findings that suggest extraterrestrial life might be ubiquitous. After all, space images had been interpreted as indicating that Mars and Europa might be or have been suitable abodes for life. And, starting in late 1995, the first planets around main-sequence stars were discovered; dozens, including members of another planetary system, are now known.

During the past decade, biologists also contributed to the controversy with their remarkable success in constructing the genealogical roots to the family tree of life, which led to the inference that terrestrial life arose rapidly 3.8–4.0 billion years ago in a hot, oxygen-free environment. This alien environment may or may not have been on Earth: terrestrial organisms have, after all, been found in extreme environments such as the Antarctic dry valleys, seething ocean vents and areas deep in the Earth.

Authors rushed to explain the new insights. Proliferating nearly as rapidly as the identifications of extrasolar planets themselves, a spate of popular books on planet detections appeared. Within 18 months of the initial discoveries, the searches had been described in the words of the scientists involved by Ken Croswell (*Planet Quest: The Epic Discovery of Alien Solar Systems*, Free Press). And the various techniques that ultimately yielded success were reviewed by Donald Goldsmith (*Worlds Unnumbered: The Search for Extrasolar Planets*, University Science Books) and Paul Halpern (*The Quest for Alien Planets: Exploring Worlds Outside the Solar System*, Plenum).

Following the distinguished tradition established by I. S. Shklovskii and Carl Sagan in their classic *Intelligent Life in the Universe* (Holden-Day), planetary researchers and astronomers, including Armand Delsemme (*Our Cosmic Origins: From the Big Bang to the Emergence of Life and Intelligence*), Bruce Jakosky (*Strangers in the Night: A Brief History of Life on Other Worlds*), S. Ross Taylor (*Destiny or Chance: Our Solar System and its Place in the Cosmos*, all Cambridge University Press) and Paul Davies (*The Fifth Miracle: The Search for the Origin and Meaning of Life*, Simon & Schuster), summarized the recent discoveries about the origin of life and then discussed their implications. All authors except the last give a resounding 'yes' to the question, 'Is extraterrestrial life abundant?'.

In *Worlds Without End*, John S. Lewis, a noted planetary scientist and author of both semi-popular books and technical texts, covers much the same territory as the above books, at the level of *Nature*'s News and Views section. He elegantly describes the constituents of our Solar System as they are known today. But, as he himself admits, "the planets of the Solar System ... offer a very limited sample of reality, and are an inadequate guide to the range of possible worlds. Worlds unknown vastly outnumber the worlds we know." So he outlines current ideas about the formation of our Solar System, and reviews the now-overwhelming evidence for the existence of planets about other stars. Lewis's unique contribution is to combine basic physics and chemistry with examples from within the Solar System to predict the likely nature of distant planets and their satellite systems, especially with regard to their potential habitability.

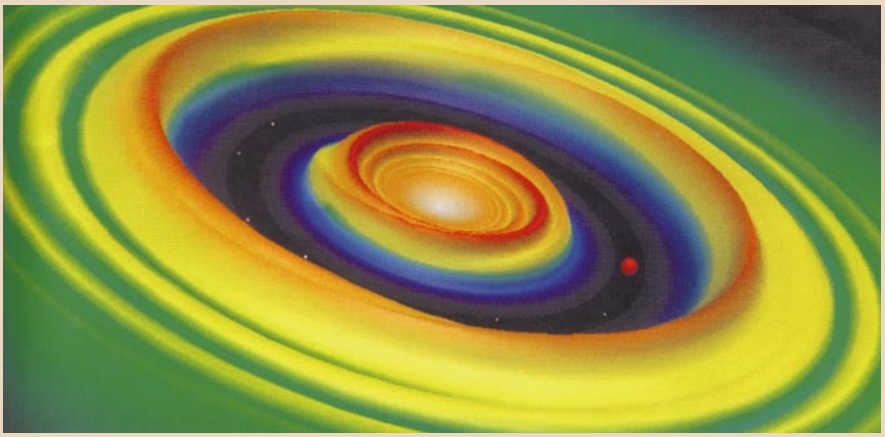
Not surprisingly, coming from a cosmochemist whose influential research three decades ago elucidated the gross distribution of compounds and mineralogy across our Solar System, Lewis believes that "we can do a better job [of understanding] alien chemistry than alien biology". In this vein, he uses thermodynamic arguments to constrain the chemical make-up of other planetary worlds.

Lewis's language is playful at times, as in his tutorial about stellar astrophysics, or when he invents "Earthissmos" and "Earthlets" (large and small Earths), "Europoids", "Titanoids", etc. to explore the planetary possibilities. As this book shows, it is downright fun to try to wonder "about life as we don't know it". Generally speaking, these places sound a lot like home, and their inhabitants much like us. That is to say, many of Lewis's arguments come, at least in part, from their similarity to the Solar System. One must question whether such an extrapolation is justified. Surely the clearest message from Voyager's gradual unveiling of the outer Solar System was that "terrestrial chauvinism is unwarranted and misleading in the Universe at large". Already, the unexpected orbital character of the detected extrasolar planets — as compared with predictions — screams out: never believe theorists, whose forecasts are almost always drably unimaginative.

Cognizant of the critical part played by stellar class and age, Lewis argues that life is most likely to be found around single stars of spectral classes G and K, extending perhaps into the F and M ranges. Even population I, but not II, brown dwarfs may successfully host life-supporting objects. He accepts James Kasting's idea of a habitable zone, a region around an astronomical unit or so where planets with appropriate spins can have clement climates. He maintains that planets of roughly Earth size to several Earths will have the temperatures and oceans that are a prerequisite for life. Lewis also suggests that life might, however, be found on a Europa-like body orbiting a giant planet or a brown dwarf; in the former case, a broader range of stellar classes is acceptable.

The book contains occasional jokes and asides on topics such as ice-skating well outside its scope. After opening with a choppy, brief survey of science fiction and historical ideas about exobiology (which has been bettered elsewhere), the book is technical in content, has no tables (some would have been preferred to paragraphs dense with numbers), and no equations or diagrams. In fact, it is remarkably devoid of space images or space art, normally commonplace in such books.

Lewis ends by addressing the ingredients needed for life. He concludes that water, the best of all possible solvents, is the medium in which the requisite chemistry occurs for life to originate and be sustained. He also maintains that, even in other worlds, carbon compounds — ideal carriers of complex information — will form the backbone of biological molecules, the actual structural material



Circles of creation

How do planets form? This model of planetary formation, to be found in Santa Cruz, California, represents a Jupiter-sized planet that has carved out a groove in a disk of gas and dust around a young star. The planet's presence is sending ripples through the nebula, which might lead to the formation of more worlds. *The Planets*, by David McNab and James Younger (Yale University Press, $35), in which this picture may be found, chronicles our planetary travels, and describes how our understanding of the Solar System has developed from the first star-gazers in ancient times to Galileo and today. Space-race archives have been plumbed, and the book contains pictures from the Apollo, Voyager, Pioneer and Viking missions.