



Jill Tarter at the Arecibo Observatory in Puerto Rico, one of the radio telescopes she has used in her hunt for extraterrestrial intelligence.

ASTROBIOLOGY

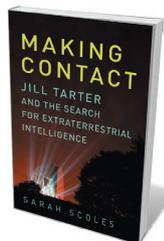
Hunting aliens

Ramin Skibba enjoys a profile of the woman heading the search for life off Earth.

As a child in the 1950s, Jill Tarter would gaze at the stars and wonder, “Are we alone?” That monumental question has driven the astronomer’s lifelong quest to find alien life in the Milky Way.

In *Making Contact*, science writer Sarah Scoles interweaves a profile of Tarter with the tumultuous, decades-long history of the SETI Institute in Mountain View, California, where Tarter holds the Bernard M. Oliver chair. Scoles argues that, without Tarter, telescopes and observing programmes focused on SETI (the search for extraterrestrial intelligence), such as the Allen Telescope Array and Breakthrough Listen, might not be around today. Yet hers may be a quixotic mission, having failed to receive a single definitive signal so far.

The book’s title references Carl Sagan’s best-selling 1985 novel, *Contact* (Simon & Schuster), adapted into the 1997 film directed by Robert Zemeckis. In them, astronomer Ellie Arroway, partly based on Tarter, succeeds in finding an alien signal. Scoles, inspired by *Contact*, quotes from



Making Contact: Jill Tarter and the Search for Extraterrestrial Intelligence
SARAH SCOLES
Pegasus: 2017.

coni and Philip Morrison argued in *Nature* that long-wavelength, low-energy radio waves could be used to communicate over long distances, potentially between stars (*Nature* **184**, 844–846; 1959). A year later, they met up with other leading scientists, including astronomer Frank Drake and a young Sagan, at the US National Radio Astronomy Observatory in Green Bank, West Virginia (see F. Kaplan *Nature* **461**, 345–346; 2009).

Drake formulated a famous equation describing seven factors — their sizes

and unknown — that determine the abundance of communicative, intelligent life in the Milky Way. They are: how often life-friendly stars form in the Galaxy; what fraction of those stars host planets; what fraction of those planets could host life; what fraction of those life forms develop intelligence; what fraction of them learn and choose to communicate across interstellar distances; and how long those communicative civilizations.

Of course, cultural references to life on other planets date back far beyond even the oeuvre of Jules Verne and H. G. Wells (see S. J. James *Nature* **537**, 162–164; 2016). But the modern concept of SETI arguably began in 1959, when physicists Giuseppe Cocconi and Philip Morrison argued in *Nature* that long-wavelength, low-energy radio waves could be used to communicate over long distances, potentially between stars (*Nature* **184**, 844–846; 1959). A year later, they met up with other leading scientists, including astronomer Frank Drake and a young Sagan, at the US National Radio Astronomy Observatory in Green Bank, West Virginia (see F. Kaplan *Nature* **461**, 345–346; 2009).

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The first four factors became the focus of astrobiology, now a mainstream field (although Scoles explores it only in her penultimate chapter). SETI’s purview is the last three. Oddly, given their close connection, a divide persists between SETI scientists and astrobiologists. And Scoles describes the astronomy community as “antagonistic” towards SETI; however, most astronomers seem not to think about it much, probably because its scientists are still few and the timescale of the search is indeterminate.

That it could take centuries to find alien intelligence created another problem for Tarter and her colleagues: funding. Scoles describes how they repeatedly scrambled for federal support for the SETI Institute

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and their telescope array at the Hat Creek Radio Observatory northeast of San Francisco, California; in the mid-1990s, they lost it at the hands of resistant Congress members, especially Democratic Senator Richard Bryan of Nevada. This only strengthened Tarter's resolve as she pitched to the heads of private companies, including Microsoft, Intel and Hewlett-Packard. Funding from commercial entities presents its own ethical questions, including potential conflicts of interest, a lack of oversight and a dependence on benefactors' caprices. These resonate even more today, with the likes of SpaceX, Blue Origin, Planetary Resources and many other for-profit organizations getting involved in space exploration.

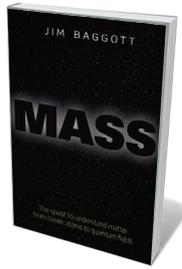
Tarter has faced a further challenge: gender. She was regularly the only woman in the room, and senior men often dismissed her or took credit for her ideas. Science and engineering colleagues "told Jill she wasn't going to make it because she was a woman", astronomer Dan Werthimer once said. Probably she has also had to contend with 'unconscious bias', in which both men and women tend to hire and promote male scientists rather than women with the same qualifications. Scoles only touches on these persistent hurdles, which are now being addressed, belatedly, by the astronomy community (see M. Urry *Nature* 528, 471–473; 2015).

