red shift method of measuring the age of the universe is highly subjective, and therefore of doubtful scientific value, is evident from Hubble's original conclusion that the universe was younger than the earth! So let me go on now from the age of the universe to the age of the earth. We have heard from Isaac Asimov that the method of measuring the age of the earth is based on the decay rate of radioactive uranium into lead. Dr. Morris has an excellent critique of this method of measuring the age of the earth:

“There is no way of being sure that the radiogenic daughter products of uranium...decay were not present in the minerals when they were first formed. This possibility is most evident in the case of modern volcanic rocks. Such rocks formed by lava flow from the earth's interior mantle commonly contain uranium minerals, and these, more often than not, are found to have radiogenic, as well as common, leads with them when the lava first cools and the minerals crystallize.

“Sidney P. Clementson, a British engineer, has recently made a detailed study of such modern volcanic rocks and their uranium ‘ages,’ as published in Soviet geophysical journals and other papers, and has shown that in all such cases the uranium-lead ages were vastly older than the true ages of the rocks. Most of them gave ages of over a billion years, even though the lava rocks were known to have been formed in modern times. This is clear, unequivocal evidence that, as Clementson says: ‘Calculated ages give no indication whatever of the age of the host rocks.’ ...

“Since, in those cases of igneous rocks whose age is known, the uranium method gives ages which are aeons too large, and since their uranium minerals are normally found in igneous rocks formed by the same kind of processes, therefore it is very probable that their uranium ‘ages’ also will be aeons too large for the same reasons. Why should the uranium ages be assumed correct when applied to rocks of unknown age when they are always tremendously in error when calculated on rocks of known age.”²¹

Dr. Morris then discusses many scientific dating methods that indicate a young earth. Let us look at just one among many - the decay rate of the earth's magnetic field. All these

dating methods, such as the uranium-lead method, are based on what is called a "uniformitarian" assumption, namely, that the physical processes operated at the same rate in the past as they do today:

“A...very important geochronometer is based on the strength of the earth's magnetic field. This evidence is found in a remarkable study by Dr. Thomas G. Barnes, Professor of Physics at the University of Texas in El Paso. Dr. Barnes is the author of many papers in the field of atmospheric physics and of a widely used college textbook on electricity and magnetism. He has pointed out that the strength of the magnetic field (that is, its magnetic moment) has been measured carefully for 135 years, and has shown, through analytical and statistical studies, that it has been decaying exponentially during that period with a most probable half-life of 1400 years.

“ This would mean that the magnetic field was twice as strong 2800 years ago, and so on. Only 7000 years ago it must have 32 times as strong. It is almost inconceivable that it could have been much stronger than this. Thus 10,000 years ago, the earth would have had a magnetic field as strong as that of a magnetic star! This is highly improbable to say the least...

“Thus 10,000 years seems to be an outside limit for the age of the earth, based on the present decay rate of its magnetic field. Any objections to this conclusion must be based on rejection of the same uniformitarian assumption which evolutionists wish to employ on any process from which they can thereby derive a great age for the earth.”²²

Let me turn now to the section of Scientific Creationism which is intended for use only in Christian schools. Here is Dr. Morris' discussion of the difficulties involved in determining the exact age of the universe by means of the Bible:

“The genealogical lists in Genesis 5 give the age of each man in the line from Adam to Abraham at the birth of the son who is next in line. When these are added, they give a total of 1656 years from Adam to the Flood. A similar list for the post-diluvian patriarchs in Genesis 11 gives 368 years from the Flood until Abraham migrated into Canaan. Abraham's time is well within the period of recorded history. Although a number of detailed chronological questions for the post-Abrahamic period are not settled, there is general agreement that Abraham's migration occurred no earlier than 2000 B.C.

“Therefore the date of the creation, as obtained by simple addition of the figures given in the Bible, was about 2040 years prior to Abraham's journey from Haran to Canaan, or around 4000 B.C....

“Dates such as these are considered by modern anthropologists to be quite absurd. These scholars believe man to have been on earth for at least a million years...

“The sharp disagreement of the Genesis chronologies of human pre-history with these

speculations of evolutionary anthropology and archaeology is a matter of serious concern. This problem has led to various theories about imaginary "pre-Adamite" men and has been one of the reasons why so many modern theologians have relegated Genesis 1-11 to the realm of mythology, rejecting its historical content altogether.”²³

Dr. Morris thinks that there are only three acceptable solutions, biblically speaking, to this admittedly difficult textual problem:

“1) Accuracy of Transmission

“For those who take these chapters historically, there seems to be three possible approaches to consider: it may be possible that the numbers in Genesis 5 and 11 have been corrupted by faulty transmission. The Massoretic text, on which the figures cited above were based, differs from the Septuagint 1466 years to the period calculated above from creation to Abraham.

“This would only extend man's creation back to about 5500 B.C. at most, and this is only a drop-in-the-bucket compared to the demands of evolutionary chronology.

“Genealogical Gaps

“To the extent that sound archaeological research may require dating of earlier settlements earlier than the traditional Ussher chronology allows, the Bible does indicate the possibility of minor gaps in genealogies (especially between the Flood and Abraham) which may correlate with such dates.

“ Revision of Secular Chronology

“On the other hand, it should be realized that the archaeological dating of prehistoric human sites is a highly uncertain process, involving a great number of unverifiable assumptions (as in the radiocarbon technique) and subjective evaluations (as in pottery correlations). All of which to some degree are based on evolutionary presuppositions. In the absence of actual proof to the contrary, the date of creation...[is] quite reasonably placed within the past several thousand years.”²⁴

Dean Smalley

It is time for me to conclude our discussion by attempting to summarize our four presentations. Our second day of creation deals with the origin of the universe, and our topic for this evening was The Age of the Universe.

Dr. Schonfield presented the scientific arguments for a universe approximately twenty billion years old based on the phenomenon of the red shift. But of course this means, he said,

only the time since the Big Bang, since the majority of scientists think that the universe is eternal.

Fr. Staatz rejected the age of the world based on the biblical chronology of Archbishop Ussher, since, he said, this age ignored the non-historical literary genre of the first chapters of Genesis. He claimed that Pope Pius XII had accepted, at least tentatively, the age of the universe claimed by modern science.

Mrs. Stepan claimed that Catholics knew from their faith and Scripture, that the universe would not end in a "heat death" or a Big Crunch, but that it would be destroyed by fire, even possibly in our own lifetimes. She said that the Pontifical Biblical Commission had left the age of the world open, and that we are free to hold a universe billions of years old, provided we make all the qualifications which Pope Pius XII attached to this opinion, or the young ages derived from the Hebrew and Greek texts. She claimed because of the experimental demonstration by Guy Berthault of the catastrophic model as opposed to the uniformitarian model of the geologic column, she felt extremely confident in believing in a young earth. She expressed a personal preference for the age based on the Greek Septuagint, but said it could not be taught with any great authority.

