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Perhaps I'm getting old and pedantic. Maybe I'm just getting fussy, but some of the rhetoric of the "environmental movement" grates on me more and more.

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In no way do I deny the seriousness of the environmental problems we have caused by our acquisitive attitudes and habits. Nor do I deny that we must correct our ways -- and soon. Christian thinkers and doers can't ignore this problem, even, and maybe especially, from a religious point of view. I believe we in ITEST have no need to defend our concern about the environment, a concern dating back to our very first meeting in 1969. But I do question the rhetoric.

Consider the bumper stickers proclaiming "Save the Planet." Can we frail humans save the planet? Perhaps more appropriately, can we puny creatures, even in our billions, destroy the planet? We can make large areas of it ugly, infertile, or even life-threatening. But can we destroy it? Were we mad enough to try, we might be able to destroy all life on the planet, make it inhospitable and even hostile to life for centuries or millennia. But can we destroy the planet?

Some environmentalists who use such slogans as "Save the Planet" accuse Christianity of anthropocentrism. Many blame Christianity for its position on the superiority of the human species over other species -- as do many "animal-rights" people. But, please, what is more anthropocentric than the slogan "Save the Planet"? Doesn't that say rather too much about our human capabilities?

I am not minimizing the environmental situation. But what is it about us Americans that makes us see every issue in totally apocalyptic terms? Isn't it enough to talk about issues or problems? Do we have to rush to "crisis" or "meow (moral equivalent of war)" every time we attempt to face a set of issues? One item in my personal credo is that words (as expressions of ideas) are important. Even slogans are important. But let's not substitute words or slogans for thought. As I said, I may just be getting old! But, please, let's leave the salvation of the planet to the Lord God and get on with dealing with aspects we can actually do something about!

ANNOUNCEMENTS

1. The Proceedings of the March, 1990 Workshop (The Inner Environment) have been sent to all ITEST members. The second Workshop in the series (The External Environment) was held the last weekend in October. We hope to have the Proceedings of this meeting completed before the March, 1991 Workshop.

2. The March 15-17, 1991 (on the Theology of the Creation) will be held at Fordyce House in St. Louis. Preliminary invitations for this meeting will be sent out around the first of the year. Please note the dates for your calendar. We have a complete roster of essayists for the March Workshop. We thank those of you who offered suggestions for the essayists. Papers will be prepared by Professor Reinhard Huetter (Lutheran); Dr. Kyriaki Fitzgerald (Eastern Orthodox); Rabbi James Diamond (Jewish); Fr. Robert Brungs, S.J. (Catholic).

3. The strength of ITEST and its ability to help the church is its membership. That is dependent on your help. We should like to know the names and addresses of your friends or colleagues whom you think would be interested in ITEST and its work. If you send their names and addresses we shall mail them information about the group. Or you might suggest that they write to us. We can never have enough experience and wisdom and dedication to faith and to science in the group.

4. We would be happy to consider any articles you send in for publication in the BULLETIN. This would include articles on a specific faith/science issue, book reviews, "letters to the editor" and such material. These submissions should not exceed 3000 words, though some leeway might be available in some issues of the BULLETIN. An essay in response to this request in the last issue of the BULLETIN is printed below.

7. We recommend two recent ITEST publications: *Decision* (our 28-minute video on the need for faith/science activity -- $29.95 for ITEST members). ITEST members outside the U.S. and its dependencies may order *Decision* in the PAL or SECAM format for $39.95 U.S.D. Note which format you need. We also recommend *You See Lights Breaking Upon Us: Doctrinal Perspectives on Biological Advance* ($9.95 for ITEST members; $12.95 for non-members). Cardinal Hickey, Archbishop of Washington, D.C. has stated: "Human dignity and freedom are threatened whenever attempts are made to refashion the world without reference to our calling to be united with God the Creator and Giver of all life....I believe that [t]his work is a great contribution to the dialogue between science and religion. It is a most helpful volume for anyone who wishes to understand more profoundly the true nature of progress."

