

▶page 5 stars not too different from the sun, and comes up with an indeterminate but awesome number of possible worlds just in one galaxy. It will contemplate the carbon basis and the universal pressures of natural selection that naturally lead to convergent evolution, in which similar environments tend to produce similar designs even though the starting points might be vastly different. It will look at biological universals likely to pop up on planet Tharg, such as bilateral symmetry.

"We have two hands, two legs, two hemispheres of the brain," says Bick. "Most animals on Earth have bilateral symmetry. There are reasons for this. You have a spare of everything, which is quite useful. You can balance yourself, you have a lot of good things going on. So there is speculation that these structures would replicate themselves with aliens and so there is a possibility that aliens on other planets might be like terrestrials, given terrestrial conditions. We don't know for sure."

We don't know for sure because aliens continue not to visit. One in 100 Americans may believe they have been abducted (cue for a short lecture on sleep paralysis, which manifests itself in pressure on the chest and the experience of being taken away) but if the laws of physics extend beyond Alpha Centauri, then they have not. The distances to the nearest stars are awesome, and the energy costs literally astronomical. There has been a brisk debate about why ET never phoned the Seti Institute, and why signals from Earth might never get through to Cygnus X-1 or a planet in the Pleiades.

One — and some serious planetary scientists and astronomers back this theory — is that we really could be alone: that life itself is rare and intelligent life probably confined to one planet. Not so, say others: the raw materials for life as we know it are being manufactured by exploding stars and carried by icy comets all over the solar system and — since the Copernican principle says there is nothing special about the Earth — by extension, everywhere. Which brings us back to Fermi. Where is everyone? Life must be common, even if communities are light years apart.

That could be all it takes to keep the neighbours from getting the message or putting a call through, say engineers such as Christopher Rose of Rutgers State University, New Jersey, in the journal *Nature*, and biologists such as Clive Trotman at the University of Otago in New Zealand, who did a similar set of sums in his book *The Feathered Onion* last year. You can't just broadcast a message saying, "Is anybody out there?" The signal dissipates as the square of the distance. By the time you get to Pluto, it's already vanishingly faint.

So you send an ultra-powerful signal as a focused laser beam. How much energy would that take? How long could you afford to transmit? How many directions must you point the transmitter to cover the whole sky? (The answer to that one is 100,000 trillion). And what chance a citizen of an alien civilisation is tuned in when your one-second message whistles by at the speed of light? The arithmetic, says Trotman, predicts one-way communication with both antennae pointing at each other will happen for one second every 10 billion billion years. Assuming, that is, both civilisations are using the same wavelength. Don't wait up for ET. Use your imagination instead.