The standing of evolutionary biology is independent of the origin of life. This has been true from the publication of Darwin's *On the Origin of Species* in 1859. In that work, Darwin allotted less than a page toward the end of 670 pages of text to the question. The last two sentences of the sixth edition read:

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone circling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

And in an 1871 letter to the botanist Joseph Hooker, Darwin wrote:

It is often said that all the conditions for the first production of a living organism are present, which could ever have been present. But if (and oh! what a big if!) we could conceive in some warm little pond, with all sorts of ammonia and phosphoric salts, light, heat, electricity, &c.,
present, that a proteine [sic] compound was chemically formed ready to undergo still more complex changes, at the present day such matter would be instantly devoured or absorbed, which would not have been the case before living creatures were formed.

Darwin added, "It is mere rubbish thinking at present of the origin of life; one might as well think of the origin of matter."

However, faced with mounting evidence in support of evolutionary biology coming from scientific fields from genetics to paleontology, the origin of life has become an obsession with creationists who assert that science’s failure to create life de novo is "proof" of supernatural creation. The first book-length argument of this sort was published in 1984. Written by Charles B Thaxton, Walter L Bradley and Roger L Olsen, *The Mystery of Life's Origin* argued that there is a scientific "crisis" in origin-of-life research, the Miller-Urey experiment was actually a failure, the early earth was oxidized and thus incapable of supporting amino acid synthesis, scientists are "dogmatic materialists" and manipulate their experiments to produce their desired results, and the second law of thermodynamics requires that order cannot appear spontaneously. There is even the introduction of a language model of DNA coupled to an "information entropy" argument.

Bradley and Thaxton reprised their information argument in 1994 for a book edited by Biola University philosophy professor JP Moreland entitled *The Creation Hypothesis*. Prominently displayed on the cover of the book are the names of Hugh Ross and the young William Dembski. In their chapter, "Information and the Origin of Life" (p 173-210), Bradley and Thaxton introduce the notion that "design detection" was similar to archaeology, the search for extraterrestrial intelligence (SETI) particularly as depicted in Carl Sagan's fiction, and forensic investigations. They also apply Leslie Orgel's 1973 concept of "specified complexity" to life and rephrase it as a sort of measure of information. In short, Bradley and Thaxton's short chapter on the origin of life set the agenda for William Dembski's whole career. Similarly, *The Mystery of Life's Origin* is a cornerstone of Rana and Ross's book.

One of the goals of *Origins of Life: Biblical and Evolutionary Models Face Off*, according to the introduction, is to update *The Mystery of Life's Origin*. Fazale Rana has a chemistry PhD from Ohio State, and Hugh Ross has his PhD from the University of Toronto in astronomy. Together, they are leaders of Reasons to Believe (RTB), an old-earth creationist organization founded by Ross. Their strong arguments regarding the age of the earth are welcome antidotes to young-earth dogmas promoted by such outfits as Answers in Genesis. Rana and Ross are most certainly creationists, however, asserting that the biblical God actively intervenes in biology to "... create each and every new species of life on Earth"; in particular, "God supernaturally and miraculously created Adam from the 'dust of the earth' ...". (See Numbers 1993 and Scott 2005 for a discussion of the various flavors of American creationism.)

The errors begin immediately. There are errors of fact, logic, and scholarship. There is a standard dose of quote mining mixed in as well. The creationists’ current favorite scientists to quote-mine on the origin of life are Robert Shapiro (a creationist’s favorite since his 1986 book), Peter Ward (paydirt from the 2000 book *Rare Earth* co-written with Donald Brownlee), and Hubert Yockey (possibly the mother lode, with half a dozen citations). *Origins of Life* also offers ample cheap innuendo that scientists lack integrity, are "desperate," and "... are keeping quiet ..." about the so-called research failures Rana and Ross claim to expose. All this before the end of chapter 1.

