The search for our neighbours

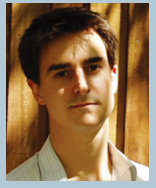
One of the prime drivers for space exploration, both in terms of scientific return and in firing the interest of the public, is astrobiology and the search for life beyond our home world. My own work at University College London is focused on the search for martian micro-organisms. A major hazard on the surface of Mars, be it to indigenous microbial life or human astronauts, is the intense particle radiation flooding down from above – the cosmic rays. I build computer simulations of how this radiation field is diminished deeper underground, as well as experimental work on the radiation survival of hardy terrestrial bacteria and 'biosignatures' indicative of their presence. ESA is due to launch the ExoMars probe in 2018 to search for signs of life on the red planet, and my work will help inform the best places to look.

Beyond Mars, astrobiologists are also intensely interested in Europa, a moon of Jupiter known to harbour an ocean of liquid water beneath its icy face. One potential show-stopper for a Europa biosphere is that this ocean is sealed in and the chemical gradients crucial for powering life might become equalised. But if enough oxidising material exposed to Jupiter's radiation belts is transported from the surface ice into this dark ocean a rich ecosystem could be sustained. This would be alien life living off not sunlight, but the energy of ionising radiation. There is even a slim chance that Europa could be the only other world in our solar system to support life more advanced than microbes, small animal life-forms akin to jellyfish or tadpoles. We need dedicated missions to Europa, firstly to map its surface and determine the thickness of the ice shell, and hopefully, before too long, to deliver an automated submarine into this hidden ocean to seek out life.

My own suspicion, however, is that we might actually first discover convincing evidence of extraterrestrial life not in our own solar system, but on a world orbiting a distant star in our galaxy. A great number of ground-based and space telescopes – including Kepler, launched in January 2009 – are hunting for exoplanets in our neck of the woods, our local spiral arm of the galaxy. There is every reason to expect that in just the next few years these surveys will discover a very special kind of planet: a second Earth. And the technology is already being demonstrated for how a next generation of space telescopes could read the chemistry of this world's atmosphere. From across the gulf of interstellar space we could spot oxygen and methane mixed together in its air, a telltale signature of life that the Earth has been proudly flaunting for around two billion years.

Astrobiology is wholeheartedly a curiosity-driven 'blue skies' field of science, and any leaps in knowledge it yields are unlikely to have directly practical, financially exploitable, applications back on Earth. But it is a powerfully evocative research area and I strongly believe that, like human spaceflight, its ability to impassion the public and inspire students into pursuing careers in science and engineering is as important to society as the fundamentally important discoveries it could deliver.

Perhaps in 20 years' time we'll know that we are not alone, and be able to point up at a twinkle in the night sky to say "that's where our neighbours live".



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