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Tom Sawyer

IS THERE LIFE ON OTHER WORLDS?

I would be willing to offer 1000-1 odds that six weeks ago not a person here tonight had ever heard of Yuri Gargarin. Few of you had ever heard of Alan Shepard. Today the names of the first astronauts are household words. Mankind has proved that he can propel himself into outer space and return unharmed. It is my purpose here tonight to discuss with you a long-range aspect of all of this--not space travel which is itself still a good bit away--but to discuss what we might find if we did travel into space. Specifically, whether we might find life, even intelligent life, somewhere in the inconceivably, immense vastness of the heavens. This paper in its scope will not be intrinsically scientific, yet the ideas I present are generally agreed upon by most modern scientists. To those of the Society who hold themselves out to be authorities on Astronomy, like Tom Roney, Prewitt Owen and my father, much of this paper may seem puerile; to meticulous Tom Smith and Browning Roberts it will seem vague; and to the Midas-minded Jack Henard and Curtis Brasher it will seem a waste of time, for there is no immediate dollar profit visible. It is hoped that this paper will be scientific or at least semi-scientific. I can promise you that it is not being written facetiously and that it is not going to resemble H. G. Wells' "War of the Worlds" or the adventures of Buck Rogers in the Twenty-Fifth Century--except to the extent that these fictional works are based on actual possibilities as pictured by modern science.

If life does exist on other worlds almost surely it must have developed somewhat as it did on earth. This paper does not purport to be a discussion of the development of life on Earth and we can only briefly mention it here. Scientists theorize--and they can only theorize--that life developed on Earth in somewhat the following manner. Tiny particles of matter, probably mostly carbon, existed in a rich "soup" of liquid whose principal ingredient was, of course, water. The

atmosphere was composed of powerful gases, and crackled with violent electrical storms. Somehow sunlight, lightning, the radioactivity of the Earth, and the bombardment of radiation from space, acted on these ingredients and welded together a carbon, hydrogen, oxygen, and nitrogen molecule--which C H O N molecule is the basis of all life today. These cells (or was there originally only one cell from which all life came?) developed and joined with other substances to form more complex molecules. Somehow "living matter" evolved. The plant family developed first; later there appeared the small cells that countless eons later evolved into what we call animals. In the beginning, life probably stuck close to the water. Finally small amphibians made the journey to shore and learned to live there. The reptiles developed and for millions of years gigantic varities of them--more fearful than the dragons of legend--dominated the earth. Off-shoots of these became birds and mammals, and millions of years later off-shoots of the great apes became the earliest proto-man.

A short time later (and ~~I use the word short deliberately since~~ in context with the above, "short" is the proper word), man in his present form appears.

The above thumb-nail description is a highly condensed version of the development of life on Earth. But it shows that it can happen. Let us now examine some of the conditions which are seemingly required for life to develop.

In the first place it is almost certain that life could never develop except on a planet, never on a star. The intense heat of a star would not permit even the simplest complex molecule to develop. Similarly we cannot expect life to develop on a planet which because of its nearness to a star or because of its own latent heat is extremely hot. At the other end of the thermal scale, extreme cold would probably rule out the development of life. At Absolute Zero (-459° F.) all molecular activity stops and at low temperatures molecular action is so inhibited that complex structures could hardly form. Furthermore, all gases and liquids, without which life is hardly conceivable to us, would turn to ice. The right temperature, or to be exact, the right range of temperature must be found.

Secondly, it seems that life could not exist on a planet without an atmosphere. Our atmosphere, besides providing the air we breath, serves us in

another extremely important way. For our purposes here, in fact, this second function of our atmosphere is more important than the first. Science can perhaps conceive of life that does not need to breathe or that does not require gases for its composition. (Indeed there are small living bits called anaerobic bacteria to which oxygen is poisonous). But life could hardly form or continue to exist if directly subjected to the dazzling radiation of outer space. Our atmosphere shields us from these rays that simply annihilate all forms of life we know.

