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Science

Nature is both a scientific and a religious challenge. Nature must be evaluated within cultures. classically by their religions. currently also by the sciences so eminent in Western culture. Religious persons often find something "beyond," discovering that neither nature nor culture are self-explanatory as phenomena; both point to deeper forces. such as divine presence. or Brahman or Emptiness *(sunyata)* or Tao underlying. Religions often detect super-nature immanent in or transcendent to nature. perhaps even more so in human culture. though some religions prefer to think of a deeper account of nature. perhaps enchanted. perhaps sacred.

1. The Physical World: Matter and Energy

Science over the last four hundred years has opened up a vast extent of physical nature in space and time. unavailable to humans when the classical religions were formed. Once only speculative. cosmology has become science – and with mixed religious results. both from the vastness of the universe and from the naturalism. or secularizing. characteristic of science. Earth is lost out there in the stars; humans are dwarfed and shown to be trivial on the cosmic scale. as well as on the microscopic scale. (nothing but) the motion of atoms. molecules. biochemistries. Science seemed progressively to rob both our planet and the humans on it of any special place. But then the physical sciences took an unexpected turn.

Astrophysics and nuclear physics. combining quantum mechanics and relativity theory. have more recently been describing a universe "fine-tuned" for life. Physics has made dramatic discoveries at astronomical and submicroscopic ranges. remote from ordinary. native-range experience. The universe (this universe at least) originated fifteen billion years ago in a "big bang" and has since been expanding. From the primal burst of energy. elementary particles formed. and afterward hydrogen. the simplest element. which serves as fuel for the stars. In the stellar furnaces all the heavier atoms were forged. Some stars subsequently exploded (supernovae). The heavier elements were collected to form. in our case. the solar system and planet Earth.

In the last half-century. physics discovered that startling interrelationships are required for these creative processes to work. Theory interrelates the two levels; astronomical phenomena such as the formation of galaxies. stars. and planets depend critically on the microphysical phenomena. In turn. the mid-range scales. where the known complexity mostly lies (in ecosystems and human brains). depend on the interacting microscopic and astronomical ranges. If the scale of the universe were much reduced. there would not have been enough time for elements to form. If the expansion rate of the universe had been a little faster or slower. then the universe would already

have recollapsed or the galaxies and stars would not have formed.

Change slightly the strengths of any of the four forces that hold the world together (the strong nuclear force. the weak nuclear force. electromagnetism. gravitation). change critical particle masses and charges. and the stars would bum too quickly or too slowly. or atoms and molecules. including water. carbon. and oxygen. or amino acids (building blocks of life) would not form or remain stable.

These results have been summarized as the "anthropic principle" (an unfortunately anthropocentric term). which argues that the universe has been programmed from the start and in its fundamental dimensions for the subsequent construction of stars. planets. life. and mind. There are non-theological. naturalistic ways of interpreting these discoveries. but a plausible interpretation is divine design.

Whatever one makes of these anthropic claims. the most complex events known are found on Earth in biological systems. and the most complex of all is the human mind. pursuing its science or its religion. In a handful of humus. which may have in it ten billion organisms encoding a billion years of evolutionary history. there is more coded information (trillions of "bits") than in all of the stars. In the trillion neurons of the three-pound human brain. each capable of hundreds or thousands of connections with the others. there is more operational organization than in the Andromeda galaxy (so far as we know). The number of possible circuits in the brain exceeds the number of atoms in the universe. So we must turn to origins on that Earth. resulting in such a mind.

2. The Biological World: Life

Biology also has developed at two scales. the range of the very small and that of big-scale history. Molecular biology. discovering DNA. has decoded the "secret of life" (once ascribed to the Spirit of God). Evolutionary history has located the secret of life in natural selection operating over incremental variations across enormous timespans. with the fittest selected to survive. At native ranges. life takes place in ecosystem communities. where the competition remains. but also with many interdependencies. and also mixtures of order and disorder.

Over evolutionary time. speciation began with the simple and resulted in the complex. from microbes to persons. As with physics. the two levels have been theoretically interrelated. The genetic level supplies variations. does the coding of life in DNA. and constructs molecular proteins. Organisms cope at their native-range levels. inhabiting ecosystems. and across evolutionary time. species are selected and generated as they track changing environments.

In ecosystems. organisms are both challenged and supported. Every organism is what it is where it is; the "skin-out" environment as vital as "skin-in" metabolisms. Early ecologists favored ideas such as homeostasis and equilibrium. Contemporary ecologists emphasize more of a role for contingency or even chaos. Others incline to emphasize self-organizing systems (autopoiesis). also an ancient idea: "The Earth produces of itself (Greek: *automatically*)" (Luke 4:28). Some find that natural selection operating on the edge of chaos offers the greatest possibility for self-organization and self-transformation.