Scoles concludes with a provocative philosophical discussion of SETI, including the question of broadcasting messages to aliens. Luminaries such as scientist and science-fiction writer David Brin are worried that, as Scoles puts it, "ET will blast us with lasers and steal all our precious metals". Stephen Hawking has expressed similar concerns. Tarter disagrees, yet believes that METI (messaging to extraterrestrial intelligence) should develop a consensus-based international process — broader than the handful of people who put together the golden records sent on the two Voyager spacecraft in 1977 — to decide whether and what to send. It could be a simple repeated radar blast or a more complex message combined with Rosetta Stone-like translation instructions.

Scoles's conversational style and cultural references (for example, to the much-debated chromatic puzzle of the 'blue and black dress'; see *Nature* 519, 6; 2015) will appeal to the readers of *Wired* magazine, to which she contributes. *Making Contact* is more biography than science history, but it's no hagiography. Tarter emerges as both heroic and all too human. To paraphrase the poet Robert Browning, humanity's reach must exceed its grasp, or what are the heavens for? ■

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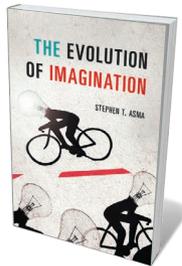
Books in brief



Mass

Jim Baggott OXFORD UNIVERSITY PRESS (2017)

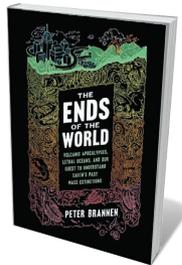
How did our understanding of mass evolve from the geometric atoms of ancient Greece to the quantum ghostliness of today? Jim Baggott ingeniously contextualizes that eventful science history. He evokes successive world views as crucibles for the evolving theories of geniuses, from atomist Leucippus through Enlightenment revolutionaries such as Isaac Newton to Albert Einstein, John Wheeler and fellow architects of the twentieth-century watershed. Today, the fundamental structure of physical reality remains elusive — but that, Baggott argues, is what the thrill of the chase is all about.



The Evolution of Imagination

Stephen T. Asma UNIVERSITY OF CHICAGO PRESS (2017)

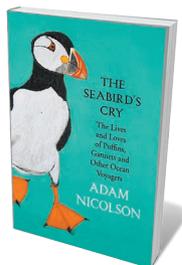
From testing a theory to playing bebop, improvisation is the fount of creativity — it's even the primal driver in our natural history. So argues philosopher and jazz musician Stephen Asma, who draws on neuroscience and animal behaviour for this intriguing, if occasionally chewy, foray into human evolution. Looking at improvisation from pre-linguistic expression (such as dance) to storytelling, Asma explores how we actively engage the imagination to create our own 'virtual realities' and to build just societies, as well as to foster the adaptability we need to negotiate life's changes.



The Ends of the World

Peter Brannen ECCO (2017)

In the middle of Earth's 'sixth mass extinction', we might recall that the other five were no picnic, science journalist Peter Brannen reminds us. He goes on the road and into deep time with geologists and palaeontologists to examine what we know of these cataclysms, which played out from 444 million to 65 million years ago. That long, piecemeal goodbye to creatures such as the killer placoderm *Dunkleosteus* and the giant sloth — wiped out by ice, lava flows or asteroid impacts — drives home how thin the "glaze of interesting chemistry" on the third rock from the Sun really is.



The Seabird's Cry

Adam Nicolson WILLIAM COLLINS (2017)

Albatross, kittiwake, gannet: the extraordinary physiology and navigational capacity of seabirds have inspired scientists and poets for centuries. Yet their numbers have crashed by 70% over the past 60 years. In this lyrical and assured scientific study, Adam Nicolson captures the worlds of 10 species on the wing, from a fulmar's 6,280-kilometre ocean journey — an astounding feat of memory and fine-tuned adaptation — to a shearwater sniffing out krill by the dimethyl sulfide they emit. A hymn to the great edge-dwellers that are also "the barometer of whole oceans".



The Plant Messiah

Carlos Magdalena VIKING (2017)

This full-throttle memoir by tropical horticulturalist Carlos Magdalena is a window on the exploits that underpin the Royal Botanic Gardens, Kew — overseer of the largest wild-plant seed bank in the world. Magdalena specializes in plants on the brink of extinction, and his quests for (and repatriation of) species such as the café marron (*Ramosmania rodriguesii*), native to the Indian Ocean island of Rodrigues, reveal the rare mix of zeal and patience needed to hunt vanishing plants and coax their seeds into germinating. [Barbara Kiser](#)