Alone in the Universe?

There may be no advanced life but us

BY IAIN MURRAY

As a long-time devotee of science fiction, I have always been excited by the possibility that mankind might encounter extraterrestrial life. But I have always tried to apply the rules of logic and reason to those prospects. And it is becoming increasingly clear to me, and others, that merely wanting to believe is not enough.

As our observation methods have improved, we've learned that somewhere on the order of 20-50 percent of all stars have planets orbiting them. We have no idea whether life-friendly planets are common, or what the chances are that life, much less intelligent life, exists on such planets, but if we assume that there is nothing special about our own solar system, we come up with some pretty optimistic numbers. Astronomers Frank Drake and Carl Sagan suggested that there could be 10 million civilizations as advanced as or more advanced than us in the galaxy today.

Such a theory, however, begs an important question, one raised by Italian physicist Enrico Fermi way back in 1950. He turned to his lunch partners at Los Alamos, who included Edward Teller, and asked simply, "Where is everybody?" If intelligent, communicating life is common, why haven't we seen evidence of it? After all, if the formation of civilizations has been fairly constant through the long life of the universe, then there should have been billions of them by now.

While the galaxy is a big place, it's also been around for a very long time, more than long enough for intelligent life to have placed signs throughout the galaxy. Los Alamos physicist John von Neumann calculated that self-replicating probes traveling at one fortieth the speed of light could spread through the entire galaxy in just 4 million years. That may sound like a long time, but the universe is more than three thousand times older than that, so there has been ample time for intelligent life to show itself if it exists outside our miraculous planet.

Even if every single other civilization that has existed over the vast life of our galaxy had chosen not to send out probes, we should still be able to pick up their traces. Most physicists who have studied the issue agree that if civilizations want to be heard, then we have the capacity to detect their most likely means of sending out signals.

But in 40 years of searching, we have detected no such signal. In 1967, we thought we had one, but that turned out to be the

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entirely natural signal of a pulsar. Ten years later, the Ohio State University Big Ear observatory detected a 37-second burst of activity that prompted astronomer Jerry Ehman to write, "Wow!" in the signal's margin. Yet attempts to find the Wow signal again have been unsuccessful; it seems likely now that it came from the mundane source of a man-made earth satellite.

Yet the skies are vast, and there's a lot of material out there. So radio observatories are using the dispersed computer power of millions of interested PC owners who have agreed to let software run on their computers during down times to search for artificial signals. In six years, all those millions of computers have come up with just one candidate, a signal named SHGb02+14a, with a frequency of 1420 megahertz, which has important ties to the element hydrogen. This makes it a good candidate for being artificial, because signals tied to the laws of physics or mathematics are much more likely to be understood by an alien civilization than anything else. Even so, the SETI astronomers are not optimistic. It comes from a point in space with no star system within 1,000 light years. "We're not jumping up and down, but we are continuing to observe it," says Dan Werthimer, a University of California radio astronomer.

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We are therefore led to the uncomfortable conclusion that there may be something wrong with the assumption that life can exist in numerous other places. Perhaps our solar system is not average at all. Perhaps life-friendly planets are rare. That is the conclusion of University of Washington scientists Peter Ward and David Brownlee, whose book, *Rare Earth*, caused a sensation when first published in 2000.

Ward and Brownlee point out that not all areas of the universe are hospitable to life. Our sun is "a star rich in metal, a star found in a safe region of a spiral galaxy, a star moving very slowly on its galactic pinwheel…not near an active gamma ray source, not in a multiple star system, not even in a binary, or near a pulsar, or near stars too small, too large, or soon to go supernova." That's quite a lengthy list of useful coincidences. And the theory goes on.

Earth, it appears, is fortunate in being placed right in the middle of a "habitable zone" around our star. We are one Astronomic Unit (AU) from the sun. Michael Hart and others have worked out the habitable zone as being between 0.95 AU and 1.15 AU. Only about 10 percent of stars with planets are likely to have a planet in a habitable zone.

Moreover, all the planets we've so far discovered around other stars are gas giants, like Jupiter. Most of them orbit much closer to their suns than Jupiter does, or have eccentric orbits. If either of these had happened in our solar system, any Earth-like planet would have been in serious trouble.

These considerations greatly reduce the number of potentially life-friendly planets per solar system. And there is more. In his 1971 book *Chance and Necessity*, Jacques Monod drew our attention to how unlikely it is that all the ingredients for life just happened to come together in the right order to make the acids and proteins necessary. Serum albumin, for instance, has amino acids in a certain order that would occur in only a vanishingly small number of random cases—what Monod called "chance caught on the wing."

And even if the preconditions for life should occur as a one in many billions chance, the difference between primitive microbes—prokaryotes—and even just more advanced microbes—eukaryotes—is surprisingly complex. Today's prokaryotes (bacteria) haven't changed much in 3 billion years. Only eukaryotes (to which humans are linked) have evolved into complexity. It is quite possible that habitable planets teeming with life exist in other parts of the universe, but that that life is little more than mold.

Intelligence and technology may be similarly rare. Speech, for instance, which appears to be pretty important in both factors, exists in only one of the 50 billion species on Earth. It is quite possible, then, that we are the only civilization around at the moment.

All this, of course, assumes that life elsewhere is as we know it. It may be that life can arise according to a fundamentally different biology. While possible, such speculation leaves science behind. For life as we know it, we are today left with the unpalatable but rational conclusion that instead of Carl Sagan's millions of civilizations, there is a very good chance we are the only one. The latest decade's discoveries and arguments do not mean that we are alone for certain, but they are probabilities that point strongly in that direction.

Those who want to believe sometimes argue that the mathematical probabilities against intelligent life may be less certain than we think. They cite "complexity theory"—which suggests there may be a certain irregularity and unpredictability even in the laws of nature. But others think the mathematical odds must be respected. "Nobody knows why equations work so well in describing things. Maybe it's the handprint of God, or an ancient, advanced, powerful alien race," says NASA scientist David Grinspoon, but "there is something spooky about the way mathematical relationships are so enmeshed with the physical nature of our universe." For the moment, cold rationality suggests that Jacques Monod was right when he said that "Man at last knows he is alone in the unfeeling immensity of the universe, out of which he has emerged only by chance."