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Extraterrestrial Life

Artists and scholars of the Renaissance we were fond of saying that "Man is the Measure of All Things", a sentiment attributed to the artist and writer Alberti. This claim reflected their delight in their new achievements in art, sculpture, science and literature, as well as in the successes of explorers finding new worlds. The five hundred years since the Renaissance have brought more discoveries than even a Da Vinci could have imagined, but they have also brought doubts about man's place in the universe. No one today is likely to assert that man is the measure of anything.

Developments over the last fifty years permit us seriously to consider the possibility of traveling to other planets in our solar system and even to other parts of the universe. Many people entertain the idea that other intelligent creatures have already done so. A spate of books in the 1970s asked us to consider that ancient astronauts had drawn the amazing figures in Peru or had built the Pyramids. Even before that Christian Countians had experienced little green men who landed in a space ship. UFOs have been in the news for years and many people are convinced that a vast (perhaps right wing) conspiracy prevents us from knowing the truth.

Space probes have found evidence on other planets of the existence of chemicals necessary to produce life but they have not yet found living organisms, much less intelligent life. Nevertheless, the belief persists that the universe must contain intelligent beings besides man

The organizers of the SETI project (the Search for Extraterrestrial Intelligence) comb the available radiotelescopic data for electronic signals that someone or something

is trying to contact us. The New York Times reported in June of this year that a speaker at the International Society of Optical Engineers annual meeting declared that Martian soil samples showed signs of harboring microscopic creatures. Reanalyzing data from the 25 year old Viking lander, the scientist concluded that gases from the soil were emitted in a circadian rhythm which implied that something in the soil was breathing.

Since Copernicus we have known that the Earth is not the center of the universe or even of our solar system. Many people now think of the Earth as rather ordinary. Considering its remote location within a typical galaxy, which is only one of countless galaxies, many scientists consider it scientific heresy to attribute any special status to our solar system, our planet, or ourselves.

Our galaxy, the Milky Way, is thought to have over 200 billion stars, with the interstellar space being filled with molecules necessary for life. Therefore many scientists and laymen alike conclude that there must be millions of other civilizations in the Milky Way alone, not to mention other galaxies far beyond our own.

But it seems to me that on close examination this reasoning does not hold up. It is actually far more likely that humanity stands alone as the only intelligent life on the only fertile island in a sterile galactic sea.

Why is this conclusion logical? Why is the Milky Way not teeming with intelligent beings? Because the odds are against it. Life must avoid many incredible pitfalls on its way to intelligence. Earth and its inhabitants had to go through an improbable sequence of events which had to occur in just the right order for civilization to develop. It was almost like winning the lottery a million times in a row.

All life that we know about; that is, life on earth, shares certain fundanental characteristics; and if there is extra-terrestrial life, it must share them too. First, living organisms take in matter and energy from their surroundings and use them for food, locomotion, and reproduction; and they expel waste. Second, living things store information and replicate it in succeeding generations. (Humans know this process as sex.)

Liquids are an ideal medium for these processes. Liquids can dissolve both solids and gases and produce complex molecules. Liquids allow molecules to combine with each other and produce chemical reactions. In gases atoms are too far apart to permit such interactions. In solids the atoms are locked in place. The process is slow. On earth where all life is based on liquids, it is thought that it took almost four billion years from the creation of the first molecule to this meeitng of the Athenaeum Society.

Not only does life have to be based on a liquid, that liquid should probably be water. On earth 70 percent of a cell's weight is water and this would likely be true elsewhere. Ammonia, the other plentiful liquid detected in our solar system does not have water's ability to dissolve inorganic chemicals so that living organisms can use them. It is no coincidence that Earth, the only planet in ~~or~~ our solar system with water on its surface, is the only planet known to support life.

If we assume that water is the medium most likely to support life, then this presents another requirement. The temperature must be moderate and stable so that the water can remain a liquid, not freeze into a solid or evaporate as a gas. This is a stringent requirement for it means that the temperature must be stable for billions of years.

To produce this stable, moderate, reliable temperature a planet needs the right sort of sun, and this is where most stars and their planets are ruled out. Of the Milky Way's 200 billion stars only a few will do.

Our sun is said to be a middle-aged star of slightly greater than average size and mass than other stars, and it produces a steady output of energy. It is a single star, unlike most stars of the Milky Way, which have one or more companions. Multiple stars either don't allow planest to form, or their gravity jerks the planets into strange orbits so that at one point the planet is so close to the star that it's water evaporates from the searing heat and at the opposite point the planet is so far from its star that its temperature falls almost to absolute zero. Life cannot evolve on such planets. Even if the star is single it must be the right size. Small single stars cannot produce enough energy, and massive stars burn out quickly. No one knows how many stars are like our sun but they probably comprise only 5 to 10 percent of the stars in the galaxy. 200 billion stars aare now reduced to 10 to 20 billion. That's still a lot of candidates, but the successfull candidates have to have the right kind of planets.