6. We have been asked to inform you of the Sixth Technological Literacy Conference to be held February 1-3 in Washington, D.C. The Call to Participate notes: "Our Planning Committee has put together an exciting program in which we are featuring three symposia: Women in Science, Technology, and Medicine; Minorities in Science, Technology, and Medicine; and International Representation in Science, Technology and Medicine. These symposia will address the conference theme of `Broadening Participation in Science, Technology, and Medicine.'

Early Conference Registration (which includes a one year membership) will be $90 before December 15. Hotel rooms will be around $85/night, single or double.

7. At its meeting in late January, 1991, the Board will discuss possible alternative programs for future (starting in 1992) spring meetings. Because of increasingly crowded schedules for people in education and in view of steeply increased transportation costs, the Board will consider the feasibility of more local meetings, the proceedings of which would be coordinated in the ITEST Office and sent as the Spring ITEST publication. We would appreciate your suggestions (and even more your volunteering to help with such meetings in your locale). We are open to advice and proposals.

8. The ITEST Directory is being sent with this issue of the Bulletin. We hope you like it. If nothing else, it will fit better on your bookshelf.

HUMAN HISTORY AND NATURAL HISTORY COMPARED

THE VIEWPOINT OF BIOLOGICAL ANTHROPOLOGY*

J. Kitahara-Frisch, S. J.
Sophia University
Tokyo, Japan

1. INTRODUCTORY REMARKS

As far as worldviews are concerned, possibly the greatest revolution marking the nineteenth century was the discovery that not only man, but also life as a whole had a history.

The concept of history used here, indicates both a development in time and the non-repeatability of this development. As a development in time history implies a continuity where each step necessitates all preceding ones. It also implies the occurrence of novelties that make it impossible to predict each new step by reference to the past ones. The non-repeatability (*Einmaligkeit* of the Germans), is predicated primarily of human history but would seem to apply equally well to nonhuman life and perhaps even, though more arguably, to the known universe as a whole, inorganic as well as organic. [1]

By the emphasis it places on development in time, our modern world picture, it has often been pointed out, [2] has become entirely different from the static conception of the universe which Western civilization inherited from classical Greece. By the importance it attributes to the historical dimension, the modern world picture, probably differs as much from the worldviews characteristic of other civilizations [3].

For the biologist, it is important to understand that, contrary to what can often be read, the revolution caused by the discovery of evolution was not exclusively, or even principally, due to the influence of Darwin. Though Darwin's contribution in providing a theory explaining the mechanism of evolution was indeed most important, the work of paleontologists and geologists who preceded him by many years created the intellectual climate that made it possible for his theory to be widely accepted within a relatively short period. It is in no way to diminish his merits to say that, by 1859, evolution was a theory whose time had arrived.

Our purpose here is to examine in what sense and to what extent the history of life studied by paleontology displays features similar to those observed in the evolution of the human phylum.

2. CONTINUITIES BETWEEN NATURAL AND HUMAN HISTORY

The history of life, as known to us from the fossil record, is characterized by a number of features.

First, evolutionary processes appear as unrepeatable and irreversible. The complete loss of a free thumb in *Ateles*, and its reduction to a functionless tubercle in *Colobus* provide good examples of how anatomical structures may disappear altogether. They do not thereby, however, cause the organism to return to an antecedent condition. Neither would an eventual renewed development of the lost structure reduplicate the initial condition.

Another feature of life's history, the occurrence of unforeseen and unpredictable novelties, is well exemplified by the sudden explosion of the animal radiation which followed upon the, as yet unexplained, extinction of the dinosaurs, some 65 million years ago. Though small size mammals had lived in the shadow of the huge reptiles for more than 50 million years, it took a sudden, and still little understood, geophysical event to usher in the age of mammals.

The fossil record also shows clearly the history of life to be characterized by a number of what Simpson [4] calls "long lasting trends." Among these most striking is the development, in vertebrates, of an increasingly complex nervous system. This trend has been carefully studied by Jerison [5] as he documents the progressive increase in brain size relative to body weight. Together there appears a greater independence from the external environment, made possible by a better autoregulation of the internal environment and by the greater use of past

experience and learned behavior as compared with genetically controlled behavior.