More importantly, the "RTB Model" predictions offered by Rana and Ross are not and cannot be differentiated from the predictions of modern origin-of-life research when they are testable at all. The creationist face of the subtitle's "face off" is a hollow mask. The proffered predictions from this "biblical model" appear on pages 43-4:

1. Life appeared early in Earth's history while the planet was still in its primordial state.
2. Life originated in and persisted through the hostile conditions of early Earth.
3. Life originated abruptly.
4. Earth’s first life displays complexity.
5. Life is complex in its minimal form.
6. Life's chemistry displays hallmark characteristics of design.
7. First life was qualitatively different from life that came into existence on creation days three, five, and six.
8. A purpose can be postulated for life's early appearance on Earth.
Predictions 1-3 are identical with those of origin-of-life research. From geochemistry, it is known that the chemical signatures of life are present in the earth’s oldest sedimentary rock (Rosing 1999, which is actually cited by Rana and Ross). A decade earlier than Rana and Ross, and well before Rosing’s confirmation, Antonio Lazcano and Stanley Miller predicted that life appeared in as little as 10 million years following the establishment of favorable conditions (Lazcano and Miller 1994, 1996). Part of the second RTB prediction is trivial — life today began at some point and then persisted. The rest — the notion that the early earth was particularly hostile to life — is absurd. Modern life is found from alkaline to acidic conditions, from below freezing to near boiling temperatures, from harsh sunlight to total darkness, from alpine lakes and hyper-salty lagoons to the driest sands, in solid rock miles beneath the surface, and in forms dependent on molecular oxygen and in others destroyed by it.

The term "specified complexity" was coined by Leslie Orgel in his 1973 book The Origins of Life: Molecules and Natural Selection. He wanted to draw the distinction between life and the non-living organization of crystals, which lack complexity, and non-living complex organic aggregates such as tars, which lack organization (that is, specificity). Given the importance that Rana and Ross give this notion of complexity in their model predictions 4 and 5, and their frequent call on "complex organization" and "function", I am unable to understand why they failed to explore its meaning. Equally puzzling is why they failed to mention that this was a central part of our scientific exploration of life for over 30 years. Predictions 4 and 5 can be dismissed.

Prediction 6, presenting the chemical "hallmark characteristics of design," would be an astounding breakthrough, and something that "intelligent design" creationists have all failed to provide in spite of a decade of promises. Alas, Rana and Ross also demur, apologizing that such a difficult topic is beyond the scope of their book, and promising a future book that will present "a comprehensive case for biochemical design" (page 43).

Their last two "predictions" are no such thing. They are at most scriptural interpretations or theological directives and leave no room for independent confirmation of any kind. Rana and Ross provide no means to differentiate their creationism from mainstream science, and try to usurp long-established scientific results for their "biblical model".

Lacking any valid predictions from the RTB model, there was little reason for me to persevere with the book, so I attribute my continued reading to masochism. The situation was not improved when I reached the "predictions" Rana and Ross claimed are the logical scientific consequences of origin-of-life research. These are listed below from pages 58-60:

2. Chemical pathways yielded complex biomolecules.
3. The chemical pathways that yielded life's building blocks and complex molecular constituents operated in early Earth's conditions.
4. Sufficiently placid chemical and physical conditions existed on early Earth for long periods of time.
5. Geochemical evidence for a prebiotic soup exists in Earth's earliest rocks.
6. Life appeared gradually on Earth over a long period of time.
7. The origin of life occurred only once on Earth.
8. Earth's first life was simple.
9. Life in its most minimal form is demonstrably simple.

The first "prediction" is amply demonstrated experimentally and by direct observations from geochemistry and astrochemistry. The second claim seems innocuous; after all, complex biochemistries are produced everyday by chemical pathways. However, Rana and Ross augment the second claim by explaining that it means that DNA, RNA, proteins, membranes, and cell walls "condensed" from the prebiotic environment. This does considerable violence to actual origin-of-life research and theory, which offer specific hypotheses about how such biomolecules formed and outlines cumulative sequences, rather than proposing life simply "condenses".

The third claim, that a rich chemistry existed under early earth conditions, is harmless enough until Rana and Ross piggyback the false assertions of their fourth prediction: The claims that modern origin-of-life researchers imagine a "placid" early environment for "long periods of time" and that such an environment would be favorable for the origin of life are unfounded. Nor are they necessary corollaries to the proposed third prediction.