How can a planet have an atmosphere? For one thing the planet cannot be too small. If a planet is very small it will not have sufficient gravity to hold gases, particularly in the early stages of the planet's life before it has cooled from the fiery mass as which it began. Heat increases the speed of gas molecules. The gas atoms (particularly hydrogen atoms) would actually attain speeds sufficiently high to be "Escape Velocity" and would depart forever from the planet and its gravitational field exactly like a rocket which has reached such a speed. Therefore, the planet must have sufficient mass or gravity to hold its atmosphere. Furthermore, if we seek life similar to ours on these planets, they must not be too large. A huge planet would have so much gravity that practically none of its gases could escape. The Earth, a middle sized planet, has lost a great deal of its original atmosphere, mostly hydrogen, and the atmosphere in which life evolved here would not have existed if Earth had been much more massive.

Other factors are necessary for the presence of life. The planet would have to be the planet of a star whose life was not too short. Some stars burn themselves out too quickly for life to evolve. Furthermore, the planet would have to orbit its sun at a relatively constant distance; otherwise tremendous climatic changes would probably prevent the slow evolution of the living cells. Similarly, it is unlikely that the planet could be the satellite of a double star, that is, a star which actually consists of two stars revolving about each other. For in that

case too, tremendous differences in temperature and radiation would be produced, as first one star, then the other, was nearer the planet.

Having described some of the conditions which seem necessary for life, let us inquire whether there are planets in the universe which can meet these requirements. Since none of the difficulties just mentioned applies to our own Solar System--that is, our sun is not a "young" star, all of its planets circle it in a fairly constant orbit and it is not a double star--and since Earth is closer both in space and in physical composition to the other members of our Solar System, let us start with them.

The planet Mercury is the smallest planet in the Solar System and the one nearest the sun. Because of its small mass (about 1/25 that of Earth) and consequent small gravity, it has, for the reasons stated above, no discernible atmosphere. Its extreme closeness to the sun (a mere 36,000,000 miles as compared with the Earth's 93,000,000 miles) causes it to be extremely hot. The temperature on the side facing the sun has been estimated at approximately 700° F. Lead would melt at this temperature. Strangely enough, however, the opposite side of Mercury is extremely cold. This is caused by the fact that Mercury's day is the same length as her year. She rotates on her axis in the same period as it takes her to revolve around the sun. Therefore, the same side always faces the sun. Consequently one side of Mercury is perpetually light and the other is perpetually dark. In short, a planet with one half intensely hot; one half intensely cold. Life could hardly exist on Mercury.

Let us leave the region near the sun and examine the more distant planets, returning later for a closer look at the middle range of planets.

Jupiter, Saturn, Neptune and Uranus are the largest planets in the Solar System, Jupiter being by far the largest. All of them have more than enough size to have an atmosphere, and most scientists think that probably they all do.

[illegible] atmosphere, and most scientists think that probably they all do. But temperatures of these planets are extremely low because of their great distance from the sun. Many people believe that the outer layer of these planets consists principally of liquids, and even gases, frozen rock solid, with a center core of more conventional "planet material". This seems to square with the conclusively demonstrated fact that these planets, while all a great deal heavier than the Earth because of their extremely great size, have a low density, that is, the average weight of a given volume of material, is very low. (For example the volume of Jupiter is over Thirteen Hundred times that of Earth's, but its mass, only Three Hundred times as great). Saturn is composed of material so light that it would actually float in water, if enough water could ever be found to float it in! The writer is tempted to talk more about gigantic Jupiter with its strange "red spot";

Saturn with its strikingly beautiful rings, mysterious Neptune, and distant Uranus, but since we have dismissed them as possible bases for life we must proceed.

Little Pluto, the most distant and one of the smallest of the planets can be quickly rejected. It is so far from the sun (approximately 40 times as far as the Earth) that it must be extremely cold. And although it is too far away for us to observe directly whether it has an atmosphere, its small mass probably indicates that it does not.

Let us now return to Earth's neighbors, Venus and Mars; Venus, which lies just on the sun side of the Earth and Mars which lies just beyond us from the sun.

