People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

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Faculty of nature and life sciences

Departement of the common core nature and life sciences

Report About :

Astrobiology

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Group A8

2020/2021

Summary

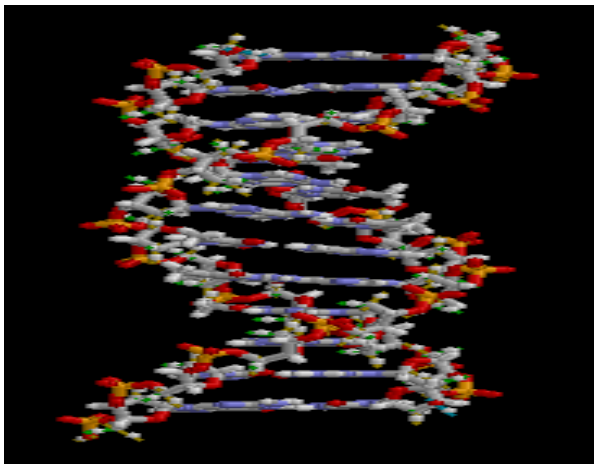
General Introduction

The search for life elsewhere in the universe is one of the most compelling aspects of modern science. Given its scientific importance, significant resources are devoted to this young science of astrobiology, ranging from rovers on Mars to telescopic observations of planets orbiting other stars.

The holy grail of all this activity would be the actual discovery of alien life, and such a discovery would likely have profound scientific and philosophical implications. But extraterrestrial life has not yet been discovered, and for all we know may not even exist. Fortunately, even if alien life is never discovered, all is not lost: simply searching for it will yield valuable benefits for society.

1) What is Astrobiology?

Astrobiology is defined as a branch of science concerned with the study of the origin and evolution of life on Earth and the possible variety of life elsewhere. Astrobiologists agree that we should have a firm understanding of how life evolved on Earth in order to ponder the existence of life in outer space. This chapter explains that the study of astrobiology has emerged to fill the gaps in human knowledge that will allow us to answer fundamental questions about biology, for example: How did life on Earth get started? Which special properties of the Earth and the Solar System make our planet habitable?



- **Image-1-**

2) From stardust to planets, the abodes for life:

Life exists because following a Big Bang 13.8 billion years ago, a hot, dense cosmos expanded and cooled. As it did so, atoms, galaxies, stars, planets, and life arose. 'From stardust to planets, the abodes for life' examines how this process produced an abode for life — the Earth. It starts with the structure of the present universe, which provides the clues about its history. It explains how part of the 'astro' in astrobiology comes from the fact that all of the atoms used by life except for hydrogen were created inside stars, and explores the importance to astrobiology of the way stars 'live' and 'die'.

- Image-2-

3) Origins of life and environment:

'Origins of life and environment' explains that quite how life arose is unknown. It may have originated on Earth or it may have been carried here by space dust or meteorites, but there is wide agreement that the origin of life would have been preceded by a period of chemical evolution, or prebiotic chemistry, during which more complex organic molecules were produced from simpler ones. The overall record shows that Earth was inhabited by 3.5 Ga — within 1 billion years of its formation and shortly after heavy impact bombardment, which suggests that life might originate fairly quickly on geological timescales on suitable planets.

4) From slime to the sublime:

'From slime to the sublime' asks: How did Earth maintain an environment fit for life? However life started, once established, it persisted for over 3.5 billion years and evolved from microbial slime to the sophistication of human civilization. The most drastic changes of the Earth's atmospheric composition have been increases in oxygen, which were just as important for the evolution of life as variations in greenhouse gases. For most of Earth's history, oxygen levels were so low that oxygen-breathing animals were impossible. With the Great Oxidation, Earth's stratospheric ozone layer formed and the ancient atmosphere made the transition from hydrogen rich to oxygen rich.