Rev. Swezey considered the scientific method of arriving at the age of the universe highly subjective, as evidenced by Hubble's original proposal that the universe was younger than the earth! He claimed that there were equally valid scientific methods that give a younger age for the universe, such as the "tired light" hypothesis, and a younger earth, such as the decay of the earth's magnetic field. He saw no reason therefore, to reject the commonly accepted biblical chronology, give or take a few thousand years.

This concludes our discussion for this evening, and we will meet again next week at Cabot University.

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THE THIRD DAY

The Origin of Life

THE FIFTH MEETING

From Spontaneous Generation to Abiogenesis

Dean Smalley

Good evening, and welcome again to Cabot University. Tonight we will discuss the third day of creation, which deals with the origin of life. We have scheduled only one meeting for this day which we have humorously entitled *From Spontaneous Generation to Abiogenesis*. Here is the Scriptural account of the third day:

And God said, "Let the waters under the heavens be gathered together into one place, and let the dry land appear." And it was so. God called the dry land Earth and the waters that were gathered together he called Seas. And God saw that it was good. And God said, "Let the earth put forth vegetation, plants yielding seed, each according to its kind upon the earth." And it was so. The earth brought forth vegetation, plants yielding seed according to their kinds, and trees bearing fruit in which is their seed, each according to its kind. And God saw that it was good. And there was evening and morning a third day (Gen 1:9-13).

Dr. Arthur Schonfield

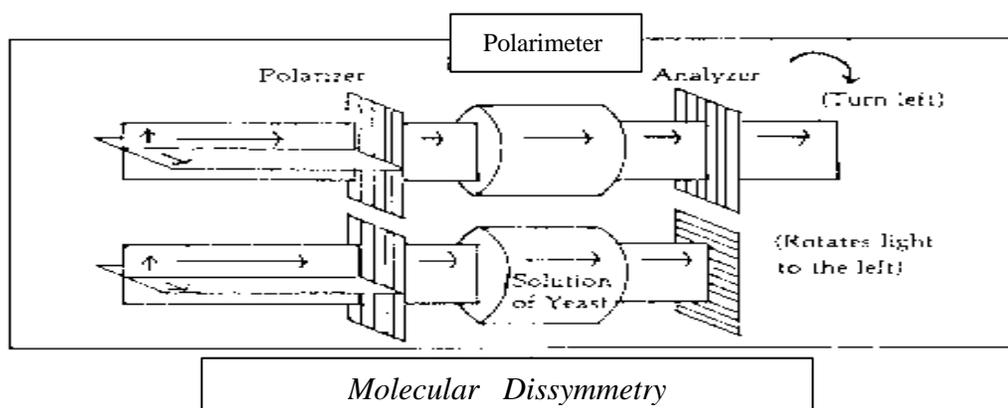
Jacob Bronowski in his *The Ascent of Man* begins his discussion of one of our "ultimate questions," the origin of life, with a humorous presentation of the old notion of spontaneous generation.

“When the theory of evolution implied that some animal species came into being more recently than others, critics most often replied by quoting the Bible. Yet most people believed that creation had not stopped with the Bible. They thought that the sun breeds crocodiles from the mud of the Nile. Mice were supposed to grow of themselves in heaps of dirty old clothes; and it was obvious that the origin of blue-bottles is bad meat. Maggots must be created inside apples - how else did they get there? All of these creatures were supposed to come to life spontaneously, without the benefit of parents.

“Fables about creatures that come to life spontaneously are very ancient and are still believed, although Louis Pasteur disproved them beautifully in the 1860's.”¹

Dr. Bronowski did not describe Pasteur's refutation of spontaneous generation, but concentrated instead on his discovery of what is called molecular dissymmetry. Let me review this subject briefly. The human face is symmetrical, that is, it can be divided in half and is the same on both sides. But the hands are unsymmetrical, or dissymmetrical, that is, the right and left hands are different, in that they cannot be superimposed one on another. The amazing thing that Pasteur discovered is that chemicals in inanimate or non-living nature are always symmetrical, while those in animate or living nature are always unsymmetrical. It is as if in non-living nature there were both left and right-handed gloves, while in living nature there were just left-handed gloves.

I have put an illustration of an instrument on the blackboard called a polarimeter



which Pasteur used in his discovery of molecular dissymmetry. A beam of light is shone through the polarizer, a sheet of crystal tourmaline. In the drawing, for the sake of simplicity, I have indicated the light vibrating only up and down and sideways, although actually it vibrates in all directions. As the beam of light passes through the polarizer, it comes out vibrating in only one direction. The crystal lattice of the tourmaline acted like a picket fence, and allowed the up and down vibrations to slip through the slats, but blocked the sideways vibrations. The now polarized light continues through a glass container in which there is a solution of, say yeast, and passes through a second polarizer called an analyzer. If the analyzer is rotated to the left or counterclockwise and the crystalline slats block the polarized light, the solution is said to be optically active to the left, indicating that the chemical molecules in the solution are left-handed in structure, like a left-handed glove. Were a different solution to block the light if the analyzer was rotated to the right or clockwise, it would be said to be optically active to the right, indicating that the molecules were right-handed in structure, like a right-handed glove.

By the use of this instrument Pasteur demonstrated that any solution which contained living matter is always left-handed, or in other words, living things are always unsymmetrical. In the TV version of *The Ascent of Man*, Bronowski was in Pasteur's laboratory seated at Pasteur's own polarimeter:

“Right hand, left hand, that was the deep clue that Pasteur followed in his study of life. The world is full of things whose right-handed version is different from the left-handed version: a right-handed corkscrew as against a left-handed, or a right snail against a left one. Above all, the two hands; they can be mirrored one in the other, but they cannot be turned in such a way that the right hand and the left hand become interchangeable. That was known also in Pasteur's time of some crystals whose facets are so arranged that there are right-hand and left-hand versions...

“Pasteur made wooden models of such crystals (he was adroit with his hands, and a beautiful draughtsman) but much more than that he made intellectual models. In his first piece of research he had hit on the notion that there must be right-handed and left-handed molecules too; and what is true of the crystals must reflect a property of the molecule itself. And that must be displayed by the behavior of the molecules in any unsymmetrical situation. For instance, when you put them into a solution and shine a polarized (that is an unsymmetrical) beam of light through them, the molecules of one kind (say, by convention the molecules Pasteur called right-handed) must rotate the plane of polarization of the light to the right. A solution of crystals all of one shape will behave unsymmetrically towards the unsymmetrical beam of light produced in a polarimeter...

“The remarkable fact is that a chemical solution from living cells does just that. We still do not know why life has this strange chemical propensity. But the property established that life has a special chemical character, which has maintained itself throughout its evolution. For the first time, Pasteur had linked all the forms of life with one kind of chemical structure. From that powerful thought it follows that we must be able to link evolution with chemistry.”²

Let me go on now to abiogenesis, a Greek term coined by Thomas Henry Huxley, meaning "life from non-life." Huxley's mentor Charles Darwin was a Deist, who believed that God had created the world, but had then let natural forces such as evolution, take over. However, he could not see how life could have evolved from non-life by chance alone, so he brought God back in, as a sort of *Deus ex machina*, to create life; then he sent Him back again into space or somewhere. But in Germany, Darwin's other great ally, Ernst Haeckel, an atheist, claimed that life had evolved from non-life by chance alone at the bottom of the sea in what he called the *Urschleim*, or "protoplasmic sludge."