Such are some of the many trends observed in vertebrate evolution by scientists as different in their overall worldviews as Teilhard de Chardin, Julian Huxley and George G. Simpson. These trends all result in the increasingly pronounced individuation of animal organisms.

Less often pointed out is the acceleration shown by the above named trends during the geological time documented by the fossil record.

Table 1

MAJOR DATES IN LIFE'S HISTORY

	Million years ago
Origin of life	3,500
Amphibians appear	400
Early mammals appear	180
Early primates appear	70
Higher primates appear	35
First hominids appear	10 to 5
Homo sapiens appears	0.2

If such are some of the features and trends that characterize the evolution of vertebrate animals as a whole, how, one may now ask, did they affect hominid evolution? The evolution of hominids, the primate lineage defined by its bipedal and erect mode of locomotion, is now well known from over 4 MY ago up to the present. As the record of hominid evolution became progressively better documented during the last thirty years, it has become clear that the evolution of this particular animal phylum exhibits indeed several of the characteristics and trends described above for the evolution of life as a whole.

Among these, the trend towards a better developed central nervous system is especially well marked. Brain size, as measured by the capacity of the brain case in the skulls of fossil hominids, increases steadily from *Australopithecus,* where it does not exceed one third of present day human brain size, to *Homo habilis (1/2) Homo erectus* (2/3) and *Homo sapiens,* the oldest variety of which, exemplified by so-called Neanderthal Man, already reaches modern man's brain capacity.

[n. b., figures given are approximate but allow a reliable comparison of the time lengths involved.]

This acceleration is best shown by considering how, while it took life 3 billion years from its inception to the first appearance of animal life on land, little over 200 further million years (MY) was sufficient for mammals to appear, then only 100 MY for the first primates, with ancestral apes appearing 35 MY and the first hominids from 10 to 5 MY ago, (Table 1).

Just as remarkable, and even less noticed, is the fact that the dynamism of evolution evidenced by the progressive increase in the development of the central nervous system affects, as time advances, a progressively narrower segment of the entire living world. This produces the paradoxical phenomenon that, while vertebrate evolution *as a whole* may be characterized by the development of the nervous system with all its consequences (morphological and behavioral), the *proportion* of phyla giving evidence of this development becomes less and less. In other words, the amount of energy spent in the construction of biologically more efficient organisms is being used within an ever more concentrated and limited area of the total number of species living at any given time.

Moreover, as in the history of life, an acceleration is detectable. While it took 2 MY, at least, to pass from *Australopithicus* to the *Homo habilis* level, less than 1 MY sufficed to reach the next stage *(Homo erectus)* and a shorter time still increased brain size to that of modern man (Table 2).

Whether this acceleration proceeded at an even rate, or whether there were spurts when it was particularly rapid, as claimed by the theory of punctuated equilibrium, [6] remains a moot point. [7] Whatever happens to have been the case, the acceleration itself is not subject to doubt.

Table 2

BRAIN SIZE IN HOMINID EVOLUTION

(volume in cc)

Mean	Range	Age
Australopithecus		(X 10, 000 years)

africanus	440	435-485	400-250
robustus	519	478-560	300-100
Homo habilis	659	590-752	200-150
Homo erectus			
(Java)	930	813-1,059	100
(Peking)	1,075	850-1, 300	40
Homo sapiens			
neandertalensis	1,422	1,200-1,620	10
sapiens	1,350	1,000-2,000	5

A further similarity between hominid evolution and that of life as a whole appears in the narrowing down of the stream of progressive evolution to a single species within the hominid lineage. While early hominids, at the Australopithecus level, are represented in East Africa by a number of distinct species, [8] only one of these is seen to have survived and given rise to later hominids of the Homo grade of evolution. [9] From then onwards, the adaptive radiation, seen to be at the origin of the speciation process in many other animal phyla, ceased to affect hominid evolution, as will be considered further down.

The continuities so far observed between the history of life and that of the hominid phylum cannot but cause one to wonder to what extent, and in what sense, trends similar to those described above equally affect the socio-cultural history of our race. That they did was the intuition of Teilhard de Chardin [10] for whom the development of culture prolongs the ascending line of biological evolution.

