As a Biology student, I have become fascinated by the process of evolution. Charles Darwin's *The Origin of Species* seemed to solve so many mysteries surrounding life. It answered the fundamental question of "where did we come from?" The theory of evolution can be used to explain so many phenomena that seemed to be unexplainable before. However, it fails to answer one monumental question: where did life originate? Space development is important not only to study the universe, but it is also essential to understanding life on Earth.

There are many theories surrounding the origin of life. One controversial theory, called panspermia, does not even attempt to answer how life began. Rather, panspermia proposes that life originated somewhere else in the universe and was simply transferred to Earth via an asteroid or comet. At first glance, panspermia sounds like science fiction. But there is some evidence that suggests panspermia is worth investigating further.

The first problem with this theory is that in order for it to be true, organisms would need to survive on an unprotected celestial body moving thousands of miles per second through the vacuum of space. They would then need to survive the harsh impact on Earth after being on this celestial body for potentially millions of years. While this may seem like an impossible feat, the mere existence of one organism makes an interstellar journey seem possible. Phylum Tardigrada is composed of over 1,000 microscopic species. Tardigrada are known for its ability to survive in the most extreme conditions, including anoxic environments, ionizing radiation, and vacuums (Wright). While it is unlikely that tardigrades were the organism that travelled through space, the mere existence of a species this resilient is evidence that life may have been able to survive an interplanetary journey.

While tardigrades gave scientists a new perspective on the conditions life is able to prosper in, it is bacterial spores that are the more likely candidate for panspermia. Some bacteria can produce a protective coating around itself to form a bacterial spore. The spore is dormant and able to survive in the absence of nutrients. A study was done at the German Aerospace Center to investigate whether bacterial spores would be able to survive in space. They put bacterial spores in small lumps of simulated martian soil and, using a satellite, exposed these lumps to space. After two weeks of exposure almost all of the bacterial spores were still viable. Another study was done and found that, if protected from UV radiation, bacterial spores can survive for six years in space (Joshi).

Both tardigrades and bacterial spores are able to survive in seemingly impossible conditions. However, for panspermia to be possible, life would have to survive for millions of years in order to travel from one planet to another. Studies have indicated that bacterial spores may be still be viable after 250 million years of being dormant. This has been tested through studying spores found in the abdomen of bees preserved in amber and from spores originating in salt crystals in the Permian Salado formation (Joshi). Between the ability of bacterial spores to survive in space and their lifespan reaching into the hundreds of millions of years, panspermia suddenly appears plausible.

After showing that life is able to survive in the vacuum of space, and for extended periods of time, the second biggest problem with the panspermia theory unfolds. If life did not originate on Earth, where did it begin? Our solar system is void of life as we know it. However, this is one major reason space development is essential. NASA’s Mars Reconnaissance Orbiter discovered significant evidence of water flowing on Mars (Brown et al). The presence of water is perhaps the most well known characteristic an environment must have in order for life to survive. Flowing water indicates that life may have, at one point, been on Mars. However, Mars is not the only possibility of the origin of life. Europa, one of Jupiter's moons, is thought to have underground oceans (Joshi). These are just two of the candidates for the origin of life. In addition to the presence of water, all life is composed of organic matter. Organic matter, including amino acids, have been discovered on meteorites (Joshi). Amino acids are considered the building blocks of life because they are used to form proteins.

Space development is essential because, while we have some evidence of water on distant planets, field work is invaluable. Investing in space development would allow researchers to send instruments into the field to collect valuable data that is impossible to get on Earth. Sending rovers and collection instruments to celestial bodies, whether it be asteroids, planets, or moons, can assist in the search for the origin of life. Whether or not the theory of panspermia turns out to be correct, space development would allow scientists to investigate environments that are much like early Earth. Observing such harsh conditions in real time may give scientists new evidence and therefore new insight on how life began.

When most people think of space development, they imagine mathematicians, engineers, and physicists working tirelessly in a control room or lab to invent new machines that can be sent to distant planets. However, biologists are an essential part of this team. Biology is the study of life, yet biologists have been unable to answer the question that has haunted humanity forever, the question of how life began. Space development may lead to the answers people have been searching for for thousands of years. Space development may help us answer where and how life originated, and it will create new mysteries that beg to be solved.

Works Cited

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