In 1868 a British naval vessel, the *Challenger*, which was equipped with a deep sea dredge, dragged up some mud from the bottom of the ocean. Huxley, after examining the mud, announced that it was moving, indeed was alive! He named it *Bathybius haeckeli*, "Haeckel's deep mud." However, other scientists on examining the mud said that the movement Huxley had observed was merely trapped gas bubbles. Huxley tried to hang on, but after nine years reluctantly withdrew his claim. But in the meantime he had managed to convince Darwin that God was not needed to explain the origin of life. In 1871 Darwin wrote:

“It is often said that all the conditions for the first production of a living organism are now present which could ever have been present. But if (and oh! what a big if!) we could conceive in some warm little pond, with all sorts of ammonia and phosphoric acid salts, light, heat, electricity, etc., present, that a protein compound was chemically formed ready to undergo still more complex changes, at the present day such matter would be instantly devoured or absorbed, which would not have been the case before living creatures were formed.”³

In 1924 the Russian Alexander Oparin said that while Darwin's "warm pond" model was substantially correct, it was missing one basic element. In the absence of green plants, there would have been no free oxygen. The primitive atmosphere of the earth must have consisted mainly of methane, ammonia, water vapor, and so on. In a weak solution of these chemicals, now humorously called the "primordial soup," the basic chemicals of life, the amino acids which make up the proteins, and the bases which make up the DNA were formed in little bubbles he called "coacervates." We will deal with these basic chemicals of life in more detail when we discuss the origin of species on the fifth day.

It wasn't until 1955 that an American, Stanley Miller, tested Oparin's hypothesis. He put Oparin's primitive atmosphere, the methane, ammonia, and so on, into a flask and heated it for several days. On examining the residue which remained, Miller found that it indeed contained amino acids. Here is Dr. Bronowski:

“ ...To talk sensibly about the beginning of life we have to be very realistic. We have to ask an historical question. Four thousand million years ago, before life began, when the earth was very young, what was the surface of the earth, what was its atmosphere like?

“Very well, we know a rough answer. The atmosphere was expelled from the interior of the earth, and was therefore somewhat like a volcanic neighborhood anywhere - a cauldron of steam, nitrogen, methane, and other reducing gases, as well as some carbon dioxide. That is crucial, because oxygen is produced by the plants and did not exist in a free state before life existed.

“These gases and their products, dissolved weakly in the oceans, formed a reducing atmosphere. How would they react under the action of ultra-violet light - which is very important in every theory of life because it can penetrate in the absence of oxygen. That question was answered in a beautiful experiment by Stanley Miller in America round about 1950. He put the atmosphere in a flask - the methane, the ammonia, the water, and so on - and went on for day after day, and boiled and bubbled them up, put an electric charge through them to simulate lightening and other violent forces. And visibly the mixture darkened. Why? Because, on testing, it was found that amino acids had been formed in it. That is a crucial step forward, since amino acids are the building blocks of life. From them the living proteins are made, and proteins are the constituents of all living things.”⁴

Then in the 1970's the English scientist, Lesley Orgel, who worked with Dr. Bronowski at the Salk Institute in California, tried freezing Oparin's "primordial soup," and produced one of the four bases which make up the master molecule, DNA:

“We used to think, until a few years ago, that life had to begin in those sultry, electric conditions. And then it began to occur to a few scientists that there is another set of extreme conditions which may be as powerful, that is, the presence of ice. It is a strange thought; but ice has two properties which make it very attractive in the formation of simple, basic molecules. First of all, the process of freezing concentrates the material, which at the beginning of time must have been very dilute in the oceans. And secondly, it may be that the crystalline structure of ice makes it possible for molecules to line up in a way which is certainly important at every stage of life.

“At any rate, Lesley Orgel did a number of elegant experiments of which I will describe the simplest. He took some of the basic constituents which are sure to have been present in the atmosphere of the earth at any early time: hydrogen cyanide is one, ammonia is another. He made a dilute solution of them in water, and then froze the solution over a period of several days. As a result the concentrated material is pushed into a sort of tiny iceberg to the top, and there the presence of a small amount of color reveals that organic molecules have been formed. Some amino acids, no doubt; but, most important, Orgel found that he had formed one of the four fundamental constituents in the genetic alphabet which directs all life. He had made adenine,

one of the four bases in DNA. It may indeed be that the alphabet of life in the DNA was formed in these sort of conditions and not in tropical conditions.”⁵

So in conclusion let me say that abiogenesis, or the origin of life from non-life by chance alone, first proposed by Huxley and Darwin, and later developed by Oparin, can now be demonstrated experimentally, at least in part. In two quite simple laboratory experiments by Miller and Orgel, the two basic chemicals of life, amino acids which make up the proteins, and the bases which make up the DNA, were produced under conditions which must have been duplicated countless times over the millenia by sheer chance.

Fr. Robert A. Staats

I would like to begin my presentation tonight with the Scripture, and then go on to the scientific account of the origin of life. I turn again to the Benedictine Ignatius Hunt and his *Understanding the Bible*:

“It is quite likely (and this is no isolated instance) that the story as we know it was worked over from a more primitive form. Thus we note that the third and sixth days are each ‘overloaded,’ including two works in place of one. This does not unduly mar the symmetry of the six days, however, and it has long been pointed out how the first day (light) corresponds to the fourth (the heavenly luminaries: sun, moon, stars, as distributors of the light); the second day (water is divided by the firmament) corresponds to the fifth (water and air creatures); and that the third day (separation of dry land and plant life) corresponds to the sixth (living creatures upon the earth and man). This is not a scientific ordering of creation. It is largely ‘mnemonic,’ i.e. helpful to memorization, and is based upon ancient oriental ideas common to other peoples besides the Hebrews. Thus we have light before the sun (for the sun was regarded not so much as a light-giver as a place where light gathers); we have the stress upon primeval water and darkness - signs of chaos and disorder. We shall recall from an earlier chapter that the idea of the firmament, a solid, inverted bowl-like covering high-up over the earth, holding aloft vast stores of water - that could be released by opening the ‘gates of heaven’ (cf. Gen 7:11) - was common in the ancient orient. The earth too, was regarded as saucer-shaped, floating on water and held up by pillars that sank down into the abyss below. These and other indications should make us realize that this is not a ‘scientific’ account. Nor is it entirely correct to describe the narrative as ‘popular,’ at least if we imply that the writer could have written scientifically had he wished to do so. God does not ordinarily infuse such advanced knowledge into the minds of his inspired instruments - especially when it has little to do with the primary purpose of the Sacred Writings. St. Thomas laid down the sound principle that the ‘sacred writers went by what sensibly appeared.’”⁶

The story of the Hexameron is told in the first chapter of Genesis 1:1-31, and the numbers in this scheme, for instance the (3) after "Light," refers to the verses. There are eight

"Works," three of "Separation" and five of "Adornment." There are two series of three days each, and the first, second, and third day of each series correspond with one another, thus our third day corresponds with the sixth. On the third day God "adorned" the earth with plants, and on the sixth day He further "adorned" the land with animals and especially with man. So we see that the Bible is not trying to teach us anything about the origin of life, but merely that all life comes from God.

