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SCIENCE AND CHRISTIANITY

Physics and biology are the two principal natural sciences with which Christian theology must reckon, although there is important dialogue with other natural sciences such as chemistry and geology. Technical sciences such as medical science and computer science sometimes raise both theoretical and ethical

issues. Questions about therapeutic genetics made possible by sequencing human DNA, or about cloning, are examples. Although Christian thought also interacts with the social sciences, psychology, anthropology, economics, and history are not addressed here.

Scientists increasingly realize that theory, models, data, and description are more entwined than once supposed. Together with discoveries in physics and shifting scientific theories over time, this recognition has softened the realism in science in favor of more historical and culture-bound accounts. Critics of science, especially the postmodernists, press these claims about the social construction of science and theology further than many scientists wish; and theologians are of mixed opinions whether to welcome these developments. Theology is evidently a cultural, historical activity; yet it too, like science, seems to make more universal and transcultural claims.

The relations between physics and theology are surprisingly cordial at present; the relations between biology and theology are more difficult. Astrophysics and nuclear physics, combining quantum mechanics and relativity theory, are describing a universe "fine-tuned" for life, while evolutionary and molecular biology seem to be discovering that the history of life is a random walk with much struggle and chance, driven by selfish genes.

Physics has made dramatic discoveries at astronomical and submicroscopic ranges, both 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. Recent 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 midrange scales, where the known complexity mostly lies (in ecosystems or 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 burn 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 "fine-

tuned" from the start and in its fundamental construction for the subsequent construction of stars, planets, life, and mind. There are nontheological, naturalistic ways of interpreting these discoveries, but a plausible interpretation is divine design. Theologians and philosophers have often been wary of design arguments, remembering William Paley, his fine-tuned watch, and the many telling criticisms of such arguments. Nevertheless, the physical world is resembling a fine-tuned watch again, and now many quantitative calculations support the argument.

Biology is a stark contrast—at least at first. 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. Speciation begins with the simple and results 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 deep evolutionary time, species are selected as they track changing environments, transforming one into another.

The process is prolific, but no longer fine-tuned. To the contrary, evolutionary history can seem tinkering and make-shift at the same time that, within structural constraints and mutations available, it optimizes adapted fit. Natural selection is thought to be blind, both 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. Evolutionary theorists insist that nothing in natural selection theory guarantees progress; many doubt that the theory predicts the long-term historical innovations that have occurred. Further, since individual organisms are selected for their self-interested reproductive skills, in competition with others, selection favors "selfish" organisms.

Though dominant throughout biology, evolutionary theory has proved quite problematic itself (independently of any theological 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, and differences between nature and culture. The theory may be incomplete. If Darwin is biology's Newton, its Einstein may be still to come.

Theological reaction is mixed. 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 long millennia. Increasing knowledge of the sophistication of molecular structures has led some to look for intelligent design there. Others suppose divine intervention at quantum levels.

The watchmaker-design approach to the concept of a Creator, if appropriate in physics, may not be the model for biology, where more autonomy and self-creativity is combined with the divine will for life, a divine parenting entwined with spontaneous creative process. Organisms defend their lives; their "selfishness," so-called, is really self-actualizing, the defense of vitality. Reproduction is the ongoing sharing of biological value and promise. 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.

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 nonmoral, natural history is "cruciform" even before humans arrive; and in all creating of life there seems to be struggling through to something higher.

In human history, where moral selfishness does emerge, superimposed on biological self-actualizing, humans fall into sin. They need creative redemption from their selfishness, and the cruciform character of life intensifies. Here, too, theologians have long spoken of a salvation by suffering. They may also claim that, with due admiration for its successes, science leaves the ultimate value questions still urgent and unresolved. Indeed, there is no scientific guidance of life; despite the evident progress in the sciences in today's world, the value questions remain as acute and painful as ever, an ongoing struggle.

The concept of divine "kenosis," first applied to God's "self-emptying" in Christ, is often more widely applied. God supports but is "self-restrained" in creation. God is not evident and overruling, but graciously allows creatures freedom of self-development, desiring and assuring their independence within the divine ambience. Although 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, evolved and created, warrants wonder and care.

HOLMES ROLSTON III

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