2) to an analysis of causal *relevance* (chapter 5) they seem to espouse an account akin to Jackson and Pettit's program explanations (1990) that was intended to save higher-level causal *explanations* while denying their efficacy. The worries raised by reductionist philosophers such as Kim concerning the causal efficacy of mind are not epistemological in nature; the real issue for them is the seeming paradox generated by the causality of an irreducible mind embedded in a materialist metaphysics.

Murphy and Brown have tackled a gargantuan topic and have attempted to address the major issues facing theorists of mind and action. The strength of their undertaking lies in their ability to integrate large bodies of disparate knowledge. Putting the deliverances of neurobiology, psychology, information theory, and philosophy into a coherent system is no easy task. What they may have missed in terms of deep and probing analyses they surely make up in terms of their expansive vision. Although I would have liked more engagement with the extant theories of consciousness and have worries concerning their account of top-down causation, the book is clear, well-written, and valuable for its extensive interdisciplinary work.

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Cosmic Jackpot: Why Our Universe Is Just Right for Life. By Paul Davies. London: Penguin, 2006, and Boston: Houghton Mifflin, 2007. xv + 315 pages. $26.00.

Paul Davies is a celebrated cosmologist with a sustained interest in its philosophical dimensions. Years ago he wrote *God and the New Physics* (New York: Simon and Schuster, 1983), and in the quarter century since he has repeatedly returned to themes surrounding the anthropic principle. *Cosmic Jackpot* is the sequel, maybe even a finale. If he can answer the question in his subtitle, that will really hit the jackpot.

Cosmology is changing (dark energy, dark matter, the thermal birth map of the universe, made with the Wilkinson Microwave Anisotropy Probe), so the issue needs revisiting. Davies is unsurpassed in summarizing highly technical results and their significance for a reasonably literate audience, such as *Zygon* readers. He can couple this with a conversational style, often with reminiscences about the cosmological celebrities involved.

He can be refreshingly blunt separating science from speculation and worrying about the transition zones: "As we consider earlier and earlier moments, we have to rely on increasingly speculative theories. Inflation, for example, makes use

of grand unified theories (GUTs) of particle physics that so far have no direct experimental confirmation" (p. 72). In one of the typically British understatements of the book, such "theories of everything" involve "considerable exaggeration" (p. 86). They seek to unify the different elementary particles and their characteristics but have nothing to say about historical particularity—trilobites, elephants, or persons, for example. This is a little like trying to explain everything in the United States by using gravity. So we just smile at the exaggeration. But then we begin to wonder whether, even if we know the "just right" cosmology, we will know why there is the unique history that has occurred on Earth.

If we play with the jackpot metaphor, Who won what jackpot when? The *who* answer seems to be humans ("arguably *the* most significant fact about the universe," p. 2), or at least life ("the universe is bio-friendly," p. 2), but the *when* answer seems to be the start-up event some 13.7 billion years ago. So there is quite a lag time between hitting the jackpot and winning. The jackpot is, to mix metaphors, a cooking pot, and the lag time is cooking time for heavy elements and for life on Earth. Davies is much more confident dealing with the primordial jackpot and the elemental cooking than he is with how life cooks up in the pot.

The book is nine chapters physics, then one chapter biology. But in that chapter we are told that "life . . . is 1 percent physics and 99 percent history" (p. 233). There is a kind of 9:1/1:99 tension throughout the book, continuing into the "how come" of concluding Chapter 10. The beauty of the book is the same as its problem. Davies is a physicist and remains challenged by the radical differences between physics and biology. "The Great Rule Book of Nature (at least as it is currently understood) would fit comfortably onto a single page" (p. 11). Has Davies looked at a recent biology text (typically 1,200 pages) and tried to shrink it to a single page?

Davies knows the laws of physics like the back of his hand; he does not seem to know that most biologists doubt that in biology there are any laws at all, in the sense in which physicists use that term—fundamental laws true of everything all over the universe. Biologists use generalizations (meiosis, independent assortment, haploids/diploids); they may find some laws in their biochemistry (valence bonds in glycolysis). But glycolysis in another galaxy? Who knows? Biologists study an idiographic Earth. Cosmologists must be universally nomothetic. "Four fundamental forces explain everything" (p. 93). Why there are marsupials in Australia, while placentals dominate other continents? More hyperbole, but the point is that gravity, electromagnetism, and weak and strong nuclear forces are in the 1 percent physics, not in the 99 percent history.

Davies has read biology, of course. "Taking life seriously" in his concluding Chapter 10 (p. 223), he realizes that biology is Darwinian and physics is not. Organisms are autonomous and contain biological information not found in physics. The emergence of mind is challenging. "Somehow the universe has engineered its own self-awareness" (p. 231). Some "just right" "engineering"? When we look for "just right" explanations of Earth's natural history, resulting in mind, biologists are divided.