Day	Work	Work of Division	Day	Work	Work of Adornment
1	Light (3)	Separation of light from darkness (4-5)	4	Luminaries	Firmament with sun, moon, stars (16-18)
2	Firmament (6)	Separation of upper from lower waters (7)	5	Fish and birds (20-22)	Waters with fish, air with birds (21-23)
3	Earth-plants (9-12)	Separation of sea from land (9-12)	6	Animals - men (24-27)	Earth with animals, man (24-31)

Poetic Schema of the Hexameron

To find out something then, about the origin of life, we have to go to science, not the Bible. So let me turn to Fr. Owen Garrigan, who is a professor of chemistry at Seton Hall University and the author of *Man's Intervention in Nature*, one of the volumes in *The Twentieth Century Encyclopedia of Catholicism*:

“Religious people generally think of life as having been created by an act of direct intervention by God rather than by his putting the potentiality for life into chemical matter. The assumption has been that a special act on God's part is necessary for a thing to begin to

live. Such a view would make chemical evolution a curiosity without a purpose. Further experiments on the details of chemical evolution may one day make the special-intervention view absurd. It does not seem necessary to put the restraint of direct intervention upon the omnipotence of God. After all, direct and indirect intervention are distinct only in man's mind. The terms were invented to help man understand God's creative work. They should be discarded when they no longer help or when they actually hinder Man's understanding of the nature of God's infinitely simple acts...

“New, and it seems, compelling reasons lead us back full circle to the idea of the Greeks, that the earth, itself inanimate by so many tests of life, is the mother of all the living.

For from the earth - from the simple elements found in the thin crust of this planet's mass - has risen that complex, self-reproducing system that merits the name of life. Not as improbably as we might have thought a few decades ago, chemical complexity tends to increase. There is built into matter a chemical driving force, a reactivity that under certain, not improbable, conditions moves simple materials to explore the possibilities of more complex combinations, venturing into the region of life itself...

“The evidence, incomplete though it is, suggests that the process of *biopoesis* [the making of life] did proceed via chemical evolution to form a self-reproducing, mutating being. And this living product, subject to the pressures of its environment, continues to evolve by means of reproduction, mutation, and natural selection. The product of chemical evolution has just those chemical properties that enable it to progress as the subject of biological evolution.”⁷

So, if you can stand it one more time, by a comparison of the Scriptural account of the origin of life, and the scientific account of that origin, we see that a concordance between the two is clearly impossible. But again, this does not mean that a harmony between science and theology is impossible, which brings me to the subject of Teilhard de Chardin. Teilhard, if you remember, says that matter is characterized by what he calls "the law of complexity - consciousness." The more complex the structure, the more the consciousness. This means that structures like the amino acids and the bases which make up DNA, the basic chemicals of life, must already have some form of rudimentary consciousness. This is not yet experimentally verifiable, but logically has to be there. The transition from non-life to life, then, in Teilhard's synthesis, is not the great problem it was to earlier theologians, but a completely natural development of the forward and upward movement of evolution. Here again is the Jesuit Robert Faricy in his *Teilhard de Chardin's Theology of the Christian in the World*:

“Teilhard's postulate concerning the law of complexity-consciousness does not just assume that this law is universal. It further states that matter presents itself in more and more complex groups with corresponding higher levels of consciousness. This is not to postulate any teleological property or metaphysical finality in matter or in the universe as a whole. It is simply to

state that, over long periods of time and through various chance combinations that take place inevitably among very large populations, matter becomes arranged in more highly complex forms that have higher degrees of consciousness. In this perspective, life is seen as the outcome of a general physico-chemical process 'in virtue of which cosmic matter, by its very existence and structure...presents itself to our experience as actuated by a movement of qualitative infolding (or arrangement, if you prefer) upon itself.'

"This 'infolding arrangement' is in the direction of higher complexity; it results with the passage of time in cells, plants, animals. Life, far from being an oddity or an evolutionary aberration, is the result of millions of years of progress along the axis of complexity. 'So as to overcome the improbability of arrangements leading to units of ever increasing complexity, the involuting universe, considered in its pre-reflective zones, proceeds step by step by dint of billion-fold trial and error. This process of groping, together with the mechanism of reproduction and heredity, results in the various species of living things.'" ⁸

What makes Teilhard's explanation of the origin of life so similar to that of humanists like Dr. Bronowski, yet so different, is that Teilhard knows where the long journey of evolution is heading. It is converging to a point which Teilhard calls "Omega," which he identifies with God.

Mrs. Maria Stepan

Let me begin my presentation tonight by commenting on Jacob Bronowski's explanation of abiogenesis or the chemical evolution of life. I would like to read a few excerpts from an excellent book, which unfortunately has not yet been translated into English, *Hasard et Certitude*, "Chance and Certainty," by a French Catholic layman, George Salet. Salet begins his discussion of the origin of life with Alexander Oparin, whose theories Dr. Schonfield explained in some detail. Here is Salet quoting directly from Oparin's *Origin of Life*:

"In the ordinary laboratory synthesis of organic substances, we always obtain a mixture of equal parts of the two forms of dissymmetrical molecules (which we call a racemic mixture)...this is why *the probability of the formation of the one or the other of the two active forms is exactly the same.* [Salet's emphasis]

"Such great numbers of molecules take part in chemical reactions that statistical laws apply perfectly. And it is always highly improbable that an excess could be formed of either one or the other of the two opposites. Indeed, we do not as a rule observe any such excess under natural conditions in the absence of life, nor under laboratory conditions, e.g. in the experiment of Miller...both alanine and other amino acids appeared in racemic form. In living beings, on the other hand, the amino acids that go to make up natural proteins are exclusively left-handed in configuration.

"This property of the protoplasm of producing and storing only one of the possible optically active forms is an indication of the dissymmetry of living matter. While it is absent from inanimate nature, dissymmetry is characteristic of all living things.

"The fact was already noted by Pasteur who spoke of it as the great characteristic feature which perhaps alone establishes the only well marked line of demarcation which can at present be drawn between the chemistry of nonliving and of living matter." [Oparin, *Origin of Life*]⁹

The amino acids which Stanley Miller found in his flask were in a racemic or symmetrical mixture, that is, they were half left-handed and half right-handed as always occurs in inanimate nature. So this does not provide, in spite of Dr. Bronowski's claim, experimental proof for the theory that life arose from non-life by chance alone; on the contrary it disproves it. Salet continues with a humorous presentation of a hypothetical rabbit made of right-handed molecules:

"The amino acids synthesized by a rabbit are left-handed because its DNA is of a determined dissymmetrical form which perpetuates itself from generation to generation by replication. Let us now consider any biochemical process, let us say DNA duplication. It is known that most of these processes are capable of being carried out *in vitro* [in a test tube] if the necessary precursors and enzymes are available. It is certain, then, that if we could substitute for every dissymmetrical molecule found in the chemist's test tube, its other enantiomorph ["opposite shape"], the process would continue just as well.

