A Fine Question Remains Unanswered

It’s a funny title—What is Life? Investigating the Nature of Life in the Age of Synthetic Biology—the grandest question of all followed by a rather nerdy limitation on it. And yet Regis is too smart an author (with several provocative science books in his oeuvre) not to know that the philosophic query predates and dominates the biological one. We get a bit of the former and a lot of the latter, mostly pendulous drops into the pit of defining life biologically. Such a tack is possible only because of our recent far-reaching knowledge of DNA, RNA, and ATP, chemicals whose nano-engineering, billion years’ adaptation, and relational diversity among creatures great and small have riddled the earth with species only a few of which survive.

And yet the more technological telescoping we do, the more difficult it is to find a unifying theory for life. Fixing that distinction is unlikely because scientists, among them Stephen Jay Gould and Stuart Kauffman, do not agree on what life is. For Gould it’s everything (dead or alive) that’s existed from mass extinctions to Barry Bonds’s last homer. For Kauffman, it’s a continuous random creative act in which self-preserving self-assembly vies with natural selection. Yet these offers are mere proposals: since cells, a.k.a. life, have not been synthetically made, what’s uncreated remains undefined. Still, a healthy resistance to pigeon-holing life is the hallmark of Regis’s compact, mindful essay.
Regis emphasizes the work of Erwin Schrödinger who proposed in a 1944 paper that life’s spark is not a mystery but rather a knowable, even reproducible, phenomenon involving physics and chemistry. The Austrian physicist helped spread the now-commonly held notion that life began with chemical reactions in a pre-biotic soup and produced a self-replicating and self-nourishing cell. To live you must do three things: reproduce, mutate, and metabolize. Self-replication is carried out by the genes encoded in every organism’s DNA. Mutation occurs as the entity adapts to the nastiness of its environment. Metabolism is the efficacious making, storing, and eating of food. All these actions happen in a cell which is inside a membrane which is in an environment, a highly cooperative-competitive relationship.

Schrödinger inspired generations of cellular biologists, but his conclusions have come in for rough scrutiny. In particular, as Freeman Dyson put it, we cannot have a definition of life that depends on Schrödinger’s—or anyone’s—“bias toward replication.”

For Regis and other investigators to declare that life reproduces-mutates-metabolizes is, believe it or not, too clubby a conclusion. Life is so evolutionarily multi-pronged (how much of what “has lived” never evolved!) that to concentrate on its “heterogeneous characteristics and capabilities” leaves out the messy elements. For example. Life atrophies, runs down and falls apart. Such an end is crucial, for whatever’s left behind is useful to other autocatalytic systems. Dying is a wrench in the self-replicating machine, and it, too, should be on the table. Don’t we know it? That lives end in unwelcome death makes clear and regrettable sense.

Just because a class of things share a semblance of DNA does not mean DNA is alive. DNA “[is] no more necessary to life,” Regis writes, “than driving on the right-hand side of the road [is] necessary to driving.” DNA is a macromolecule made of nucleic acids that tells other cellular forces to make other molecules that build amino acids, proteins, enzymes. It’s marvelous organic chemistry with a function. But for Regis the cell’s “embodied metabolism” is far more important. What we’ve defined as life is invariably a husked activity.

But what of the world outside the husk? Consider the nonconformists. Are gases and other inorganic materials, non-living viruses that colonize living cells, organisms like the mule and other sterile hybrids which cannot reproduce and live only once part of the definition? Is an earthquake alive? A rainbow? A candle flame? Where are their husks, their feed stores? Can’t non-replicating, non-mutating, non-metabolizing entities act? How about a language that “lives” metaphorically? And what of Larry King, who still hosts a live show on CNN but has been functionally dead since 1989?
Despite our DNA-centrism, the multi-ring circus of earth-bound metabolites is one of many shows in town. Over time, the performance is hardly special—a once, not a forever. A part of some mysterious whole. The other damnable thing about "life" is that much of its energy is as if—something is transforming itself into something else that it presently is not. On this point, Regis give us a fine qualifier: life is "at best semidecidable."

Regis falters by imposing too big a gap between his opening gambit about the new field of synthetic biology—the DNA-less protocell and its Petri-dish environment—and its elaborated possibilities at the book's end. There was plenty of space to make the protocell, which scientists are close to creating, a more dramatic part of the narrative. Otherwise, Regis answers the title's question by faithfully exploring its unanswerableness.