ASTROBIOLOGY

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ASTROBIOLOGY

all components derived from the old Greek language

- astro → astron → celestial body (star, planet, constellation)
- bio → bios → life
- logy → logia → study of

ASTROBIOLOGY

- is, according to NASA, the study of the origin, evolution, distribution, and future of life in the universe (space & Earth).

- is probably the most interdisciplinary field of science and it brings together scientists from

physics, astrophysics, astronomy,
geophysics, geography, geology,
chemistry, radiochemistry
biology, molecular biology, ecology,
information science.

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LIFE BEYOND EARTH

THE LIFE IN THE UNIVERSE GROUP - an interdepartmental group of specialists from the Institute of Space Science (ISS) put together their experience in space microbiology, cosmic ionizing radiation, management of space threats and also in space applications for the health and safety of persons and communities

- **more details to be found at**
  http://www.spacescience.ro/projects/life/

- **ASTROBIOLOGY is one of the research fields of this group**

ASTROBIOLOGY

the search for EXTRATERRESTRIAL LIFE implies the quest for:

- **PRIMARY life forms - SIMPLE**
- **INTELLIGENT life forms - COMPLEX**

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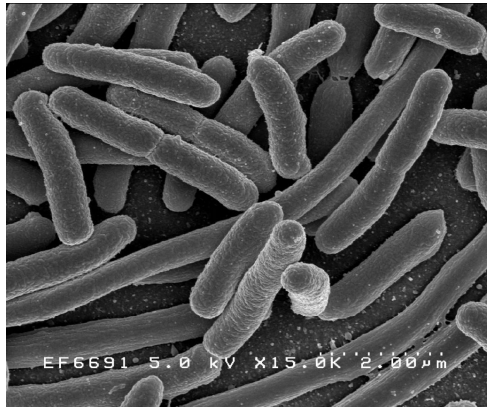
PRIMARY

- bacteria, viruses, fungi
  → BIOsignatures
- e.g. particular gases: O_2, O_3, N_2, CH_4
- and expect the unexpected:
  totally new life forms



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PRIMARY

- A new study proposes that molecules called ethers, not used in any genetic molecules on Earth, could fulfill the role of DNA and RNA on worlds with hydrocarbon oceans. Ethers, like DNA and RNA (C,O,N,P), have simple, repeating backbones, in their case of carbon and oxygen.

- These worlds must be a good deal warmer than Titan, the study found, for plausibly life-like chemistry to take place.

- This study appeared in the March issue of the journal *Astrobiology*.

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INTELLIGENT

- human like or maybe different
- this search is an exploratory endeavor that seeks evidence of life in the universe by looking for some signature of its technology → TECHNOsignatures
- best known: the SETI Institute (SETI - Search for Extraterrestrial Intelligence) located in Mountain View, Ca., USA.

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INTELLIGENT

- so far ... energetic emissions, such as radiowaves, which are neither highly regular, as from a pulsar, nor highly random, as in the universal background have been serched for, but NO positive result

- new idea: use detectors tuned to infrared light.
  - a *powerful infrared laser* could *outshine a star*, if only for a billionth of a second.
  - *interstellar gas* and dust is almost *transparent* to near *infrared*, so these signals can be seen from greater distances.
  - it takes *less energy* to send the same amount of information using infrared signals than it would with visible light.

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MODERN TOPICS IN ASTROBIOLOGY

- Extraterrestrial Materials and the Emergence of Life
- Planetary Protection in the Age of Exploration
- Methods for Detection of Habitability, Biosignatures, and Their Variations
- Life in the Clouds - the Upper Atmosphere Exploration
- Comparative Planetology and Habitability

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MODERN TOPICS IN ASTROBIOLOGY

- The Exploration of Icy Worlds (Europa - Jupiter, Titan - Saturn)
- The Emergence of Life at the Intersection of Prebiotic Chemistry and Early Earth Environments
- The Origin and Nature of Prebiotic Species in Comets
- Omics Research on Microbial Communities, Their Chemistries, and What it Means for Life in the Solar System

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MODERN TOPICS IN ASTROBIOLOGY

- Definition and Boundaries of Exoplanet Habitable Zones
- Radiation and Habitability: Friends or Foes?
- From Molecules and Viruses to Cells and Populations
- Energy in Extreme Environments
- Biosignatures and Technosignatures: the Search for Inhabited Planets

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ASTROBIOLOGY @ THE INSTITUTE OF SPACE SCIENCE

- Biosignatures detection.
- The influence of the ionizing and UV radiation on the atmospheres of the planets, exoplanets and moons.
- The influence of the ionizing and UV radiation on the biosignatures.

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THE IONIZING RADIATION

- Can have solar, galactic and extragalactic origin.
- Categories:
  - **charged particles**: electrons, protons, nuclei from He to Fe
  - **electromagnetic radiation**: gamma-rays, X-rays, EUV
  - local and galactic **radioactive nuclei**

ASTROBIOLOGY

CURRENTLY ...

- even if water and complex organic compounds have already been found in the outer space (e.g. *amino acids* - the building blocks of proteins → *meteorite*), life as we know it, has not been found yet.

- we still face the two equally terrifying possibilities: either we are alone in the Universe or we are not.

- ... and we continue the quest. If anyone is interested please contact me at:

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