"If then it were possible to replace every dissymmetrical molecule in the body by its other enantiomorph (which is the same as imagining another rabbit identical to the mirror image of the first) the rabbit we would get would be perfectly viable. As a matter of fact there exist only left-handed rabbits, but it is impossible to find the least reason why there could not exist right-handed rabbits...We must however say that, as long as animals know only how to synthesize a part of the amino acids able to support life, all the right-handed rabbits would die of starvation surrounded by the vegetable world as it is today."¹⁰

A right-handed rabbit would be perfectly capable of life; there is no chemical difference between it and the left-handed rabbit. But all the plants in the world are left-handed, and could not be assimilated by a right-handed rabbit. A right-handed rabbit could only eat a right-handed carrot, and there are none.

"The mystery then is this: if life were the natural evolution of inanimate matter, because this matter is symmetrical, there could only have appeared racemic mixtures, in which the two optically active forms always exist in equal proportions. We must then push the matter to its logical extreme. If life results from the evolution of matter according to the laws of matter, there would be racemic mixtures of alanine [one of the twenty amino acids], racemic mixtures of

protobionts [the hypothetical ancestor of the simple cell], racemic mixtures of simple cells, and racemic mixtures of rabbits. The right-handed rabbit had an apparition probability rigorously identical to the probability of the left-handed rabbit. How is it that you can't find even one?"¹¹

In Oparin's "primordial soup," if it ever existed, when the amino acids and bases supposedly formed in little bubbles, the "coacervates," they would have formed in racemic or symmetrical mixtures, as they did in the experiments of Miller and Orgel. But as a matter of fact all of the amino acids and bases that appear in animate nature are left-handed or unsymmetrical. The mathematical chances for the appearance of a right-handed cell are identical to those of a left-handed cell. So the fact that there are none indicates that the origin of life was directed not by chance but by an Intelligence.

Dr. Bronowski called molecular symmetry the "thumbprint of life," but it could better be called "the thumbprint of the Creator." These new discoveries about the chemical bases of life have brought us right back to the third day of creation - "And God said, 'Let the earth put forth vegetation'" (Gen 1:11). George Salet would rephrase the Scripture, with a smile I am sure, "And God said, 'Let the earth put forth (the left-handed) vegetation.'" Dr. Bronowski on the other hand wanted to phrase it - "And the earth brought forth the left-handed vegetation"; God was not needed. But Salet has shown that if this were true, it would have been - "And the earth brought forth the left-handed and the right-handed vegetation." So God has left His "thumbprint" on all living things, for all men of good will to find Him.

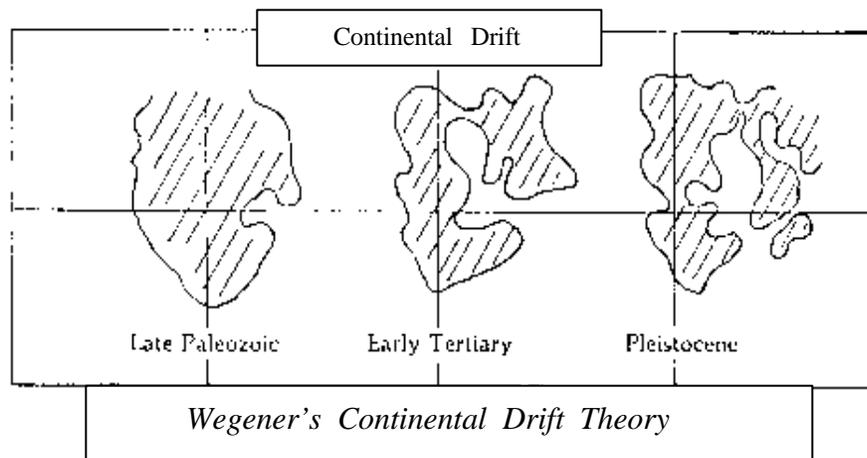
Another amazing thing about the left-handed make-up of all living things, is that after the death of a living organism all the amino acids gradually begin to rearrange themselves until they are in a racemic mixture - "Dust thou art and into dust thou shalt return" (Gen 3:19).

I would like to take issue once again with Fr. Staatz and his ongoing claim that it is impossible to make a harmony between the Scriptural account of the third day of creation and contemporary science. But let me reread the first two verses of the third day:

And God said, "Let the waters under the heavens be gathered together into one place, and let the dry land appear." And it was so. God called the dry land Earth, and the waters that were gathered together he called Seas. And God saw that it was good (Gen 1:9,10).

If I seriously proposed just a few years ago that at one time all the land masses of the earth were gathered into one place because the Bible says so, I would have been subject to ridicule by both scientists and liberal Catholics alike. But today it is considered reputable science to say that at one time all the land masses of the earth were indeed gathered together into one place now called *Pangea*, "all the land." This is the so-called "Continental Drift Theory" which was first proposed by the German geologist Alfred Wegener in 1912. Let me read a brief summary of this theory from a student reference book entitled *The Book of Popular Science*:

“Soon after the mapping of the Atlantic ocean, some four hundred years ago, geographers noted that the western coast-lines of Europe and Africa seemed to match the opposite coastlines of Eastern North and South America. By just "moving" these continents together, so to speak, one could fit them along these coasts. But it was not until 1858 that a map was published demonstrating the excellence of the fit; it was suggested that the continents in question had once been united. The idea this time took hold. By about 1900, a number of geologists proposed that certain lands of the Southern Hemisphere - major parts of Africa, Madagascar, Australia, Antarctica, and South America - were joined in a huge supercontinent called *Gonwanaland* (named after the *Gonwana* region of central India). However, the vast majority of orthodox geologists refused to take these ideas very seriously. But from 1912 into the 1920's, the German scientist Alfred Wegener advanced a powerful theory of continental drift. He proposed that in a time of earth history about 200 to 300 million years ago, the so-called Upper Paleozoic, all the present continents were united in a single tremendous land-mass called *Pangea*. At that time, *Pangea* started to break up slowly into its component continents which eventually moved into the configuration they have today...



“Many of Wegener's...ideas are sound and have continued to provide a firm basis for later drift theories. In fact, a number of them have been noted even before Wegener wrote. It

was pointed out that many rock beds, rock structures (such as faults, or cracks), fossils and even living organisms were so alike on widely separated continents that they could not have originated independently of each other. According to the drift theorists, they must have developed together originally on a single land mass that later broke up.”¹²

Berthault has shown that we can safely ignore the orthodox geological time scale and the evolutionism of the Drift Theory, and yet we can still harmonize the theory with the Bible. In other words rather than speaking of the Hexameron as a purified form of a pagan myth, we should be purifying science of its evolutionary myths. Let me continue on this point of harmonizing the Bible and science, by reading an excerpt from an article entitled *How Life on Earth Began* by George Alexander in the *Reader's Digest* for August 1982. Alexander goes briefly through the theory of Oparin and the experiments of Miller and Orgel, adding the latest development from NASA's Ames Research Center in California, where it is has been recently proposed that metal-bearing clays could have played a crucial role in the origin of life. The article concludes:

“And God said, ‘let the waters bring forth abundantly the moving creature that hath life,’ the King James Bible tells us. ‘And the Lord God formed man of the dust of the ground.’