Venus excluding, of course, the sun and the moon, is the brightest object in the heavens. It, of all the planets, is most similar to the Earth in size, mass and mean density. It might be expected then that it would be fairly probable that life would exist here if anywhere else in the Solar System. But most authorities feel that there is no life on Venus. Venus is believed to be

extremely hot by Earth standards. It is, of course, closer to the sun than Earth, though not so prohibitively close as Mercury. The surface temperature is not known exactly since the planet is blanketed with dense clouds that defy penetration even by infra-red light. This relatively dense atmosphere also serves to increase the temperature on the surface, since it acts like the glass in a greenhouse, permitting the sun's rays to enter, but holding in the heat so generated. Professor H. Spencer Jones, the British Royal Astronomer, has estimated the surface temperature at roughly 50° C., approximately 120° F. Perhaps it is not too hot on Venus for life to exist. Other observers, however, put Venus's temperature somewhat higher.

For many years astronomers were unable to detect signs of water vapor on Venus, and this partially accounts for the wide-spread belief among them that there is no life on Venus. But recently, in 1959, Charles Moore of the Arthur D. Little Company Observatory, making his experiments in a balloon 15 miles up beyond most of Earth's own distorting atmosphere, took spectroscopic pictures which showed a water vapor content in Venus's atmosphere very similar to Earth's. Until actual exploration of Venus, we will know little about her. Venus shyly hides behind her dense clouds like the demure goddess for whom she is named.

The planet Mars is our last and (as we shall see) best chance for finding other life in our Solar System. Mars is slightly smaller than the Earth and somewhat colder because of its greater distance from the sun. But the temperature is not too low for life to exist. Although at night, the Martian temperature falls to -95° F., at noon in the region of the Equator, it is as high as 85°. On the whole, Mars is almost certainly warmer than Antarctica and possibly warmer than Siberia or Northern Canada. Her atmosphere, while not exactly like that of the Earth, is composed principally of nitrogen, just as ours is. Fortunately the Martian atmosphere, unlike that of Venus, is sufficiently clear for us to observe the planet quite well with telescopes. And we observe what is almost

certainly a change of seasons. In winter, the polar regions are covered with white caps of ice, just as ~~our planet is~~ on Earth. During the summer, the ice caps shrink tremendously and as the liquid released spreads, vast green areas gradually appear, indicating to most observers that vegetation is beginning to grow. A few authorities, it must be added, have advanced the theory that this change in color is purely chemical, being caused by the action of the liquid on the Martian surface.

But assuming, as most scientists do, that some form of simple vegetation exists on Mars, what is the possibility of intelligent life?

Some astronomers--the most prominent of whom is Professor Percival Lōwell, the discoveror of the planet Pluto--believe that there is a good chance that intelligent life exists on Mars. They base their opinion partially on the existence of the so-called Martian canals. These were first reported by the Italian Astronomer, Schiaparelli, in 1877, and he called them "canali," which is Italian for "channels." However, the Italian word "canali" and the English word, "canal" are so similar that we translated the word as "canal". Since canals, by defination, are artifically constructed channels, the very use of the word canal, implies that they were actually built by intelligent beings. If there were canals

in a regular net work pattern on Mars, we would almost be forced to conclude that there is, or had been, intelligent life there. But many observers have not been able to detect the canals at all, let alone to see them in a regular pattern. Yet this does not necessarily mean that the eminent astronomers who claimed to have seen them are falsifying. Viewing conditions differ; the canals actually may have been visible at one time and not at another. On the other hand, many astronomers feel that those who have seen the canals, have connected together in their own minds a series of dots or markings on the surface of Mars and have seen them as lines, much as you in this audience would say that you saw a straight line if at this distance I held aloft a large piece of paper with a series of dots placed very close together in a straight line.

But Mars is a dying planet. The amount of water vapor in her polar caps is small--estimated to be only about enough to fill Lake Erie. It is possible that at one time advanced life existed on Mars, but if so, it is likely extinct with only the hardier mosses or lichens surviving.

