Reading 61

Panspermia

The idea that life did not originate on Earth, but was carried here either deliberately or by natural processes, has its roots at least as far back as the ancient Greeks. This idea, often referred to as panspermia, took on a scientific form in the work of various nineteenth-century authors. It later gained widespread popular appeal through the work of the Swedish chemist Svante Arrhenius, who argued that spores of life could survive in space and travel between star systems through the pressure of solar radiation.

The panspermia hypothesis eventually fell out of favor for a variety of reasons. [A] Skeptics pointed out that microorganisms could not possibly survive the damage caused by ultraviolet radiation and cosmic rays while being **propelled** out of a solar system away from a star. Indeed, it was unclear how biological material could escape from a planet by natural processes in the first place. [B] If unprotected, the molecules of life would quickly be destroyed by radiation near the ejecting planet. [C] Furthermore, it was not clear how microorganisms, having made a journey across the huge distances of interstellar space, could have safely descended to the surface of the Earth or any other planet. [D] Arrhenius himself argued that organisms caught inside meteorites would be subjected to incandescent* temperatures while entering the atmosphere of a terrestrial body. Such heat would destroy any life-forms lucky enough to have survived to this point.

Despite the seeming implausibility* of the panspermia hypothesis, some theorists have **resurrected** the notion in recent decades since laboratory research has shown that many of the objections to the hypothesis can be overcome. Scientists have shown that microorganisms protected from radiation by grains of material could be ejected from a solar system if the repulsive force (p) of the ejecting star is greater than the attractive force (g) of the star's gravity. Such ejecting stars cannot be too luminous since brighter stars emit too much ultraviolet radiation for the survival of bacteria. Organisms can only enter new solar systems whose stars' p/g ratio is low, thus allowing the gravity to pull the microbes into the planetary orbits. According to some researchers, material ejected from a planetary system could also eventually become part of an interstellar molecular cloud, which eventually produces a new planetary system as well as a large number of comets. Comets can **retain** microorganisms protected by other material and water, and impact onto new planets, which by then would have cooled sufficiently for the life in the grains to take hold.

Further supporting evidence about the likelihood of survival of bacteria traveling through space and entering a planetary atmosphere has been gained from studies of a meteorite of Martian ongin found in Antarctica in 1984. Whether or not the meteorite contains fossils of Martian bacteria (and many researchers now seem to reject this possibility), microscopic studies of **its** internal structure have shown that the interior was not heated to more than 40 degrees Celsius since before leaving the Martian surface. In other words, neither the original impact that must have ejected the rock away from the Martian surface nor the heat generated by its entry into the Earth's atmosphere did, in fact, melt or vaporize the internal portions of the meteorite. So it is quite possible that any life-form that had undergone **such a trip** would survive. As for the long journey itself, experiments aboard a European Space Agency mission have shown that bacterial spores can survive in deep space for at least five years. This is sufficient time for viable interplanetary travel, although not, of course, for interstellar travel.

Today, the panspermia hypothesis is being regarded with less skepticism than formerly. Although the orthodox view is still that life evolved on Earth (and possibly other planets in the universe) without extraterrestrial input, more and more research is pointing to the feasibility of some form of interstellar “seeding." Wickramasinghe and Hoyle, who championed the hypothesis of the interstellar transmission of life during the 1970s, argued persuasively that prebiotic chemicals have been shown to exist by remote sensing data of Comet Halley. Furthermore, they point out that evidence for viable microorganisms existing in comets could be attained in the near future if unmanned space missions could capture and return to Earth with cometary material.