“As the Bible proclaimed, and as many primitive societies have intuited life began in the mud at the ocean's edge, and the mother molecules emerged out of a handful of clay a long time ago. We are just beginning to learn how.”¹³

Despite the evolutionary assumptions, George Alexander is saying that the Scriptural and the scientific account of the origin of life can easily be harmonized. This is also the position of both St. Augustine and St. Thomas Aquinas, as I will show. If the Hexameron is not an historical account, but merely a purified form of an ancient pagan myth as the liberals claim, how is such a harmony possible?

<i>The Origin of Life</i>	
Creationists	1) Produced by God as the sole organizing cause of matter
St. Augustine	2) Produced by God acting through causes intrinsic to matter.
St. Thomas Aquinas	3) Originated under the influence of secondary causes extraneous to matter.
Humanists	4) Produced from matter without influence of extraneous causes.
Teilhard de Chardin	5) Has always existed.
Fred Hoyle	6) Came from other planets.

Possible Origins of Life according to Philosophy

Let me go on now to my own presentation on the origin of life. I would like to read a few excerpts from *An Introduction to the Philosophy of Animate Nature* by the Holy Ghost Father, Henry Korin, a scholastic philosopher in the tradition of St. Thomas:

“The question to be considered here is not how living bodies originate now. With respect to the present, everyone admits biogenesis [‘life from life’] as a law; i.e., not a single instance is known of a living body which did not come into existence through a process of generation from another living body. The experiments of Pasteur and others have conclusively shown that in all instances where life seemed to originate from inanimate matter, microscopically small organisms gave rise to new living bodies.

“Our problem is concerned with the possibility of living bodies originating from inanimate matter. To a certain extent this problem refers to the future insofar as the question can be raised whether or not laboratory experiments will ever succeed in producing a living organism, no matter how primitive from inanimate matter. It refers to the past insofar as all available evidence points to the fact that once life on earth was physically impossible, so that at some time in the distant past living bodies must have made their first appearance on earth. Because observation of this first appearance is evidently physically impossible, the question how this life originated may be studied philosophically by an investigation of any position that is not in

accordance with reason. In this way it perhaps will be possible to arrive at the conclusion that only one position offers a greater probability than others.”¹⁴

This is an outline of six possible explanations for the origin of life by Fr. Korin. Let us run through them briefly:

1) Produced by God as the sole organizing cause of matter. This would seem to be the position of our fundamentalist friends. Let us quote directly from Fr. Korin:

“The first living bodies were produced by God's positive intervention in the existing order of nature. Suspending the laws of nature, He directly produced in inanimate matter the conditions which made matter proximately disposed for actuation by a soul. This soul was educed from the potency of matter, except in the case of man whose soul was directly created by God...

“There cannot be any doubt that God had the power directly to organize matter in such a way that it is immediately disposed for actuation by a soul. However, it would seem unreasonable to attribute directly to God what can be brought about through the activity of natural forces of inanimate matter in accordance with the laws of nature. If the Author of nature has endowed matter with forces that can naturally lead to the emergence of living bodies, it would seem unreasonable to suppose that He positively intervened in the process of natural development by suspending the activity of these forces and directly organizing inanimate matter. We say if, for it remains to be seen whether or not living bodies can have originated from inanimate matter acting in accordance with the laws of nature.”¹⁵

Of course, it is a scientific question whether inanimate matter actually has an intrinsic potency to life, but both St. Augustine and St. Thomas, going by the science of their

day, thought that it did. This seems to be implied in the words of Scripture, "Let the earth," - the earth seems to have played some role in the origin of life. The creationists, on the other hand, seem to maintain that matter has no intrinsic potency to life, and that God had to intervene directly by way of miracle in suspending the deterministic laws of inanimate matter. I suspect that they are afraid of taking the phrase "Let the earth," too literally, because they think it would open the door to chemical evolution and thus to evolution in general. So while the creationist position is not unreasonable, Fr. Korin thinks it less probable than the two following positions.

2) Life produced by God acting through causes intrinsic to matter. This is the position of St. Augustine, and here are St. Thomas' comments:

“Concerning the production of plants, Augustine's opinion differs from that of others. For other commentators, in accordance with the surface meaning of the text, consider that the plants were produced in act in their various species on this third day, whereas Augustine...says

that the earth is said to have then produced plants and trees in their causes, that is, it received then the power to produce them. He supports this view by the authority of Scripture, for it is said (Gen 2:4,5): ‘These are the generations of the heaven and the earth, and every plant of the field before it sprung up in the earth, and every herb of the ground before it grew.’ Therefore, the production of plants in their causes, within the earth, took place before they sprang up from the earth's surface. And this is confirmed by reason, as follows: In these first days God created all things in their origin or causes, and from this work He subsequently rested. Yet afterwards, by governing His creatures in the work of propagation, ‘He worketh until now.’ Now the production of plants from out of the earth is a work of propagation, and therefore they were not produced in act on the third day, but in their causes only.”¹⁶

One of the wonderful things about St. Thomas is that he always gives St. Augustine's interpretation as well as his own. St. Augustine does not take the third day in the strictly literal sense. He is assigning the production of plants, not to the work of creation, but to God's work in governing the universe. St. Augustine seems to want to give matter a certain dignity, a potency to life, perhaps because some of his opponents, the Manichaeans, claimed that matter was evil.

3) Life originated under the influence of secondary causes extraneous to matter. This is the opinion of St. Thomas which differs somewhat from that of St. Augustine:

“Whether the Lights of Heaven are Living Beings?.

“Obj. 3. Further, a cause is nobler than its effect, but the sun, moon, and stars are a cause of life, as is especially evidenced in the case of animals, generated from putrefaction, which receives life from the power of the sun, moon, and stars. Much more therefore, have the heavenly bodies a soul...

“Reply Obj. 3. Since the heavenly body is a mover moved, it is of the nature of an instrument, which acts in virtue of the agent; and therefore, since the agent is a living substance, the heavenly body can impart life in virtue of that agent.”¹⁷

St. Thomas thought that the sun, moon, and stars, were moved by angels, and ultimately by God, who used these creatures in the production of life. St. Thomas seems to be concerned about the reasonableness of St. Augustine's position, that the earth was apparently the only secondary cause in the origin of life. This could give the impression that the effect was greater than the cause, since the effect, life, was obviously greater than the secondary cause, earth. So St. Thomas, following the science of his day, introduces an additional secondary cause, the sun, moon, and stars, which were also thought to be instrumental in the origin of life. The sun, moon, and stars, were considered superior to lower forms of life, such as insects, so this eliminates the problem of the effect being greater than the cause. St. Thomas' opinion is true to a certain extent even today, since the sun is still considered an instrumental cause in the origin of life. Of course it is not necessary to say that St. Thomas would have considered *abiogenesis*, the chance origin of life absurd.