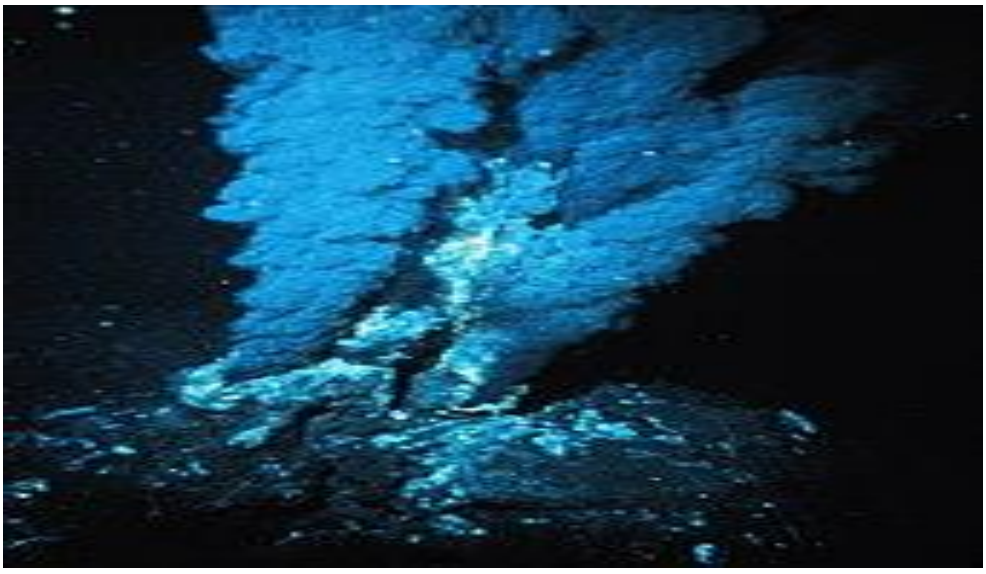
5) Life: a genome's way of making more and fitter genomes:

'Life: a genome's way of making more and fitter genomes' provides a global perspective of terrestrial biology. The history of life on Earth can be deduced from the way that evolution has altered genes. Evolution is the

change in inherited characteristics in a population from one generation to the next. Because individuals are genetically variable, in any given environment some will be better adapted and have greater reproductive success than others, which biologists describe as higher fitness. In every generation, individuals of lower fitness are lost. This is natural selection. So, over many generations, lineages accumulate genetic adaptations and new species evolve.

6) Life in the Solar System :

On Earth, wherever we find liquid water, we find life, whether in bubbling hot springs, drops of brine inside ice, or films of water around minerals deep in the crust. 'Life in the Solar System' asks: which worlds might be habitable today? Many of the cold outer Solar System objects used to be dismissed as potential habitats. But perceptions have shifted. It's possible that there are subsurface ammonia-rich oceans on Saturn's moon Rhea and Uranus's largest moons Titania and Oberon. Given that so many objects in the Solar System are potential refuges for life, billions of similar possibilities surely exist throughout our galaxy.



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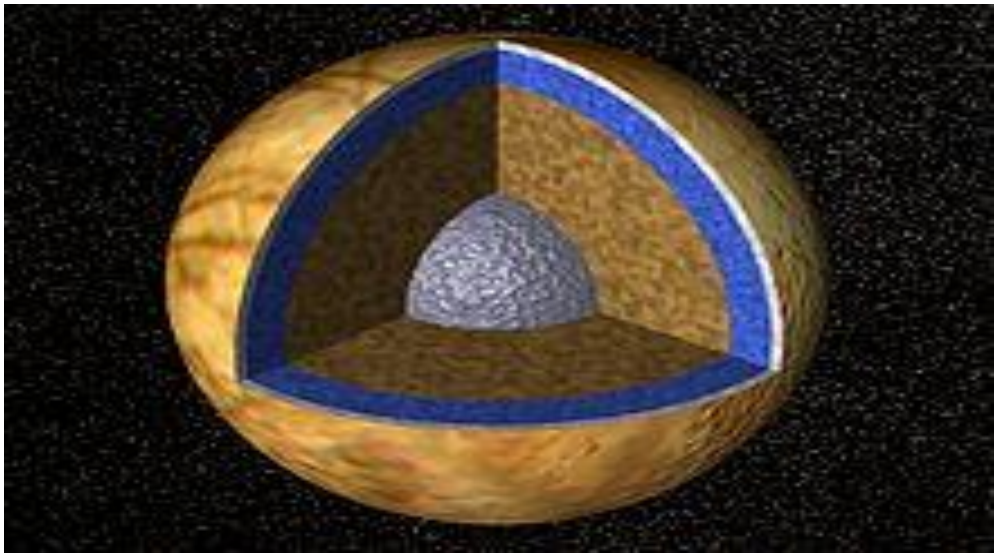
7) Far-off worlds, distant suns :