The process is prolific. but no longer fine-tuned. To the contrary. evolutionary history can seem tinkering and makeshift at the same time that. within structural constraints and mutations available. it optimizes adapted fit In contrast to the astrophysics and microphysics. in the middle-range earthbound natural history. there is much openness. emergence. surprise. struggle. loss. gain. or wandering. Natural selection is thought to be blind. initially in the genetic variations bubbling up without regard to the needs of the organism. some few of which by chance are beneficial. and also in the evolutionary selective forces. which select for survival. without regard to advance. Many evolutionary theorists insist that nothing in natural selection theory guarantees progress; most doubt that the theory predicts. or even makes probable. the long-term historical innovations that have occurred. Others think that the creative results are inherent in the system.

Though dominant throughout biology. evolutionary theory has proved quite problematic itself (independently of any religious agenda). There are disagreements involving the relative degrees of order and contingency. repeatability. predictability. the role of sexuality. competition and symbiosis. the extent of social construction in evolutionary theory. the evolutionary origins of mind. especially the human mind. differences between nature and culture. The theory is. in many respects. incomplete.

Fundamentalist theology denies (much or any) evolution and sometimes seeks to prevent its teaching in public schools. Others construct an evolutionary theism. emphasizing the continuing vital creative processes over time. the ascent of life from the simple to the complex. the increase of information. the effective and efficient results of genetic creativity and natural selection. producing a quasi-design. the production of more out of less over the millennia. Increasing knowledge of the sophistication of molecular structures has led some to look for intelligent design there. Evolutionary speciation generates and tests novel kinds. a cybernetic process employing open innovation and selection. with analogues in rational thought. including the logic of science. where novel theories are generated and tested.

Asian religious traditions interpret natural history as appearance *(maya.* illusion) spun over Brahman. or as a spinning world *(samsara)* spun over Emptiness. *sunyata.* As with the monotheists troubled by the character of the evolutionary process. Asian traditions too may have

difficulties knowing how much of the phenomenal world to embrace. and how much to see through or transcend.

By Buddhist accounts life is suffering. *dukkha.* driven by thirst. *tanha.* which seems biologically compatible; although what becomes of nature in *nirvana.* with desires extinguished (extinction). remains problematic. Taoism is the most naturalistic of the classical faiths. though critics find the ever-oscillating. complementary yang/yin inadequate to explain the historically developing natural history. Native faiths find an enspirited world; they may loosely embrace evolutionary history. They struggle to make their animistic or personalist accounts of animals and plants compatible with those of zoology and botany.

Struggle and suffering. and life renewed in the midst of its death and perishing are central themes in Christianity. In the Psalmist's metaphors. life is lived in green pastures and in the valley of the shadow of death. nourished by eating at a table prepared in the midst of enemies. In the letters of Paul. the creation is groaning in travail. with the labor of giving birth (the original meaning of "nature"). Jesus suffers and dies redemptively. Although non-moral. natural history is "cruciform" even before humans arrive; and in all creating of life there seems to be struggling through to something higher.

Though biologists are typically uncertain whether life has arrived on Earth by divine intention. they are almost unanimous in their respect for life and seek biological conservation on an endangered planet. Earth's impressive and unique biodiversity warrants wonder and care. Anciently. the Hebrews marveled over the "swarms" of creatures Earth brings faith in Genesis 1.

3. Nature and Culture: Human Life.

Nature has generated only one species capable of cumulative transmissible cultures. Nature and culture are classical opposites. or complements (as are nature and supernature). By nature humans are "born that way"; by nurture humans learn to become civilized. Humans have a dual inheritance system. In one meaning (recalling Latin etymology. *natura).* "nature" refers to everything generated or produced. For metaphysical naturalists. perhaps for methodological scientists. nature is all that there is. without contrast class. Humans evolved within nature and break no natural laws.

Still. culture differs from nature. Humans are nurtured into an inherited linguistic and symbolic system. a world-view. by which humans communicate. perpetuate. and develop their knowledge. This cultural genius makes possible the deliberate and cumulative. and therefore the extensive. rebuilding of nature. Humans reshape their environments. rather than being themselves morphologically and genetically reshaped to fit their changing environments. Humans come into the world by nature unfinished and become what they become by nurture. Religious persons find their traditions vital in such nurture. and absent from nature.

Critics may object to distinguishing so sharply nature from culture (too "dualist") on grounds that culture is already present in animals. and also that nature remains a strong determinate in human affairs. If by culture is only meant transfer of acquired (and non-genetic) information from one generation to the next. culture is present in various social animals: chimpanzees (who imitate tool using). even in warblers (who imprint songs or migration routes). In classical anthropological meaning. however. culture requires intentional teaching of language. beliefs. skills. morals. laws. customs. arts. worldviews. religions – all historically transmitted over generations.