But if the sun and other heavenly bodies were instrumental in the origin of life, which takes place on the third day, why were they not mentioned until the fourth day? St. Thomas replies:

“In the words of Basil (*Hom v in Hexam*), plants were recorded as produced before the sun and moon to prevent idolatry, since those who believe the heavenly bodies to be gods hold that plants originate primarily from these bodies; although as Chrysostom remarks (*Hom vi in Gen*), the sun, moon, and stars cooperate in the work of production by their movements as the husbandman cooperates by his labor.”¹⁸

We have seen that St. Thomas does not interpret the Hexameron in the strictly literal sense, but in what is called the broad literal sense. Where were the sun, moon, and stars if they assisted in the generation of plants on the third day? St. Thomas thinks that they were indeed there but in a somewhat formless state. They did not receive their final definitive form until the fourth day.

4) Life produced from matter without influence of extraneous causes. This is the position of the secular humanists, who would like the Hexameron to read something like: "And the earth put forth vegetation," because matter, they say, brought forth life all by itself. Here are Fr. Korin's comments:

“If the material causes operating in a living body, which the soul combines into a single unit, are able to cause the necessary dispositions for life and thus produce a new living body, why should it be impossible for those forces to be united "by chance" into an operational unit and thus give rise to a living body? If such a thing did happen, a living body would have been produced from inanimate matter. Thus it would not be impossible for a combination of inanimate forces to give rise to a living body.

“Granted that such a combination is a possibility, does it prove an adequate explanation for the origin of life? An adequate explanation is one which takes into consideration all the causes that are at work in the production of an effect. No one admits that in the present state of science it is possible to indicate even all the physical forces that are necessary for the production of the dispositions of matter required for actuation by a soul. But supposing that a time will come when man will know all the material causes the combination of which would result in the production of living bodies? The answer is in the negative, because he has failed to indicate the cause which led to the combination of these causes by unifying their activity. But could not this unification be brought about by chance, as was suggested above? We must answer that an appeal to chance is not an explanation, but a confession of ignorance of the adequate explanation. Chance refers to the unpredictability of an effect produced by causes whose combined action cannot be foreseen, because the cause of their combination is not known. To deny that their combination has a cause is tantamount to a denial of the principle of causality. Therefore an appeal to chance is an admission that the known physical forces of

inanimate matter cannot explain the origin of life.”¹⁹

Matter, according to both St. Augustine and St. Thomas, has an intrinsic potency to life. But we have seen that if life arose by chance alone, it would have appeared in racemic or symmetrical form, that is half left-handed and half right-handed molecules. The fact that life appears only in a left-handed or dissymmetrical form, indicates that there was an intelligence, not chance, directing that potency of matter. So George Salet's science and Fr. Korin's philosophy concur. The position of St. Augustine and St. Thomas makes good sense both from the philosophic and the scientific point of view. To claim that life arose by chance alone is bad philosophy and worse science.

5) Life has always existed. This is the position of the pantheists and implicitly of Fr. Teilhard de Chardin. We have heard that Teilhard thought there was no such thing as "brute matter." that the more complex that matter became, the more consciousness it possessed. Fr. Korin rejects this position as both unreasonable and unscientific.

6) Life came from other planets. This is the position of Sir Fred Hoyle who after abandoning an unreasonable theory of the origin of the universe, the Steady State Theory, has now produced an unreasonable theory of the origin of life. He claims that life arose when organic molecules fell to earth from a comet. So how did the organic molecules arise on the comet?

I frankly believe that the creationists made a tactical blunder during the 1982 trial in Arkansas, when a state law allowing time for teaching creationism in the public schools was declared unconstitutional. The creationists called to the stand Hoyle's partner, N.C. Wickramasinghe, and although he did ridicule the evolutionist position on the origin of life, he then presented his own position which is just as ridiculous.

Rev. De Verne Swezey

I think by now it have sufficiently made my point that we creationists are not plotting to teach the Bible in the public schools. So from now on when I read from Dr. Morris' *Scientific Creationism* about science you will know, without my specifying, that it is from the public school section of the book, and when I read about the Bible, it is from the edition intended to be used only in the Christian schools.

We heard Dr. Bronowski claim that life arose by chance alone in the primordial seas. Now, chance is the realm of a branch of mathematics called probability math. So, let us take a look at what mathematics can tell us about the probability of the most simple self-replicating chemical structure that can be conceived arising by chance alone. An argument from math is always a little difficult to follow, but Dr. Morris does it about as well as I have ever seen it done:

“The evolutionary model attributes all the systems and structures of the universe to the operation of natural processes operating under the impetus of the innate properties of matter and the laws of nature. It assumes that no external supernatural agent plans and directs these processes; the universe is self-contained and self-evolving by random action of its components. On the other hand, the creation model attributes the system and structures of the cosmos to a planned, purposive creation of all things in the beginning by an omniscient Creator. The creationist maintains that the degree of complexity and order which science has discovered in the universe could never be generated by chance or accident.

“This issue actually can be attacked quantitatively, using the simple principles of mathematical probability. The problem is simply whether a complex system, in which many components function unitedly together, and in which each component is uniquely necessary to the efficient functioning of the whole, could ever arise by random processes. The question is especially incisive when we deal with living systems. Although inorganic relationships are often quite complex, living organisms are immensely more so. The evolution model nevertheless assumes all these have arisen by chance and naturalism.”²⁰

Dr. Morris, for the sake of argument, grants the possibility of Oparin's "primordial soup." The basic chemicals of life are the proteins and DNA, but Dr. Morris lets the DNA go and concentrates just on the protein. Proteins are composed of long chains composed of twenty different amino acids, and can function only if the chain is in one particular sequence. Now as long as there are only a few components, the odds of the probability of the correct sequence arising by chance alone in the "primordial soup" are not too great.

For example, suppose we have two components A and B that function only in the sequence A-B. The only other possibility B-A does not work. So we have a one-in-two chance of success, just like tossing a coin - heads or tails.

Let us add a third component C, and assume that only the sequence A-B-C works. There are six possible ways these three components can combine: A-B-C, A-C-B, B-A-C, B-C-A, C-A-B, and C-B-A. So now the odds of getting the correct system by chance have risen to one in six. As we continue to add components, the odds rise sharply. For five

components A-B-C-D-E, the probability is one in one-hundred-and-twenty.

Let us jump to a protein chain composed of one hundred units. Remember this system will work only if it appears in one particular sequence. Believe it or not, there are 10^{158} possible sequences in a system composed of one hundred units. 10^{158} is a one followed by 158 zeros. So the odds are now one in 10^{158} . Now suppose in the "primordial soup" these 100 components keep trying to hit the proper sequence, getting together, breaking up, and trying again. The humanists tell us that the universe is less than thirty billion years old. Suppose we let one hundred components combine a billion times a second for thirty billion years. We will have reached 10^{105} of the possible sequences. Remember we need 10^{158} chances to be sure of

success. So the evolutionists are hoist on their own dating petard. Thirty billion years is just not enough time. And this is just for the protein. We haven't even considered the other necessary chemical for life, DNA.