How about planets other than those in our Solar System? To be sure, there are almost countless stars--some have estimated their number at a billion trillion. But what are the chances of these stars having planets? This is not a paper on the origin of the Solar System, but to explore the possibility of other stars having planets, we must quickly make mention of it. There are three general types of theories about the origin of our own Solar System. One school of thought holds that the sun and the planets coalesced from a vast cloud of dust. This is the so-called "nebular" theory, from "nebula", the Latin word for "cloud". Another school holds that the sun (whether by atomic fission or otherwise) spontaneously ejected large portions of itself which formed planets. A third theory holds that the solar system was formed in a gigantic collision--or perhaps near miss--between our own sun and a passing star. If this, the so-called "cataclysm theory," is correct, the presence of planets in the universe would be extremely unusual, because the distance between stars is so great that collisions between them would be a very

rare event. (One writer has likened it to the possibility of a collision between four tennis balls moving about in a hollow sphere the size of the earth!) But if either of the first two theories is correct, apparently any star could have planets around it.

It is impossible to observe directly planets about other stars because of their great distance from the earth. But a very large planet might make its presence known by its gravitational effect on a star near it. Some astronomers claim to have observed such an effect on the relatively close star 61 Cygni. If one of the closest stars has planets, it would seem quite likely that a great many other stars have them, so perhaps planets are quite common in the universe. Professor S. S. Huang of the University of California estimates that there are, in our own galaxy, five billion planets on which life could develop and fifty billion billion in the universe. Some of the stars which might have planets are not hopelessly far away from us--for example, Epsilon Eridani and Tau Ceti are only eleven and twelve light years away respectively.

With the tremendous number of possible abodes of life, it seems quite likely, statistically, that somewhere in our universe intelligent life exists. It is an example of man's intolerable conceit for him to say that his particular planet--an inconceivably infinitesimal speck in the universe--is the only one which bears intelligent life.

Assuming for the moment that intelligent life exists elsewhere, let us examine in a random fashion a few related aspects. Is this life higher or lower in the evolutionary scale than man? The only sensible answer seems to be that if life exists on many different planets, some life would almost certainly be higher and some lower, since planets vary so much in age, if for no other reason.

Theologians have concerned themselves with this problem. Some have argued that since God would certainly not create intelligent life without providing for it a plan of salvation, and since He sent to Earth as our Savior His "only begotten Son", that there is no life elsewhere in the universe. Others have

postulated a Christ-figure for these other creatures. Still others have suggested that perhaps these beings are morally perfect and without need of salvation; that they are in a state of grace similar to that of Adam and Eve before Eve (naturally it was the woman) ate that apple. Less traditionally minded theologians usually content themselves with remarking that a God who could create other intelligent beings would have no problem in providing a way for their salvation if needed.

What would such creatures look like? What form would they take? William Howells, a leading anthropologist, in his book "Mankind in the Making", attempts to describe such a creature, basing his conclusions on his studies about the development of man. An intelligent being would almost certainly have the power of motion. He could not be like, for instance, a tree, powerless to exert force or alter its environment. Such a creature would almost certainly have to be fairly large to contain a brain of sufficient size to possess intelligence. Midget, goblin-like green men are out. But this creature could not be too large, or it would be so bulky that it would be unable to perform any feats requiring delicacy or dexterity. It would need a skeleton to keep it rigid and almost certainly arms and fingers if it is to use tools or handle objects. It would probably have two arms, since more than that would actually be a disadvantage, sacrificing any possible benefit by the resulting loss of coordination. Witness the centipede, the octopus or the star fish. So far we have a creature who might be fairly similar to man. But Professor Howells goes further. He points out that man, being a four-limbed creature, if he were to liberate his hands for practical tasks at all, was required to walk on two legs, and a two-legged base is actually quite inefficient and unstable. A four-legged base would be better. A three-legged base would be unlikely, since our creature would probably be symmetrical. Howells states that intelligent life might well resemble a centaur, the mythological creature with the body and legs of a horse and the torso, head and arms of a man. Who knows what other possible shapes might exist?

A great many--perhaps most--modern astronomers, bio-chemists and scientists do not think so. Nor does the United States Government.