Obviously, important distinctions become here necessary. For, while technology may certainly be regarded as an extension of the trend towards greater auto-regulation of the organism and towards greater independence from the physical environment, on the other hand, it is much less evident that the cultural and social history of humankind represents a similar prolongation of the trend towards higher levels of consciousness and inner freedom. As a matter of fact, considerable ambiguity must be said to affect many of the developments observed within human cultural history.

Even more questionable is the sense in which the spiritual energy of civilization may be said to have become canalized in an ever narrower segment of the human race. Would not such a concentration, in fact, run counter to the longing for universality found in the world great religions? Among these, Christianity, particularly, bids us to see God's Spirit at work in *all* cultures and nations. Thus, according to the Christian worldview, the stream of spiritual life, far from becoming constrained within an ever narrower channel, is seen to embrace progressively the entire universe.

These difficult questions, in order to be answered, call for a further examination, that of the discontinuities that separate and distinguish natural and human history.

3. DISCONTINUITIES BETWEEN NATURAL AND HUMAN HISTORY

Seen through the eyes of the paleontologist, human evolution departs from animal evolution as a whole principally by the way it switched from a polyphyletic and divergent type of evolution to a monophyletic, convergent evolutionary pattern.

As interpreted by the synthetic theory of evolution, animal evolution commonly occurs as an ancestral phylum expands over a number of diverse environments. Local populations are thereby submitted to a variety of environmental pressures and become progressively better adapted to their respective environments. This process, known as adaptive radiation, eventually results in the breaking up of the original ancestral phylum into a number of reproductively isolated species. Seen at all levels of vertebrate evolution, adaptive radiation accounts, for instance, for the many fossil ape species of Pliocene times, among which are to be found the ancestors of the living species of great apes as well as those of *Homo.* [11,12]

Not unexpectedly, therefore, early hominids, at the *Australopithecus* grade of evolution, are seen to have become divided into a number of species. Surprisingly, however, this fanning out radiation process appears to end there. For *Homo habilis,* the limited size of the fossil sample available and the limited known geographic distribution of the species make it advisable to postpone a firm judgment as to the number of the then coexisting hominid species. At the following *Homo erectus* grade, however, it becomes clear that the differ-

ences observed between hominid fossils recovered from widely remote regions of the earth no longer warrant the recognition of distinct hominid species. The hominid evolutionary process, from the radiating pattern it still shows at the *Australopithecus* grade, has now become a monophyletic one.

In their study of Middle Pleistocene evidence from East Asia, Wolpoff, Wu Xin Zhi & Thorne [13] regard ancestral populations within a dispersing genus *Homo* as "having had decreased genetic and morphological variability". This new evolutionary pattern was to perdure and even to become better marked. The more we learn about human evolution from Middle Pleistocene times until present, the better we realize that humans evolved as a single species, interbreeding on a worldwide scale. As a matter of fact, "through the late Pleistocene we notice increasing amounts of gene flow from the more central areas, reflecting the late Pleistocene improvements in human adaptation and the consequent population expansion." [14]

A similar pattern is seen in Western Europe, where it is best documented at the next evolutionary stage, that of early *Homo sapiens.* Recent finds of hominid fossils with Neanderthal characteristics in France, for instance, strongly suggest the coexistence of Neanderthal Man with anatomically more modern looking populations. [15] Whether this coexistence implied hybridization, and to what extent, remains a moot point. Raising the question, however, already implies that such differences as are observed between ancient and modern *Homo sapiens* do not exceed those obtaining between human races living today. Evidence from Central Europe leads Smith [16] to a similar conclusion: "morphological continuity between Neanderthal Man and the early modern sample in central Europe is clearly documented by the available information."

The change from a polyphyletic to a monophyletic pattern of evolution was most probably due, as suggested above, to the entirely new adaptive strategy adopted by the hominid lineage. While all other animal species rely chiefly for adaptation on genetic mutations strained through the filter of natural selection, human populations, past and present, all make extensive use of technical and cultural adaptations, the work of human hands and brains. Thereby they are able to survive, and even to prosper and multiply, without developing the type of genetically based adaptations that eventually caused their nonhuman ancestors to split into reproductively isolated species.