We've already learned that a planet must have water and moderate steady temperature. Astronomers think that solar systems like ours which have rocky inner planets and gaseous outer planets like Jupiter offer the best chance for life to develop. An inner planet can support life while the outer planets act as gigantic vacuum cleaners to gobble up meteors, asteroids and comets which would otherwise plow into the inner planets. Such impacts, like the meteor strike which wiped out the dinosaurs, wouild occur

with enough frequency to prevent intelligent life from developing.

A moon or moons also give life a better chance of developing. At least Earth's moon seems to have helped. Our moon tends to offset the gravitational pull of Jupiter. Our moon is actually so big that the earth and moon make up a double planet system. Computer simulations show that without the moon Jupiter's gravity would cause the earth's rotational axis to tilt chaotically within a range of 0 degrees to 85 degrees over millions of years. Compare this with our stable 23 21/2 degree tilt which seems to change only about 2.6 degrees over 41,000 years. Without our moon the earth would have experienced Venus' 800 degree temperature followed by an ice age.

Another requirement for life is an atmosphere to act as a thermostat to help hold temperatures steady. This is the famous greenhouse effect which is currently generating so much political heat if not scientific light today. It appears that when the earth's climate cools, carbon dioxide is released into the atmosphere by volcanic activity, warming the earth. As the temperature rises, plant growth increases, absorbing the excess carbon dioxide. Thus temperature fluctuations are dampened down.

The size of our rocky planet is also important, because it must have enough gravity to assist livimg organisms in locomotion but not so much as to make them unwieldy. There is a star which is thought to resemble our sun, and it has a planet, which has caused a lot of excitement among the extra-terrestrial intelligence enthusiassts. However this planet is twice as large as Jupiter and its gravity would be enormous. It is difficult to imagine anything moving on such a planet.

P:utting it all together it appears that any kind of life requires a good sun. a Jupiter sized planet to ward off meteors, a rocky inner planet with the right gravity, a moon, and

atmosphere, water, and chemical elements. There must be planets which meet these conditions but there cannot be many. If there were we would have seen signs of life by now.;

Even if there are such planets and even if life develops there is no reason to assume that intelligent life will occur. Evolution is not a steady march of progrress; it goes by fitsand starts and many more species die out than ever survive. Consider that of all the species now on earth and that have ever lived on earth, only animals produce intelligence. Of the seventy phyla of animals, only one, the Chordates produced intelligence. One class of chordates, the mammals produced intelligence. Only one class of mammals, the Primates produced intelligence. Only one family of primates, the GreatApes produced intelligence. Only one species,Homo, produced intelligence . Many branches of the species Homo have proved to be evolutionay dead ends. After 4 billion years of earth's existence only one intelligent species, Homo Sapiens, exists today.

The survival of primate intelligence required two unlikely traits in addition to all that went before, manual dexterity and upright posture. Manual dexterity permitted the making and use of tools. Upright posture aided locomotion and vision.

Thus it seems to me that earth really is a special place and that man really is the measure of all things Extra-terrestrial intelligence enthusiasts would probably say that this line of thought is anthropocentric. They might say that maybe other intelligrent organisms can take on shapes which we can't even imagine. But we know the form of intelligent life which has been successful and we can deduce the conditions which were required to achieve this success. To postulate other life forms is the ultimate in

speculation and imagination.

If the universe is teeming with intelligent life, where is it? If it were commonplace, surely our instruments would have detected some sign of it by now. Surely such life forms would be looking for us. The SETI group after despairing of finding life through analysis of radiotelescope data has just announced a new project: the search for laser pulses that some far-off outpost may be flashing at us. In 1999 scientists announced a project called SETI@home, asking computer owners to download a free program that continually gathers and analyzes data gathered by the Arecibo Radio Observatory in Peru. The response was overwhelming. More than 3 million users downloaded the program, including 46 in the Central African Republic. So far, these individuals have contributed what amounts to 700,000 years of processing time.
As these computer owners surf the web or play games, SETI@home works in the background looking for signs of a deliberate transmission. It is programmed to be skeptical and it is very time consuming. it takes 10 to 50 hours to analyze a 107 second recording from Arecibo. In a sense SETI has created the ultimate super computer.
As yet the silence remains unboken

Some think that extra-terrestrial beings are here among us now; that they are merely waiting for mankind to mature to a stage worthy of being their peers.
On the other hand, is it not equally reasonable to think that they might be out there planning to raid our marvelous planet of its minerals and other resources?

It does no harm for those 3 million people to look for radio signals from another world, but if they find anything it will be the purest serendipity. Until that time seems most reasonable to apply Occam's razor;accept the simplest explanation with the

fewest assumptions and reject the fantastic and involved.

It seems reasonable to conclude that we are indeed alone in this vast universe and that Mankind, the intelligent life on a small planet, with an average sun, on the edge of an ordinary spiral galaxy, is indeed the measure of all things.

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