*incandescent: producing a bright light after being heated to a high temperature
*implausibility: the condition of being difficult to believe

1 Early supporters of the panspermia hypothesis

A rejected the main elements of the hypothesis
B argued that some primitive life has been detected on a comet
C pointed out that space missions will find life elsewhere
D suggested that the "seeds" of life may have been deliberately planted

2 The word "propelled" in the passage is closest in meaning to

A rejected
B plunged
C heaved
D thrust

3 According to the passage, the panspermia hypothesis fell out of favor for all of the following reasons EXCEPT

A the potential damage caused by ultraviolet radiation
B the unlikelihood of natural processes leading to the ejection of biological material
C the probability that heat would destroy incoming life-forms
D knowledge that life can't exist elsewhere in the universe

4 The word "resurrected" in the passage is closest in meaning to

A destroyed
B reintroduced
C initiated
D succeeded

5 The word "retain" in the passage is closest in meaning to

A prevent
B erode
C avert
D keep

6 According to the passage, the panspermia hypothesis is

A of historical interest only
B being taken seriously again
C not really good science
D probably true

7 The word "its" in the passage ("microscopic studies of **its** internal structure") refers to

A the Martian
B the bacteria
C the meteorite
D the interior

8 The phrase "such a trip" in the passage refers to
A a journey from Mars to Earth
B the descent through Earth's atmosphere
C a trip from another solar system
D interstellar travelling

9 According to the passage, the meteorite found in Antarctica

A does not contain bacteria fossils
B might contain bacteria fossils
C has fossils originating on Earth
D could not originate from Mars

10 Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A Nowadays, the panspermia hypothesis has been more or less rejected.
B Currently, the panspermia hypothesis is looked on with more astonishment than previously.
C These days, the panspermia hypothesis is judged more plausible than before.
D The modern scientific establishment now generally accepts the validity of the panspermia hypothesis.

11 Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

However, even if organisms were somehow shielded inside fine grains of carbon they would be too heavy to be ejected from a planetary system by the pressure of radiation.

Where would the sentence best fit? Choose the letter of the square that shows where the sentence should be added.

12 Select the appropriate phrases from the answer choices and match them to the category to which they relate. THREE of the answer choices will NOT be used.
Write the letters of the answer choices in the spaces where they belong.

Answer Choices

A Prebiotic chemicals exist in comets.
B Bright stars emit a lot of ultraviolet radiation.
C Distances in interstellar space are huge.
D Comets are made up of water and other materials.
E Interstellar space has ultraviolet radiation and cosmic rays.
F Meteorites are subjected to burning temperatures when entering Earth's atmosphere.
G Meteorites from Mars have been found on Earth in areas of Antarctica where the cold

temperatures protected life-forms.

H The meteorite found in Antarctica contained frozen fossils.

I Bacterial spores have been shown capable of surviving for several years in space.

J Stars with a repulsive force greater than their attractive force are able to eject material.

Arguments Against Panspermia Hypothesis

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-
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Support for Panspermia Hypothesis

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Reading 61 — Keys

1 D
The Greeks were early supporters of the idea that life originated elsewhere and was carried to Earth.
2 D
When something is "propelled" or "thrust," it is pushed onward with great force.
3 D
If it were known for certain that there is no life elsewhere, there would be no hypothesis or debate.
4 B
"Resurrected" and "reintroduced" mean "revived or brought back."
5 D
"Retain" and "keep" mean "to hold in place."
6 B
The phrase "objections ... can be overcome" indicates that people are seriously looking at the hypothesis again.
7 C
Microscopic studies have been done on the meteorite's ("its") internal structure.
8 A
The phrase "such a trip" refers to a trip from Mars.
9 B
The phrase "many researchers now seem to reject this possibility" indicates that there is some disagreement about whether or not the meteorite contains fossils of microscopic bacteria.
10 C
The panspermia hypothesis is regarded [judged] with less skepticism [to be less doubtful] than formerly [than was once thought]."
11 C
The word "However" indicates that conflicting information will follow. The facts of being "too heavy to be ejected from a planetary system" conflict wifh the previous sentence, which introduces the possibility of an organism being ejected.

Arguments Against Panspermia Hypothesis
C
Although bacterial spores can survive long enough for interplanetary travel, they cannot for interstellar travel.
E
The ultraviolet radiation and cosmic rays would destroy any life-form.
F

Any life-form inside a meteorite would not be able to survive these high temperatures.

Support for Panspermia Hypothesis

A

These chemicals may indicate that life can also exist in comets.

D

Since comets retain materials that life requires, they could also retain life-forms.

I

If bacterial spores can survive in space, the objections to their being destroyed by ultraviolet radiation and cosmic rays is not significant.

J

Such an ejecting star would have a high repulsive force.