Beyond the Solar System, astronomers have discovered over 3,400 exoplanets. 'Far-off worlds, distant suns' explores the hunt for exoplanets and describes the methods astronomers have developed to find them. The first of these methods, indirect detection, looks for stellar properties, such as position or brightness, which are affected by the presence of unseen planets. The second is direct detection of a planet with an image or a spectrum of its light. Exoplanets with liquid water right at the surface have the chance of a biosphere that pumps lots of gases into an atmosphere. In principle, such biogenic gases are detectable in the light from the planet and might indicate life.

8) Controversies and prospects :

Controversies and prospects' examines the Rare Earth Hypothesis and looks at prospects for astrobiology and finding life elsewhere. The Rare Earth Hypothesis is that the fortuitous circumstances that have allowed complex life on the Earth are so uncommon that Earth might harbour the only intelligent life in the Milky Way. Opponents of this theory argue that our galaxy is unremarkable among many in the observable universe. With advances in technology, it's increasingly likely that major discoveries will be made in the coming decades. The discovery of Earth-sized exoplanets in habitable zones will ensure that the possibility of life elsewhere becomes more relevant than ever.



- **Image -4-**

- **Bibliography :**

- **Image-1-:** Nucleic acids may not be the only biomolecules in the Universe capable of coding for life processes. "Launching the Alien Debates (part 1 of 7)". Astrobiology Magazine. NASA. 8 December 2006. Retrieved 5 May 2014.

- **Image-2-:** Artist's impression of the extrasolar planet OGLE-2005-BLG-390Lb orbiting its star 20,000 light-years from Earth; this planet was discovered with gravitational microlensing. NASA (7 June 2018). "Ancient Organics Discovered on Mars" (video (03:17)). NASA. Retrieved 7 June 2018.

- **Image-3-:** Hydrothermal vents are able to support extremophile bacteria on Earth and may also support life in other parts of the cosmos. Cockell, Charles S. (4 October 2012). "How the search for aliens can help sustain life on Earth". CNN News. Retrieved 8 October 2012.

- **Image-4-:** Europa, due to the ocean that exists under its icy surface, might host some form of microbial life. Postberg, Frank; et al. (27 June 2018). "Macromolecular organic compounds from the depths of Enceladus". Nature. 558 (7711): 564–568. Bibcode:2018Natur.558..564P. doi:10.1038/s41586-018-0246-4. PMC 6027964. PMID 29950623.

Index :

1. **Branch** : a part of a subject.
2. **Gaps**: a period of time spent doing something different.
3. **Fundamental:** relating to the most important or main part of something.
4. **Cosmos:** the universe considered as a system with an order and pattern.
5. **Galaxies:** one of the independent groups of stars in the universe.
6. **Stardust:** (something that causes) a pleasant dream-like or romantic feeling.
7. **Meteorites:** a piece of rock or other matter from space that has landed on earth.
8. **Originate:** to start something or cause it to happen.
9. **Genomes**: the complete set of genetic material of a human, animal, plant, or other living thing.
10. **The Solar System:** the sun and the group of planets that move around it.
11. **Controversies:** a lot of disagreement or argument about something, usually because it affects or is important to many people.
12. **Prospects**: the possibility that something good might happen in the future: