

II. The Theory of Evolution

1. Introductory

In the previous lecture, we were able to study the concept of creation by reading the texts of St. Thomas. In this lecture, we will discuss the theory of evolution. In doing so, of course, we will not be able to do much from the texts of St. Thomas since those texts antedate the first evolutionary theories by several centuries.

That does not mean, however, that we cannot learn from St. Thomas as we explore the evolutionary sciences. Though we may not learn much from his words on this matter, we can learn from his example. The example I have in mind is the one he gave us as he read the texts of Aristotle.

It is easy to forget how novel Aristotelianism was in the thirteenth century and how alien it seemed to some Christian philosophers. Was it not Aristotle who taught the eternity of the world? Was it not Aristotle who taught that all men shared a single agent intellect (and immortal soul)? Whether Aristotle himself actually taught these things or not, he was certainly believed to have done so by many pious thirteenth century traditionalists.

It was St. Thomas and his fellow Dominicans who were able to recognize the profound truths that Aristotle had discovered and to separate them from those conclusions of or attributed to Aristotle that were at variance with Catholic doctrine. We must learn from St. Thomas' example here and have a mind that is open to the best that secular inquiry has to offer. We, as he, can do that without endangering our faith. Indeed we not only can, but must. St. Augustine warns us:¹

Usually even a non-Christian knows something about the earth, the heavens, and the other elements of this world ... and this knowledge he holds to be certain from reason and experience. Now it is a disgraceful and dangerous thing for an infidel to hear a Christian presumably giving the meaning of Holy Scripture, talking nonsense on these topics The shame is not so much that an ignorant individual is derided, but that people outside the household of the faith think our sacred writers held such opinions, and to the great loss of those for whose salvation we toil, the writers of our Scripture are criticized and rejected as unlearned men. If they find a Christian mistaken in a field that they themselves know well and hear him maintaining foolish opinions about our books, how are they going to believe those books concerning the resurrection of the dead, the hope of eternal life and the kingdom of heaven, when they think that

¹ *The Literal Meaning of Genesis*, Bk. I, ch. 19, John Hammond Taylor, translator (Newman, 1982).

their pages are full of falsehoods on facts which they themselves have learnt from experience and the light of reason?

In St. Thomas' hands, Aristotelian metaphysics became the foundation for profound theological insights. I am surely not suggesting that we attempt to do the same with Darwinism or the evolutionary sciences. That attempt was made in the mid-twentieth century by Teilhard de Chardin, with results that impressed few Catholic theologians and few evolutionary scientists.² I am suggesting merely that we do our theology in a way that is mindful of the best available natural knowledge and that we do our science and philosophy in a way that is mindful of the truths of revelation.

With that as preface, let us turn to the evolutionary sciences in order to determine what connection, if any, their theories have with theological doctrines.

2. Facts, Laws, and Theories

The doctrine of creation is often juxtaposed to what is called *the* theory of evolution. I will argue below that we should talk instead of evolutionary theories (in the plural), but in order to understand the juxtaposition, however it is made, at all, we must begin by asking two questions—What is a theory? and What is an evolutionary theory?

It is common in casual conversation to distinguish theories from facts and to distinguish them on the basis of the degree of certainty which they have. “Here are the facts,” we might say. The implication is that they are not open to question. “Here’s my theory,” we might add. “What’s yours?” The theories, in contrast to the facts, are seen as tentative, conjectural, uncertain.

However much this account of the meaning of the word “theory” corresponds to ordinary usage, however, it does not correspond to scientific usage. The Kinetic Theory of Gases and the Special Theory of Relativity are not called theories because they remain somewhat conjectural. In a piece of popular science writing, Nobel Laureate Sheldon Glashow offers us an account of what the term “theory” means when used by scientists:³

...what was really needed [in the nineteenth century] was a logical system that would allow physicists to truly understand why the atom behaved as it did, so that they could successfully predict not only the atom's observed behavior but new phenomena that had not yet been observed.

² For sympathetic treatments, however, see (for biology) Edward O. Dodson, *The Phenomenon of Man Revisited* (Columbia, 1984) and (for theology) Henri de Lubac, *The Religion of Teilhard de Chardin* (Collins, 1967).

³ Sheldon Glashow, *Interactions: A Journey Through the Mind of a Particle Physicist and the Matter of This World* (Warner, 1988), p. 51.

Physicists call such a logical system a *theory*. This word is much misunderstood by non-scientists. When a physicist talks about a theory, he does not mean a hunch, guess, or unproven hypothesis. He means a logical system of ideas that ties together a large number of observations of the real world into a coherent and understandable pattern.

Pope John Paul II has made essentially the same point:⁴

A theory is a metascientific elaboration, distinct from the results of observation but consistent with them. By means of it a series of independent data and facts can be related and interpreted in a unified explanation.

An example should make the point clear. In the years 1912-1917 at the Lowell Observatory in Flagstaff, Arizona, astronomer V. M. Slipher decided to measure the motion of galaxies relative to the earth. On the basis of a shift in the spectral lines of light received from these galaxies, he concluded that most of them were moving away from us at a high rate of speed.⁵ This we might call a fact, a fairly particular claim about what happens in nature. In 1929, Edwin Hubble measured the distance from us to these galaxies and noticed that the velocity of recession (as determined by Slipher) is directly proportional to distance from solar system. He proposed what has become known as Hubble's Law: $V = Hr$.⁶ These are curious facts, however, and call for explanation. For a variety of reasons the best explanation of Slipher's facts and of Hubble's Law is that the universe is expanding. This is called the "Big Bang" *Theory* not because it is conjectural but because it is, in Glashow's words, "a logical system of ideas that ties together a large number of observations of the real world into a coherent and understandable pattern."

Statements of fact, then are mere descriptions of events, processes or things. Laws correlate events or properties. Theories offer us an explanation of those facts and laws.

3. Kinds of Theories

A survey of the various kinds of logical systems of ideas which play an explanatory role in modern science allows us to distinguish three, which I will call the nomothetic, structural, and evolutionary.

Sometimes, the work of explanation is done by positing a set of laws which govern the operation of objects already known to us. Examples would be Newtonian mechanics or Maxwellian electrodynamics. In each case a wide

⁴ Message of 24 October 1996 to the Pontifical Academy of Sciences, *Acta Apostolicae Sedis* 89 (1997): 186-190

⁵ Anton Pannekoek, *History of Astronomy* (Interscience, 1961), p. 481.

⁶ Edward Robert Harrison, *Cosmology, the Science of the Universe* (Cambridge, 1981), p. 207.

area of natural phenomena was explained by appeal to a few basic laws—Newton's Laws of Motion or Maxwell's Equations.

For example, Newton was able to explain why cannon balls follow a parabolic trajectory by positing two factors. The first is the principle of inertia—every body continues in its state of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it. By this principle, the cannon ball, once the cannon is fired, would continue moving in a uniform straight line from the muzzle if no other forces were impressed upon it. The other principle is the force of gravitation, which causes an acceleration towards the earth. The mathematical result of the addition of these two factors is a parabola, which corresponds to the actual motion of the projectile.

Some natural phenomena cannot be tied together without positing an invisible micro-structure the operation of whose parts explains the phenomena we see. Here the properties of substances are explained, not just by reference to a coherent set of laws, but by an account of the elements which make the substance up and of the laws of elemental interaction. This is often called structural explanation. Why does combining two liters of hydrogen with one liter of oxygen yield only two liters of steam? Three principles are key to the explaining this mathematics-defying fact. First, gases are structurally composed of molecules. Second, the number of atoms per molecule is substance-specific. And third, the number of molecules present determines the volume. So, when four hydrogen atoms and two oxygen atoms are rearranged in a way that replaces diatomic gas molecules with triatomic water molecules, the total number of molecules, and consequently the volume, is cut by one-third.

Both nomothetic and structural theories are fundamentally synchronic. They explain how things now work without appeal to any historic dimension of the phenomenon in question. A third kind of theory makes precisely such an historical appeal. An example is the Proto-Indo-European hypothesis which explains the patterns of similarity and difference among a wide array of European, Persian and Indian languages by suggesting that they are all descended, with differential modification, from a single language, a language of which we have no traces, but which can be reconstructed from the languages we do know. The fact that we do have documentary evidence of the splintering of Latin into an array of modern Romance languages suggests that such a thing is entirely possible and the reconstruction of proto-languages has been an important feature of historical linguistics. The essence of such evolutionary explanations is nicely stated by Georges Lemaître, the Belgian abbot who played an important role in developing an evolutionary theory of cosmology:⁷

⁷ Georges Lemaître, *The Primeval Atom, An Essay on Cosmogony*, Betty H. and Serge A. Korff, trans. (Van Nostrand, 1950), p. 140.

Cosmogonic theories propose to seek out initial conditions which are ideally simple, from which the present world, in all its complexity, might have resulted, through the natural interplay of known forces.

Not all evolutionary theories fit the descent with modification pattern of historical linguistics, however. Complexity and diversity are sometimes explained, not by appeal to descent with modification, but by showing that the diversity among the individuals of a certain kind is a consequence of the fact that individuals of a single kind were formed at different times and are presently at different stages of a common life cycle.

An example of this second pattern is the explanation of the diversity of stars as a consequence of a stellar “life” cycle. Some stars formed relatively recently and are still at the Red Giant stage. Those that formed long ago have nearly burned out by now and are at the White Dwarf stage.

That descent with modification and life cycle theories are indeed patterns of explanation is shown by the fact that they are applicable to a wide array of phenomena. Darwin appealed to the life cycle pattern to explain the variety he and others had observed among coral reefs. The fringing reefs, barrier reefs, and coral atolls that dot the Pacific Ocean are successive stages in the history of coral reefs on islands that are slowly sinking into the sea. Lamarck unsuccessfully attempted to explain the variety of species found on earth by appeal to a life cycle theory. Darwin was more successful in appealing to descent with modification to explain the same diversity.

Evolutionary theories differ from nomothetic and structural theories in that they attempt to explain what we see now in terms of what happened in the past. But they share with structural explanation an appeal to something we cannot see (the past in one case, the microstructure in another) to explain what we do see. On what basis can we make assertions about the languages of prehistoric peoples or the nature of subatomic particles?

4. The Logic of Theory Evaluation

A popular view of the logic of scientific work is that scientists make observations and generalize from those observations. Generalization is clearly necessary to scientific work. Without it we could never move beyond the individual observations we ourselves make to statements about the way the world works. But generalization is equally clearly insufficient to get us to the kinds of theories mentioned in the previous section of this paper. At best, it can get us to general descriptions of correlations; it can never even get us to causes, much less to microstructure or to those facts about the past on which evolutionary theories are based.

We do not, however, need anything exotic to get us to microstructure or to the past. We can get there by means of an argument form that is no less a matter of everyday thinking than is generalization. It can be called

retroduction or argument to the best explanation. It is central to everyday problem solving, as is clear from the following case:

The car won't start. The headlight switch is on but the lights themselves aren't burning. What happened?

Probably, the headlights were left on and ran down the battery. That explanation is reasonable good and is better than all the alternatives, so we accept it. We accept the explanation on the basis of an argument of

Premise #1: [A statement of certain facts about the world]

Premise #2: [A possible explanation—some theory—claimed to be the best explanation of those facts]

Conclusion: The theory is probably true.

What makes an explanation a good one? There are a variety of factors—that it implies the known facts, that it makes accurate predictions of new (and especially of new kinds of) facts, that it has broad explanatory scope (i.e., that it can explain other facts as well), that it is at least coherent if not elegant, that it is consistent with the rest of the things we know about the world. These, and perhaps other factors as well, all play a role in theory assessment. They form, we might say, the basis for an Aristotelian argument from signs.

This same common sense approach to explaining the puzzles of everyday life is used in scientific arguments for the truth of theories. Why should we believe that there was once a Proto-Indo-European language? Because if there were we could understand the striking similarities we find between, say, Lithuanian and Sanskrit. Why should we believe that there are minimal pieces of, say, water that cannot be divided into smaller pieces of water? Because the chemical atomic theory makes sense of a vast array of facts about chemical combination.

5. Evolutionary Theories & the Evolutionary Story

On the basis of such arguments, scientists make a number of claims about the history of the material world. Included are the following:

For the past 10-20 billion years, the universe has been in a state of expansion from an initial singularity.

The present surface of the earth (its mountains, the stratified lithosphere, etc.) is the result of the operation of plate tectonics, deposition of sediment, and other geological forces.

All the different species of life on earth are the result of descent with modification [evolution] from one or a few first kinds of organisms.

The first two claims are made on the basis of extrapolation of presently observed phenomena.

The third is made on the basis of a consilience of induction. A large number of facts of paleontology, biogeography, comparative anatomy, biochemistry and genetics can all make sense if all living things originated by descent with modification from one or a few first kinds. His theory of descent with modification, Darwin says, explains the following facts about the fossil record:⁸

Fossil remains of each formation [are] in some degree intermediate in character between the fossils in the formations above and below. ... Recent beings are generally looked upon as being, on the whole, higher in the scale of organization than ancient forms. ... Within the same country the existing and the extinct will be closely allied by descent.

The same theory that explains the distribution of organisms in time also explains the geographic distribution of presently existing organisms. The biogeographical facts that need explaining include these:

On the same continent, under the most diverse conditions ... most of the inhabitants within each great class are plainly related. ... Species belonging to those groups of animals which cannot cross wide spaces of the ocean, as frogs and terrestrial mammals, do not inhabit oceanic islands; ... on the other hand, new and peculiar species of bats, animals which can traverse the ocean, are found on islands far distant from any continent.

Finally, Darwin points out that his theory will also explain certain peculiar facts of comparative anatomy:

The similar framework of bones in the hand of a man, wing of a bat, fin of the porpoise, and leg of the horse,—the same number of vertebrae forming the neck of the giraffe and of the element,—and innumerable other such facts, at once explain themselves on the theory of descent with slow and slight successive modifications.

Without such an hypothesis, all the peculiarities of these various disciplines remain unexplained brute facts. That is what Theodosius Dobzhansky had in mind when he said that “nothing in biology makes sense except in the light of evolution.”

Most scientists expect that further research will allow them to make historical claims about the origins of the solar system and about the emergence of life from a prebiotic environment as well. No theory of the

⁸ Charles Darwin, *The Origin of Species* (1859), ch. 15.

origins of the solar system or of life has yet, however, attained general acceptance.

It is important to note, however, that, although these various ideas can be merged into a single story, they cannot be merged into a single theory. Each theory is advanced on the basis of its own evidence and does not depend on the other theories for its truth. For example, Darwinian biology, as Darwin himself emphasized, makes no claims about the origins of life itself, only about the historical evolution of the biosphere once life has appeared. It is for that reason that I have repeatedly referred to the evolutionary sciences or theories of evolution (in the plural) in these lectures. In turning to a comparison of scientific and theological insights into the origins of the world, therefore, we will have to discuss various theories and not some single process of evolution.

6. Evolutionary Theories & Catholic Doctrine

If we must recognize the plurality of distinct scientific parts of the evolutionary story, we must also recognize that there are several distinct theological doctrines that must be brought into the discussion. The first, of course, is the doctrine of creation itself, the subject of the first lecture. The second is the question of how Sacred Scripture is to be interpreted. The third is certain doctrines which I characterized in the first lecture as not strictly part of the doctrine of creation, but allied to it—the non-eternity of the world and monogenesis.

a. Creation

What is the relation between the theories of evolution just discussed and the doctrine of creation discussed in the previous lecture? There are, to be sure, authors who claim that evolution and creation represent stark alternatives between which we must choose. Are they right?

In answering that question, we must first keep in mind the distinction between absolute and derivative creation made in the previous lecture. The doctrine that all material things were created by God no more contradicts such claims as that mammals came into existence by evolution from therapsid reptiles than it contradicts such claims as that refrigerators came into being by human manufacture.

We must second keep in mind the above-mentioned independence of the various evolutionary theories from one another.

Given those considerations, a conflict between evolution and creation would have to take the form of a Church teaching that some thing was directly created by God and a theory of evolution stating that that same thing emerged by evolutionary process from some earlier material thing.

Catholic doctrine teaches direct creation by God in only three cases—the angels, the material world as a whole, and each human soul. Since the Church has no teaching about the origin of stars, life, or particular plant and animal

species, no evolutionary theory of the origins of these things can possibly conflict with the theological doctrine of creation.

That is why Pope Pius XII said in his encyclical *Humani Generis*:⁹

the Teaching Authority of the Church does not forbid that, in conformity with the present state of human sciences and sacred theology, research and discussions, on the part of men experienced in both fields, take place with regard to the doctrine of evolution, in as far as it inquires into the origin of the human body as coming from pre-existent and living matter

And in his recent message on evolution to the Pontifical Academy of Sciences, Pope John Paul II said:¹⁰

Today, almost half a century after the publication of the encyclical, new knowledge has led to the recognition of the theory of evolution as more than a hypothesis.

The doctrine that the material world as a whole was directly created by God cannot conflict with any theory of evolution. All evolutionary theories presuppose the existence of the material world since they do no more than to offer an account of how a later state of the material world might have emerged from an earlier state of the material world. In other words, they do not address the question of where the material world itself comes from. The Catholic doctrine of creation answers the question of where the material world comes from without addressing the question of the initial state of the created world.

The doctrine of the direct creation of each human soul by God, reaffirmed by both Pius XII and John Paul II, is not properly speaking so much a doctrine about the origins of the human race as it is a doctrine about the origins of each individual human being. It does, of course, imply that the origin of the first man involved a creative act by God in the way that the origins of other species may not have, or, in other words, man is not simply a product of evolution, however much the human body might be such. But the doctrine asserts nothing about the first human beings that it does not also assert about every other human being. This claim then, touches not so much evolutionary biology as reproductive physiology. But if modern science does not claim to address the question of the existence or nature of the human soul, then evolutionary biology can hardly come into conflict with the theological doctrine that each human soul was directly created by God.

⁹ §36.

¹⁰ Message of 24 October 1996 to the Pontifical Academy of Sciences, §4. *Acta Apostolicae Sedis* 89 (1997): 186-190.

b. The Hexaemeron

Someone might argue that I have construed the doctrine of creation too narrowly. St. Thomas wrote that “in the work of corporeal creation, three works are found”—the work of creation, the the work of distinction (the work of days 1-3), and the work of adornment (the work of days 4-6). Do not these important passages clearly contradict the claims of the evolutionary sciences? That, of course, depends on what these texts say.

Twentieth century Fundamentalist Protestantism has, in recent years, been particularly insistent that Genesis 1 be interpreted in a non-metaphorical way. One can understand the appeal that this approach to exegesis has for them. Holding as they do to individual interpretation of Scripture, they fear that metaphorical interpretation will allow the promiscuous to set aside the teachings about chastity, the greedy to set aside teachings about generosity, etc. One wishes that they would apply to John 6 the principles they so insistently apply to Genesis 1.

We Catholics do not need to worry about such an evisceration of Scripture. We know that God’s remedy for this problem was the establishment of a Church with the authority to guide us in such matters. Even in the Middle Ages, the principles of metaphor, accommodation, and the like were well established in Scriptural interpretation. St. Thomas says in his *Treatise on the Six Days* that “any word may be used in two ways—that is to say, either in its original application or in its more extended meaning.” For example, in addressing the question of why Genesis 1 does not talk about the creation of the angels, St. Thomas presents as one possible explanation the following:¹¹

Moses was addressing an uncultured people, as yet incapable of understanding an incorporeal nature; and if it had been divulged that there were creatures existing beyond corporeal nature, it would have proved to them an occasion of idolatry, to which they were inclined, and from which Moses especially meant to safeguard them.

There have been, to be sure, great saints who have interpreted the first chapter of Genesis as describing seven days in the ordinary sense of the term. But there have also been saints who have not so interpreted this text. St. Augustine, for example, in his commentary *On the Literal Meaning of Genesis*, argued that the world was created in an instant and that the “days” of Genesis 1 were properly speaking moments in the angelic understanding of the divine act of creation.¹² I mention this view not so much to endorse St. Augustine’s view on the question as to emphasize that some Fathers of the

¹¹ *Summa Theologiae*, 1a, Q. 61, a. 1, ad 1.

¹² Bk. 4, ch. 22. The issue is discussed by St. Thomas in *op. cit.*, 1a, Q. 74, a. 2.

Church were perfectly willing to give the word “days” a metaphorical interpretation when they saw a sufficient reason to do so.

The Fathers of the Second Vatican Council warn us:¹³

Those who search out the intention of the sacred writers must, among other things, have regard for ‘literary forms.’ For truth is proposed and expressed in a variety of ways, depending on whether its form is that of prophecy, poetry, or some other type of speech.