It is certainly no fortuitous coincidence if the earliest known stone tools are found at the time level where the hominid lineage becomes monophyletic. Expressed briefly, while animals modify their body so as to fit into the environment, humans modify their environment so that it may suit the their own needs.

Thus, human technology, while it can be considered as an extension of the much more general trend towards control of the environment, introduces in fact an entirely novel and, it turned out, revolutionary element in the evolutionary process: artificial adaptation. Thereby, most importantly, technology began to cancel, or at least to weaken, some of the biological mechanisms that contributed to its birth. For, while a selective pressure for an efficient and flexible response to the demands of a changing and varied environment undoubtedly played a major role in triggering and sustaining the brain expansion that made artificial adaptation possible, the substitution of cultural to genetic adaptation also caused the development of technology to escape, at least in the short run, the control of natural selection.

The consequences of this momentous step were not immediately evident. The still large morphological differences observed at the *Homo erectus* grade of evolution between Asian and European populations can probably be interpreted as a reflection of the as yet elementary refinement and efficiency of their technology. Only as the *Homo sapiens* grade is reached, and as the more complex and differentiated Middle Paleolithic stone tool making techniques develop, does one notice, both in East Asia and in Europe, as noted above, a decreasing morphological variability, sign of a correspondingly reduced genetic distance between populations living under different environmental constraints. [17]

It took a much further development of technology, however, for the long term consequences of the human adaptive strategy to appear. Two centuries after the industrial revolution, environmental destruction and the negative effects it exerts on human beings have made it evident to the eyes of many how technological development, once freed from the control of natural selection, risks to run wild and destroy what it was meant to bring about, namely humankind's harmonious

integration within nature.

Briefly, man's unique evolutionary strategy is seen to breed equally unique problems, unknown to other animal species which remain submitted to, but also protected by the mechanism of natural selection.

4. LESSONS TO BE DRAWN FROM THIS COMPARISON

Considered together, the similarities and differences revealed by a comparison of natural and human history warn us to beware of oversimplified or superficial analogies. On the one hand, the continuities detected show man to be a part of nature and cultural history to have been prepared by the evolution of life which made culture's emergence possible. It would thus be a dangerous illusion to conceive human thought or human action to possess extraterritoriality rights within the realm of nature. Consequently, a sound philosophical anthropology must take scientific data on biological evolution into account.

On the other hand, the discontinuities examined above show culture to have emerged as a quite novel entity, with consequences also at the biological level. Some of these consequences, those due to the development of biotechnology for instance, only recently began to draw our attention. Entirely unforeseen, these consequences of technology now appear as potentially threatening the very human culture that gave it birth.

While mankind's tree is rooted in the cosmos, there grow on it flowers and fruits entirely novel, some of which begin to scare us. Indeed, as Michael Polanyi wrote, more than twenty years ago: [18] "The series of increasingly comprehensive operations which lead up to the emergence of man is accompanied at every step by an additional liability to miscarry." Moreover, as Polanyi further remarks, "man is found not only liable to a far greater range of errors than animals are, but, by virtue of his moral sense, becomes capable also of evil." This is made still more evident today as the progress of genetics and molecular biology enables us, to a limited but real extent, to control and modify the biological future of our species.

The nineteenth century discovered humankind and life on earth to be united by their origins. The twentieth century now further discovers how they are bound by a common destiny.

The nineteenth century showed human history to be rooted in necessity i. e., in the evolutionary process to which *Homo sapiens,* as a species, is subjected like all other animal forms. The twentieth century now teaches us how, by the choices proposed to us, we are being made responsible for the future of life on this planet of ours.

Our common history has revealed to us our solidarity.