Consider whether this 99 percent history is contingent, inevitable, probable, or possible. Stephen Jay Gould, outspoken Harvard paleontologist, spent his career insisting that life is "the fragile result of an enormous concatenation of improbabilities, not the predictable product of any definite process" (1983, 101–2).

Michael Ruse, equally outspoken philosopher of biology, claims that scientists who read progress into the evolutionary record have slipped into "pseudo-science" (1996, 526). John Maynard Smith, theoretical biologist, together with his colleague Eörs Szathmáry, concludes that the major transitions in evolution have depended on "small number of major transitions" in the way information is transmitted (genetic code, cell nucleus, sexuality, acquired learning, language), but finds "no reason to regard the unique transitions as the inevitable result of some general law" (1995, 3).

There are biologists who think the Earth life history inevitable, of course. Lately, Simon Conway Morris, prominent Cambridge paleontologist, has been quite outspoken about how "life . . . is full of inherencies." "Life shows a kind of homing instinct . . . given enough time, the inevitable must happen" (2003, 8, 20). He is impressed by convergences and parallel evolutions on Earth (doglike, catlike, rodentlike marsupials). Conway Morris is more inclined to find a jackpot Earth in an otherwise lonely universe.

Christian de Duve, Belgian microbiologist, is closer to Davies: "I view this universe [as] . . . made in such a way as to generate life and mind, bound to give birth to thinking beings" (1995, xviii). Theoretical biologist Stuart Kauffman agrees: "I believe that the origin of life was not an enormously improbable event, but law-like and governed by new principles of self-organization in complex webs of catalysts" (1993, xvi).

Davies knows who these people are, though he deals with them mostly by way of mention, en route to a discussion of teleology in physics ("the dreaded t-word," p. 233). There he ends wondering whether mathematics and physics are one and the same and whether quantum mechanics permits teleology. Rather than evaluating whether de Duve, Conway Morris, or Kauffman might be finding laws of biology, or statistical probabilities, or convergent trends against the sheer-contingency claims (or whether they have fallen into pseudoscience), we end with the "key point" that backward causation might be a "quasi-respectable route to teleology" (p. 259). Maybe so, but backward causation is not going to illuminate whether or why life persists and elaborates in the midst of its perpetual perishing—mammals speciating rapidly after dinosaur extinctions.

The subtitle, *Why Our Universe Is Just Right for Life*, promises an answer the book never gives. Rather, we discover that when it comes to the big questions, bright physicists wander around like everybody else. We do get from Davies an intriguing account of *how* our universe is promising for life, which for him does keep open (keep promising, if you like) the *why* question, with God as one of the possible answers. Yes, there was an original cosmic jackpot; but, after that, there is also on Earth an escalating serendipity generating a wondrous richness of biodiversity and biocomplexity that physics cannot touch. Perhaps the best way to say this is that Davies's cosmology is necessary for life (1 percent absolutely required) but not sufficient for Earth's 99 percent storied natural history. We should welcome that much.

Davies takes stock: "In our search for an explanation of cosmic bio-friendliness we have encountered a heady mix of speculation, ranging from the intriguing to the seriously flaky" (p. 202). He inclines toward an "overarching law," a "life principle," or "self-explaining universe" (p. 266). A major reason for the spectrum is "the intractable nature of the problems being confronted" (p. 203). A

skeptical reader will conclude that Davies, for all his brilliance in cosmology, never gets much further than banging into intractable metaphysical problems. He concedes: "Confused, I certainly am" (p. 204). So much for the subtitle with its promised answer to the *why* question.

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Evolution and Christian Faith: Reflections of an Evolutionary Biologist. By Joan Roughgarden. Washington D.C.: Island Press, 2006. 168 pages. Cloth. $14.95.

Joan Roughgarden, Professor of Biological Science and Geophysics at Stanford University, believes that there are more important things we could be doing than arguing about creation and evolution. I agree. By reducing evolutionary theory to its component parts, clarifying what is certain and what is not, then examining scripture in light of it, this book clears away some of the rubble that keeps us arguing. The content of the book is not groundbreaking, but by clearly and lucidly describing evolutionary theory and giving intriguing interpretations of scripture it provides an accessible resource for discussions in both congregations and classrooms. The book's value as a conversation starter is enough to overcome flaws in Roughgarden's biblical exegesis and in her approach to the relationship between science and religion.

Roughgarden begins with two facts that form the basis of evolutionary biology: "one family tree unites all of life, and species change through time and place" (p. 24). The support for each is compelling, and neither is contradicted by a literal reading of scripture, which is silent on the question of whether God created from a single source and whether offspring must be an exact copy. Evolutionary theory explains these facts through "natural selection" and "random mutation." Again, neither contradicts scripture or the existence of God, in this case because biology is silent. Mutation is random, but neither "evolutionary biology nor neo-Darwinism specifically asserts that evolution overall is random, directionless or unguided" (p. 57). What part God plays depends on whether or not you "have a hands-on view of God" (p. 47).