For example, remember the "flying saucers"? Any speculation that they were space ships was met with hoots of derision, but the United States Air Force set up a large semi-secret project to investigate the saucers. The saucers were referred to in official parlance as "UFO's", the initials for "unidentified flying objects". To be sure, most of the reports investigated were satisfactorily explained away as weather balloons, the planet Venus, ball lightning, reflections, hallucinations, pranks, hoaxes, etc. But a small and extremely hard core of unexplained cases remained. At least one of the members of our Society (and in my opinion, one of our most intelligent, well informed and practical minded members) on one occasion, with four other witnesses, saw "flying saucers", if I may use the term. He was consulted by military authorities who had a two hour conference with him, asked him question after question and had him fill out a four page printed form! The last word about the so-called "flying saucers" has not been uttered.

Some of you have heard of Project Ozma. Ozma is named for one of the characters created by Frank Baum in his well-known series of books for children about another mysterious, far-away region, the Land of Oz. In the Ozma Project, gigantic radio-type receivers are attempting to pick up radio messages from outer space. There is a great deal of random radio activity in outer space and the receivers hum constantly. But what the observers are hoping to find is a pattern of some sort. The receivers are set on 1420 megacycles. This frequency was chosen because it is the frequency emitted by a hydrogen atom as its electron jumps from one certain level to another and is apparently a constant throughout the universe. Accordingly, it seems to be a logical wave length to choose in trying to communicate with other intelligent beings, if any. A mere waste of taxpayers' money? Perhaps. But one wonders what the history of the world might have been if Queen Isabella has paid attention to the "budgeteers" of her court instead of hocking her jewels to

That all of this activity by our government is not a waste of time and money might be shown by the following quotation from the May 5, 1961 issue of Life Magazine:

> Are there traces of life from other planets now present on earth? This is a strange, unnerving possibility, unacceptable to many scientists and incredible to most other people, but it may be true. The possibility has been raised twice within the past few weeks.
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> First, three New York researchers disclosed that they had discovered chemical evidence of life in a piece of stone from outer space. Second, two scientists in Washington revealed that they were actually nurturing some tiny specks of matter from the powder of a crushed meteorite--matter which seemed to multiply like living organisms but resembled nothing they had ever seen before.

Were these meteors parts of a shattered planet, an inhabited one? Or had these primitive forms of life developed in the meteorites during their fall through space? Either way, we have further evidence of extra-terrestrial life.

And so we approach the end of this paper. In it I have attempted to throw out certain ideas, sometimes speculations, about the possibility of life on other worlds. I am not here to debate one side or the other. I don't know whether the "flying saucers" will be explained by conventional means or whether they will prove to be space ships operated by highly intelligent inter-galactic voyagers whose courage and daring make the above mentioned Columbus look like a Girl Scout on a daisy-picking expedition. I don't know whether these extra-terrestrial creatures, if any, would be evil (as they almost always are in science fiction), or benign, in which event they might bring with them solutions to many, or possibly all, of the world's problems--problems which to them may seem as elementary as the cave man's problem of destroying sabre-tooth tigers would appear to us with our knowledge of firearms.

The immense distances of inter-stellar space may prevent us (or them, if they exist,) from ever reaching one another. They may not exist at all. Many people assert positively that they do not exist; that there can be no other intelligent life in the universe, but I would caution against this. I would request that before

outfit the crack-pot, egg-head from Genoa, Christopher Columbus.

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taking such a stand, the skeptic go out alone some warm, clear night, gaze above him into the immense depths of outer space, observe the myriad points of light which we call stars, consider that the great majority of them would actually make our sun pale into insignificence, view the gleaming blur that we call the "Milky Way", and remember that it itself is actually a vast galaxy, and only one of the many galaxies in the Universe. I would ask him to conceive, if he can, just how the vast expanse of space ends, if it does; to visualize, if he can, what lies beyond these countless suns; and before concluding that there is no intelligent life elsewhere, to repeat slowly to himself the words of Shakespeare, "There are more things in Heaven and earth than are dreamed of in our philosophy."

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