When Pope John Paul II said of these early chapters of Genesis:¹⁴

the language in question is a mythical one. In this case ... the term “myth” does not designate a fabulous content, but merely an archaic way of expressing a deeper content.

he was only repeating what many Catholics had said before him. It is important to emphasize that that judgment about these passages by no means empties them of meaning. Conrad Hyers summarized their teaching in the following terms.¹⁵

For most peoples in the ancient world the various regions of nature were divine. Sun, moon, and stars were *gods*. ... In light of this historical context, it becomes clearer what Genesis 1 is undertaking and accomplishing: a radical and sweeping affirmation of monotheism vis-à-vis polytheism, syncretism, and idolatry. Each day takes on two principal categories of divinity in the pantheons of the day, and declares that these are not gods at all, but creatures.... Each day dismisses an additional cluster of deities, arranged in a cosmological and symmetrical order.

There is, then, no more a conflict between the evolutionary sciences and the first chapter of Genesis than there is between those sciences and the doctrine of creation taken abstractly.

c. Allied Doctrines

The doctrine that the world had a beginning in time can no more conflict with any scientific theory than can the doctrine of creation itself. It is sometimes said that the Steady State Theory popular in the 1950’s was

¹³ *Dei Verbum* 3:12.

¹⁴ *Original Unity of Man & Woman: Catechesis on the Book of Genesis* (St. Paul Editions, 1981), p. 63.

¹⁵ “Biblical Literalism: Constructing the Cosmic Dance” in R. M. Frye, ed., *Is God a Creationist? The Religious Case Against Creation-Science* (Scribner’s, 1983), p. 101.

developed by Fred Hoyle and others precisely because they found its tension with Christian creationism particularly congenial. In this, however, they were mistaken. God could surely have created a Steady State universe as easily as one originating in a Big Bang. There is nothing implausible about God creating a world which, in James Hutton's phrase, showed "no vestige of a beginning,—no prospect of an end."¹⁶

What about the doctrine of monogenesis? Does it, if not the doctrine of creation itself, conflict with the evolutionary sciences? It could only do so, of course, if there were some kind of scientific evidence that could bear on the question of whether there was a first human couple. A number of years ago, Theodosius Dobzhansky wrote:¹⁷

Since species differ in numerous genes, a new species cannot arise by mutation in a single individual, born on a certain date in a certain place....Species arise gradually by the accumulation of gene differences, ultimately by the summation of many mutational steps which may have taken place in different countries and at different times. And species arise not as single individuals but as diverging populations, breeding communities and races which do not reside at a geometric point, but occupy more or less extensive territories.

In a presentation made to the American bishops in 1996, Francisco Ayala said:¹⁸

The genes of living humans manifest that our ancestors were no fewer than several thousand individuals at any one time in the history of these hominid species [*sc. Homo habilis* and *Homo habilis*, dating back to about 4 million years ago].

Although the claims made by Dobzhansky and Ayala seem to be inconsistent with the theological doctrine of monogenesis, in fact it is not. To show this consistency, it is sufficient to tell a consistent story in which both the scientific claims and monogenesis are true.

Here is the story. It begins with a population of about 5000 hominids, beings which look rather like human beings, but lack an intellect, i.e., lack the capacity for conceptual thought, judgment, reasoning, and true choice. Out of this population, God selects two and endows them with intellects. If St. Thomas is correct, divine creation is the only way that an intellect can come into being. Let us call these beings true humans. These first true human

¹⁶ *Theory of the Earth* (1795), Vol. I, p. 200.

¹⁷ *Mankind Evolving* (Yale, 1962), pp. 180-1.

¹⁸ "Evolution and the Uniqueness of Humankind," *Origins: CNS Documentary Service* 27: 34 (12 February, 1998), pp. 565-574, here p. 567.

beings have offspring, which continue, to some extent, to interbreed with the non-intellectual hominids among whom they live.¹⁹ If God endows all offspring of even one true human parent with intellects of their own, a reasonable rate of reproductive success and a reasonable selective advantage would easily replace the non-intellectual hominid population with a true human population within a couple of centuries. Throughout this process, all true humans are descended from the original human couple.

This story is able to accommodate both the genetic evidence and monogenesis because it does two things. First, it distinguishes between true (i.e., intellectual) human beings and their genetically human-like, but non-intellectual, relatives. Second, it recognizes that the theological doctrine of monogenesis requires only that all human beings have the original couple as ancestors, not that they have only that original couple as ancestors. They (and we) can also have the several thousand hominid ancestors which Ayala says the genetic evidence requires.

¹⁹ For an earlier application of the distinction between theologically human beings and genetically human beings, see A. Alexander, "Human Origins & Genetics," *Clergy Review* 49 (1964), 344-53, here pp. 350-1.