By becoming aware of the process whereby life's evolution resulted in the emergence of mankind, man is given the opportunity to assess the meaning of life's history. The direction of evolution observed by our research acquires thereby a possible meaning for the minds which build and manipulate our research instruments. As indicated at the beginning of this essay, quite apart from technological progress, the 19 and 20th centuries will forever be known as the time when mankind became aware of its biological roots. Today it is technological progress that forces us to take one more step, as important as the preceding one: we begin to understand that the awareness of our insertion in the history of life (and in the history of the cosmos) brings with it a call to participate actively in that history. Though it began without us, life's ascent will not continue without our cooperation. The impact of technology, including biotechnology, on life at large and on humankind itself shows that humans cannot remain outside the evolutionary process as passive spectators. Either they will contribute to enhance the richness of life, or their achievements will cause destruction, their own and that of life on earth.

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If the world is convergent and if Christ occupies its centre, the Christogenesis of St. Paul and St. John is nothing else than the extension both awaited and unhoped for, of that noogenesis in which cosmogenesis -- as regards our experience -- culminates. Christ invests himself organically with the very majesty of his creation. And it is in no way metaphorical to say that man finds himself capable of experiencing and discovering his God in the whole length, breadth and depth of the world in movement. To be able to say literally to God that one loves him, not only with all one's body, all one's heart and all one's soul, but with every fibre of the unifying universe -- that is a prayer that can only be made in space-time. Teilhard de Chardin.

ADDITIONS TO THE ITEST MEMBERSHIP DIRECTORY

Since the final draft of the Membership Directory was sent to the printer at the beginning of October we have enrolled several new members. We have also received a few changes of address. We shall try (on a space available basis) to update the list throughout the year. We will keep the changes as a unit so that you can remove them from the Bulletin and keep them in the Directory.

NEW MEMBERS

ASHROF, V.A.M.
Thinkers Library
Valiyaveetil Edavanakad. P.O., Kerala 682502
India

Librarian
Thinkers Library
Theology, philosophy, ethics

BACHMAN, Dr. James
Valparaiso Univ. Dept of Philosopy
Valparaiso, Indiana 46383
U.S.A.

(219)-464-5059
Eckrich Prof. Religion and the Healing Arts
Valparaiso University

CLARK, Ms. Michele
3401 West Wisconsin Ave.
Milwaukee, Wisconsin 53208
U.S.A.

(414)-933-7220
Science Teacher
Marquette University High School

DOMNING Ph.D., Dr. Daryl P.
Howard University, Dept. of Anatomy
Washington, District of Columbia 20059
U.S.A.

(202)-806-6026
Paleontologist
Howard University
Evol. biol, ecology, laity in Cath. Chur.

DONOVAN, Dr. James J.
263 Keith Avenue
Waukegan, Illinois 60085
U.S.A.

(708)-623-0590
Senior Research Scientist
Abbott Laboratories

HENKELS, Mr. Paul
345 Stenton Avenue
Plymouth Meeting, Pennsylvania 19426
U.S.A.

(215)-283-7901
CEO & Engineer

Religion, Science, Education

HILL, Rev. John Clifton
Duquesne University
Pittsburgh, Pennsylvania 15282
U.S.A.

Professor of Physics
Duquesne University

INTERPROVINCIAL JUSTICE COMM.
7800 Natural Bridge
St. Louis, Missouri 63121
U.S.A.

(314)-382-2800 Ext. 309

Vincentians & Daughters of Charity

KESSINGER, Glen L.
P.O. Box 4000 - MS 5213
Idaho Falls, Idaho 83403-1109
U.S.A.

(208)-526-3600
Chemist
Idaho National Engineering Lab
Radio active waste management

MEIJKNECHT, Dr. A.P.J.
Anthony Duyckstraat 4
2612 G Z Delft,

015-123421
Student Chaplain
Delft University of Technology

The Netherlands

MURPHY SJ, Fr. Joseph
3601 Lindell Blvd.
St. Louis, Missouri 63108
U.S.A.

(314)-658-2588
Professor Moral Theology
Saint Louis University
Systematic & moral theology

RAIKOV, Mr. Ventezeslav
"Preslav" 3
Sophia, 1619
Bulgaria

Metallurgical engineer

Transcendental Phenomenology

WINKER, Mr. Jeffrey
1522 Grand Avenue #1A
St. Paul, Minnesota 55105
U.S.A.

(612)-699-6128
Student
University of Minnesota at Minneapolis
Cultural/tech. aspects of internat. develop.