“And yet an organism composed of only 100 parts is impossibly simple. Research sponsored by NASA (for the purpose of enabling astronauts to recognize even the most rudimentary forms of life on other planets) has shown that the simplest type of protein molecule that could be said to "living" is composed of a chain of at least 400 linked amino acids, and each amino acid is a specific combination of four or five basic chemical elements, and each chemical element is a unique assemblage of protons, electrons, and neutrons. It is thus inconceivable (to anyone but a doctrinaire evolutionist) that a living system could ever be formed by chance. Yet, if a Creator is excluded from the problem, there is no other way that at least the first living system could ever have been formed.”²¹

I was glad to hear Mrs. Stepan speak of the Continental Drift Theory or the Tectonic Plate Theory. There has been recently a fascinating new development of this theory by Walt Brown a retired colonel who taught at the Air Force Academy, which he calls the "Hydroplate Theory," *hydros* being a Greek word meaning water. We read in the Bible that at the time of the Noachian Deluge, "on that day all the fountains of the great deep burst forth, and the windows of the heavens were opened" (Gen 7:11). Brown's theory majors in "the fountains of the great deep." The theory has three assumptions: "...it will be assumed that (1) the continents were interconnected, (2) there was a large shell of salty, subterranean water, and (3) the pressure was increasing within that water." There are four phases in the chain of events described in this theory: the Rupture Phase, the Flood Phase, the Continental Drift Phase and the Recovery Phase. Here is Brown's description of the Rupture Phase from his *In the Beginning*:

“ The increasing pressure in the subterranean water stretched the overlying crust, just as a balloon stretches when the pressure inside increases. Eventually this shell of rock reached its failure point. Failure began with a microscopic crack. Stress concentrations at both ends of the crack resulted in its rapid propagation at about 2 miles per second, nearly the velocity of sound in rock. The crack followed the path of least resistance, generally along a great-circle path. The ends of the crack traveled in opposite directions, circling the earth in several hours. The initial stresses were largely relieved when one end of the crack ran into the path left by the other end. In other words the path traveled by this crack intersected itself (or formed a "T" or "Y") somewhere on the opposite side of the earth from where the rupture began.

“As the crack raced around the earth, the ten-mile thick ‘roof’ of overlying rock opened like a rip in a tightly stretched cloth. The pressure in the subterranean chamber immediately beneath the rupture suddenly dropped to almost atmospheric pressure. Water exploded with great violence out of the ten-mile mile deep "slit," which wrapped around the earth like the seam of a baseball.

“All along this globe-circling rupture, a fountain of water jetted supersonically into and above the atmosphere. The water fragmented into an ‘ocean’ of droplets that fell to the earth great distances away. Some jetting water rose above the atmosphere where the droplets froze. Huge masses of extremely cold, muddy ‘hail’ fell at certain locations where it buried, suffocated, and froze many animals, including some mammoths.”²²

Brown has a whole chapter devoted to the mammoths found frozen in the tundra of Siberia. He gives several of the current scientific attempts to explain this phenomenon, all based on uniformitarian assumptions, and all completely inadequate. Only the Hydroplate Theory has a satisfactory scientific explanation of this mystery.

Let me go on now to the biblical account of the third day. If you remember from my presentation of the second day of creation, some creationists take the phrase "upper waters" in the strictly literal sense, and think that the earth must have been covered by a vast water canopy which screened out harmful radiations coming in from outer space, thus drastically reducing the mutation rate in living cells. This vast canopy is thought to have fallen down at the time of the Noachian Deluge.

“In addition to all this, there was in the beginning no death! Death only came into the world when sin came into the world (Rom 5:12;8:23). Man would have lived forever if he had not sinned, and so apparently would the animals (at least all those possessing the *nepesh*, the ‘soul’). Plant life, of course, is not conscious life, but only very complex replicating chemicals. The eating of fruits and herbs was not to be considered ‘death’ of the plant materials since they had no created ‘life’ (in the sense of consciousness) anyhow.

“All this has changed now. Decay and death came with the Curse, and the antediluvian environment changed to the present environmental economy at the time of the great Flood.”²³

The third day of creation deals only with the origin of plants, and Dr. Morris has a footnote explaining why the origin of plants cannot properly be understood as the origin of life, at least in the biblical sense:

“The exact boundary line between unconscious replicating chemical systems and creatures that have life in the biblical sense (that is, creatures possessing *nepesh*) is not yet clear from either science or Scripture. It may be possible that some of the simpler

invertebrate animals are in the former category. In the case of plants, at least, the fact that they were designed by God to be used as food by men and animals means that they did not really possess life and therefore could not "die." Death came into the world only as the result of man's sin (Rom 5:12).”²⁴

Dean Smalley

We scheduled only one meeting for the third day of creation which deals with the origin of life.

To summarize: Dr. Schonfield claimed that the basic chemicals of life, the twenty amino acids and the four bases of DNA, had evolved by chance alone in the "primordial soup." He claimed that this thesis had been demonstrated in two quite simple laboratory experiments by Stanley Miller and Lesley Orgel.

Fr. Staatz maintained that it was impossible to harmonize the biblical and scientific accounts of the origin of life. He then described Teilhard de Chardin's "law of complexity-consciousness" (the more complex the arrangement of matter the more the consciousness), which he says, makes the origin of life less of a problem to theologians than formerly. This notion, he said, while similar to scientific proposals concerning the origin of life, has the advantage of knowing where the emerging life is ultimately tending - to Omega or God.

Mrs. Stepan said that the chemicals in non-living matter are always half left-handed and half right-handed, while those in living matter are only left-handed. She claimed that this phenomenon, which she referred to as the "thumbprint of the Creator," precluded the possibility of life arising by chance alone, but pointed to a directing Intelligence. Mrs. Stepan then, Fr. Staatz notwithstanding, proposed a harmony between contemporary science and the biblical account of the third day. She said that the phrase "let the dry land appear," could easily be harmonized with the Continental Drift Theory, which postulates that all the land masses of the earth were once gathered together in one place called *Pangea*. She also claimed that the phrase "And God said, 'Let the earth bring forth the (left-handed) vegetation,'" could easily be harmonized with contemporary science. Matter, she claimed, the "earth," has an intrinsic potency to life, but that tendency has to be directed, not by chance, but by God.

Rev. Swezey by a simple demonstration in probability math, proposed that the most rudimentary form of life, a simple protein composed of a chain of 400 amino acids, could not possibly have arisen by chance even in 30 billion years, let alone the 4.5 billion years currently claimed as the age of the earth. He also gave us a glimpse of Walt Brown's Hydroplate Theory, which attempts to explain scientifically the phrase "and the fountains of the great deep burst forth" during the Flood. Turning to the Bible he then offered a strictly literal interpretation of the statement that death did not enter the world until after the Fall of our first parents. This implies, he said, that both men and animals would have been immortal, and since they would have lived on plants, and there could be no death before the Fall, plants should not be considered living, but rather complex replicating chemicals.

This concludes our discussion on the third day of creation.

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