In that classical sense. culture remains distinctive to humans and is the dominant determinant in their affairs. Information in nature travels intergenerationally on genes; information in culture travels neurally as persons are educated into transmissible cultures. The determinants of animal and plant behavior are never anthropological. political. economic. technological. scientific. philosophical. ethical. or religious. Animal imprinting and limited transmitting of acquired information notwithstanding. humans gain a deliberated modification of nature that separates humans in their cultures from wild nature. increasingly so in high-technology cultures. Recently decoding our own genome. humans stand at the threshold of rebuilding even their own genetic nature.

Animals are not in this sense nurtured. Without some concept of teaching. of ideas moving from mind to mind. from parent to child. from teacher to pupil. a cumulative transmissible culture is impossible. Though language "comes naturally" to humans. what is learned has been culturally transmitted. using a specific language. The content learned during childhood education is that of an acquired. non-genetic culture. These cultural traditions are the locus of the generation and transmission of religious faith. In that sense religion is a phenomenon of culture. not nature.

4. Worldviews: Causes. Meanings. Values

Humans are only part of the world in biological. evolutionary. and ecological senses. their nature; but *Homo sapiens* is the only part of the world free to orient itself with a view of the whole. to seek wisdom about who we are. where we are. where we are going. what we ought to do. Religious persons claim that. with due admiration for the successes of science discovering causes in nature and culture. science leaves the ultimate value questions still unresolved. those assigning meaning and value. One needs a scientifically informed worldview. but the ultimate value questions remain as acute and painful as ever. There is no scientific guidance of life.

Nor can humans simply follow nature. Nature does not teach us how we ought to behave toward each other. Com-

passion and charity. justice and honesty. are not virtues found in wild nature. There is no way to derive any of the familiar moral maxims from nature: "One ought to keep promises," "Do to others as you would have them do to you." "Do not cause needless suffering." No natural decalogue endorses the Ten Commandments.

Although nature Is not our moral tutor. there may be goods (values) in nature that humans ought to respect and conserve. Animals. plants. and species. integrated into ecosystems. may embody values that. though non-moral. count morally when moral agents encounter these. And. even if one is in doubt about divine creation. or sacred nature. or intrinsic values in nature. there is little doubt that humans and their planet have entwined destinies. Sustainable development has been a recent focus. pleasing economists. developers. and humanists. who find that ecologists and conservation biologists continually caution that what most fundamentally must be sustained is the biosphere.

Humans. if uniquely the wise species. are also uniquely the species that needs redemption. Religions may celebrate creation. or struggle with what to make of evolutionary history. But the real business of religion is salvation. mending the perennial brokenness in human nature. Ultimately such salvation is beyond the natural. perhaps supernatural. by the grace of the monotheist God. perhaps in some realization of depths underlying the natural; such as Brahman or *sunyata.* Meanwhile. whatever the noumenal ultimate. humans reside in a phenomenal world. which they must evaluate. and in which they must live. hopefully redeemed or enlightened by their faiths.

Humans sin. unlike the fauna and flora. Religion is for people. and not for nature. nor does salvation come naturally; even the earthly good life is elusive. Christian and other ethicists can with considerable plausibility make the claim that neither conservation. nor a sustainable biosphere. nor sustainable development,.nor any other harmony between humans and nature can be gained until persons learn to use the Earth both justly and charitably. Those twin concepts are not found either in wild nature or in any science that studies nature. They must be grounded in some ethical authority. and this has classically been religious. The Hebrews. for instance. were convinced that they were given a blessing with a mandate. The land flows with milk and honey (assuming good land husbandry) if and only if there is obedience to Torah.

Scientists turning to environmental policy often appeal to ecosystem management Such management connects with the idea of nature as "natural resources" at the same time that it has a "respect nature" dimension. Christian ethicists note that the secular word "manage" is a stand-in for the earlier theological word "steward." Ethicists have frequently thought of ethics as a social contract; environmentalists add that ethics needs also to be a natural contract. human responsibility for this marvelous planet on which we reside. Humans need a land ethic. Anciently Palestine was a promised land. Today and for the century hence. the call is to see Earth as a planet with promise.

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Further Reading

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See also: Conservation Biology; Darwin. Charles; Ecological Anthropology; Ecology and Religion; Einstein, Albert; Environmental Ethics; Evolutionary Biology, Religion. and Stewardship; Religious Studies and Environmental Concern; Sagan. Carl; Social Science on Religion and Nature.