CHANGE OF ADDRESS

BRENNAN, Mr. Terrance
2068 Valley Lane
Glen View, Illinois 60025
U.S.A.

DAILY, Most Rev. Thomas V.
75 Greene Avenue
Brooklyn, New York 11238
U.S.A.

GEORGE OMI, Most Rev. Francis E.
5301-A Tieton Drive
Yakima, Washington 98908-3493
U.S.A.

SCHNEIDER SSJ, Sr. Maxyne
P.O. Box 116
Hubbardston, Massachusetts 01452
U.S.A.

SISTERS OF MERCY, Mercy Center Washington
1001 Spring St. Suite 224
Silver Spring, Maryland 20910
U.S.A.

SOME THOUGHTS ON FATHER FRISCH'S PAPER

Robert Brungs, S. J.
Director: ITEST

One aspect of Fr. Frisch's remarks triggered some theological reflection. On page 5 we read "Seen through the eyes of the paleontologist, human evolution departs from animal evolution as a whole principally by the way it switched from a polyphyletic and divergent type of evolution to a monophyletic, convergent evolutionary pattern."

That statement reminds me very much of a notion that I remembered from the Adversus Haereses of Irenaeus. There is, I think, a suggested harmony between Fr. Frisch's statement of a physically monophyletic, convergent evolutionary pattern and Irenaeus' treatment of divine election. The physicist in me sees a magnificent symmetry -- not probative of any certain conclusion, of course, but certainly one which can lead us to further reflection.

Irenaeus in his treatment of divine election, of God's choosing whom he wishes to carry out his designs, uses a description that can be pictured as a double cone. In the beginning God chose all of creation to be covenanted to him. But with the creation of Adam and Eve the election is narrowed to humanity expressed in our first parents. After the Flood it is again narrowed. God's choice is further restricted to Abraham and his descendants through Isaac and Jacob. The narrowing continues until it is Israel and then the Faithful Remnant of Israel on whom the covenant rests. Finally, as Irenaeus points out, God's election is centered on the Suffering Servant, on the Messiah. This is the point of absolute singularity after which the "cone" again widens to include the Apostles, all Christians, all mankind and finally the entire creation that God has flung out from himself partially to echo and reflect his goodness and bounty.

There is always a danger in mixing the empirical too readily and too automatically with the theological. Yet recent developments in our knowledge of biology and of paleontology (as well as many other "ologies") allow us to highlight some things better and more fully than we did previously. We are in a position to speak more clearly and with a broader vision than we were in the past. Modern discovery can bring some aspects of the revelation and our faith in it into a far greater appreciation.

If we combine Fr. Frisch's observation about the evolutionary growth of our species and Irenaeus' observations on God's election with St. Paul's realization that all creation will be freed from decadence in God, then enormous vistas of God's saving plan open before us. As God created all, so He wishes all to be saved. This in turn reminds me of Thomas Aquinas' remark that God will lose none of the beauty He has created. So from the creation of all, passing through the unique and absolute singularity of the Suffering Servant, we see God preparing for the salvation and glorification of all in Christ. We catch a hint of Paul's vision that this is a new creation, the old is gone. In Christ the world has been recreated and is proceeding dynamically towards its destiny in God. It proceeds under the power that is God enfleshed and risen from the dead.

That which evolutionarily converged toward en-soulment (using the term in Paul's sense in 1 Corinthians 15 -- alive but perishable) now diverges toward "enspiritment in Christ." As a Christian and a physicist I take delight in the suggestion of that kind of a symmetry. It helps me ponder the immensity of God's purpose which I continually try to domesticate to the limits of my own mind.

If the soul has its own embodiment, so does the spirit have its own embodiment. The first man, Adam, as scripture says, became a living soul; but the last Adam has become a life-giving spirit. That is, first the one with the soul, not the spirit, and after that, the one with the spirit. The first man, being from the earth, is earthly by nature; the second man is from heaven. As this earthly man was, so are we on earth; and as the heavenly man is, so are we in heaven. And we, who have been modelled on the earthly man, will be modelled on the heavenly man. 1 Cor. 15, 44-49)

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