The fifth proposed consequence for a natural origin of life, that some original remnant of the prebiotic environment must exist,
is neither necessary nor cogent. However, such an evidentiary demand can be satisfied in two obvious ways. First, there are multiple examples of amino acids, sugars, and even vesicle-forming lipids from products extracted from meteors, and detected in space by spectroscopy. These are the least altered fragments of our ancient solar system. As it turns out, Rana and Ross cite a small part of this literature, only to dismiss it. Second, isotopic studies provide some indications that even under the horribly destructive dynamics of the earth, some vestige could still exist (Pavlov and others 2001).

Their sixth proposed "scientific prediction" is simply untrue, as is their seventh. It is in fact an area of considerable research and discussion whether there were multiple origins of life, and whether this can ever be untangled. Work by Carl Woese (especially 1998, 2002) argues strongly that multiple origins will never be disentangled. It is with a respect bordering on awe that I contemplate how Charles Darwin allowed for this in the last page of his Origin of Species, writing that life was originally breathed "... into a few forms or into one."

Rana and Ross's claim that science predicts first life to be "simple" is incoherent because they have never defined complexity. The scientific conception of life has always entailed complexity, and Rana and Ross's argument cannot be evaluated without some anchor to make it meaningful. According to the scientific literature, the earliest life was simple compared with later life, and complex compared to most chemistry. Efforts are under way to find, as well as to theoretically predict, the minimal complexity of a living organism, and these results will also inform origin-of-life research.

One of the frustrations reviewing a book one finds fault with is suppressing the desire to mention all its errors, or worse attempting to correct them. Regarding Rana and Ross, this would require a longer work than their original. Failing that, a modest goal is to ask if they have met the goals they set forth in the introduction to their book. First, they wished to update the creationist classic The Mystery of Life's Origin. Second, they wished to set out their model of the origin of life. A striking departure from most creationist approaches is that Rana and Ross promise explicit predictions for a "face off" with mainstream scientific theory.

So how did Rana and Ross fare in their efforts to update The Mystery of Life's Origin? They have failed. They have many references more recent than 1984, but no new ideas. Many references they do give are incorrect, incomplete, or misinterpreted. Every old objection raised by Thaxton, Bradley, and Olsen is recycled by Rana and Ross — from the idea that the second law of thermodynamics prohibits life to the claim that there is no explanation for chiral biomolecules, there is nothing new.

The origin-of-life model offered by Rana and Ross fails on two grounds. First, their biblical model slips in considerable scientific material without acknowledgment, and they then failed to present any evidence for those parts that are original. Second, they have offered a caricature of origin-of-life research in their so-called "naturalistic predictions." The greatest difference of course is that science never appeals to divine intervention to do the heavy lifting.

Do we know how life originated on earth? No. Is every one of the innumerable chemical and geological events that led to the origin of life preserved? No. Is this "proof" of a supernatural origin of life? No. Nevertheless, the origin of life will be the last refuge for "God of the gaps" arguments in decades to come.

References


Abiogenesis, or informally the origin of life, is the natural process by which life has arisen from non-living matter, such as simple organic compounds. While the details of this process are still unknown, the prevailing scientific hypothesis is that the transition from non-living to living entities was not a single event, but a gradual process of increasing complexity that involved molecular self-replication, self-assembly, autocatalysis, and the emergence of cell membranes. Although the occurrence of an oxidizing atmosphere and the availability of water in the early Earth were critical conditions for life to emerge, the exact conditions and mechanisms remain a subject of ongoing research.

J.B.S. Haldane (1892-1964) was born in England but migrated to India in July 1957 and settled in Bhubaneswar, Orissa. He was biologist, biochemist, and geneticist. Both Oparin (1938) and Haldane (1929) gave similar views regarding the origin of life. Modern views regarding the origin of life include chemical evolution and biological evolution: A. Chemical Evolution (Chemogeny): 1. The Atomic Phase: Early earth had innumerable atoms of all those elements (e.g., hydrogen, oxygen, carbon, nitrogen, sulphur, phosphorus).


