

COMMISSION F3 ASTROBIOLOGY

Astrobiology is the study of the origin, evolution, and distribution of life in the universe.

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Commission WG **Education and Training in Astrobiology**

TRIENNIAL REPORT 2015-2018

1. Scientific domain and justification

Astrobiology, also called bioastronomy, is the study of the origin, evolution, and distribution of life in the universe. Research in Astrobiology encompasses:

- The origin of the biogenic chemical elements and the search, observations, and analysis of biologically relevant molecules in the circumstellar and interstellar media and in external galaxies;
- Study of biomolecules and organic solids in primitive solar system bodies such as comets, asteroids, interplanetary dust particles, meteorites and planetary satellites;
- The search for extant life, evidence of past life, and evidence of prebiotic chemistry on solar system bodies, including Mars, Europa, Titan and Enceladus;
- The study of the origin, early evolution, and environmental constraints for life on early Earth;
- The detection of extra-solar planets and search for spectroscopic evidence of life, habitability, and/or biological activity on extra-solar planets;
- Historical and philosophical issues linked to the origin and evolution of life on Earth and to its possible presence elsewhere in the Universe;
- The search for intelligent signals of extraterrestrial origin.

IAU Commission F3 coordinates efforts in all these areas at the international level, and has established collaborative programs with other international scientific societies with related interests, such as the Nordic Network of Astrobiology, the Centro de Astrobiologia, the Instituto de Astrobiologia Colombia, the Japan Astrobiology Network, the European Astrobiology Network Association (EANA), the NASA Astrobiology Institute, and the International Society for the Study of the Origin of Life.

2. The astrobiology community

Astrobiology is a field of research that draws from the communities of physics, chemistry, biology, geology, and astronomy. Its field of research interact with areas of cosmology.

ogy, atmospheric science, oceanography, evolutionary science, paleontology, planetary science, biochemistry, molecular biology, microbiology, and ecology. Furthermore, astrobiology also touches upon the disciplines of history, philosophy and sociology. Research in astrobiology covers the past, present and future, including cosmic evolution from Big Bang, the formation of galaxies and stars, synthesis of elements, formation of the solar system and planets, chemical evolution, origin of life, pre-Cambrian biology, complex life, intelligent life, cultural evolution, civilization, science and technology, and the study of life in the universe. It integrates disciplinary insights to construct a more comprehensive understanding of the problem.

3. History of commission

IAU Commission F3 Astrobiology was created after the commission reform in 2015. The Commission's predecessor was Commission 51, which was first formed in 1982 as "Bioastronomy: search for extraterrestrial life", and later renamed "Bioastronomy" in 2006.

4. Meetings and conferences

Commission F3 (and its predecessor C51) has a strong and consistent record of running symposia once every three years. Previous symposia were held in Boston (1984), Balaton, Hungary (1987), Val Cenis, France (1990), Santa Cruz, U.S.A. (1993), Capri, Italy (1996), Hawaii, U.S.A. (1999), Hamilton Island, Australia (2002), Reykjavik, Iceland (2004), San Juan, Puerto Rico (2007), Montpellier, France (2011), and Nara, Japan (2014).

The following conferences and workshops were organized during this reporting period:

- *Search for water and life's building blocks in the Universe*, Focus Meeting during the IAU General Assembly, 3 – 5 August 2012, Honolulu, Hawaii, USA
- *International conference on astrobiology* 18–22, October 2016, Manizales, Colombia
- *Search for life: from early Earth to exoplanets*, 12–16, December 2016, Qhy Nonh, Vietnam
- Astrobiology training school 24–25 November, 2017, Santiago, Chile
- *Astrobiology 2017*, 26 November – 1 December, 2017, Coyhaique, Chile. This major event of this commission was attended by 200 participants from 27 countries.

5. Education and outreach

The Commission also puts great emphasis on education, especially in developing countries. Its activities include lectures and training for young scientists in different fields to prepare for research in astrobiology, outreach functions, and production of educational shows and displays. One example the members of the Commission helped produce is the sky show "In Search of Cosmic Life" produced by the Hong Kong Space Museum, which will run between February to November 2018. Details of other activities are presented in the report of the Education and Training Working Group.

6. Encyclopedia and monographs

Members of the commission have had major contributions to much advancement in research on the origin of life and astrobiology, and have also played instrumental role in the development of the second edition of the Encyclopedia of Astrobiology was published in 2015 and a continuously updated "living edition" is now being implemented. This

volume of 3000 entries has served as a valuable resource and reference for researchers, teachers, and students.

A Handbook of Astrobiology is under preparation to be published by CRC Press (Taylor and Francis Group) in 2018.

7. Connections to other IAU divisions and commissions

As part of the interdisciplinary nature of our commission, we work closely with

- Div C: Education, Outreach and Heritage, and in particular C1 (Astronomy Education and Development) and C2 (Communicating Astronomy with the Public),
- Div F: Planetary Systems and Bioastronomy (the main affiliated division), and in particular F2 (Exoplanets and the Solar System).
- Div H: Interstellar Matter and Local Universe, and in particular Commission H2 (Astrochemistry).

Our commission also serves as an interface between astronomy and other scientific disciplines involved in astrobiological research issues such as chemical sciences, life sciences, and Earth sciences.

Astrobiology remains an active area of research at the current frontier of science. We would like to continue as a Commission of IAU in the 2018-2021 cycle.

Sun Kwok
President, Commission F3

Inter-commission WG C1-F2-F3-H2 Education and Training in Astrobiology**CHAIR**

Muriel Gargaud

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TRIENNIAL REPORT 2015-2018**8. Introduction**

This Working Group has been created in October 2015 in order to coordinate training, education and outreach activities in astrobiology at the international level.

Five goals were identified :

- To collect all lectures and conferences in astrobiology which have been recorded during the last 10 years (whatever the language is), to categorize them according to their field and the public concerned (from general public to specialist of the field), and to make them available for free on a website so that people with few financial resources can access them remotely. The platform *Online courses in astrobiology* has been launched in November 2017: <http://astrobiovideo.com/en/>. So far 3 languages are available: French, English and Spanish. ;

- To produce handbooks and Massive Open Online Courses (MOOCs) for university students - pooling the individual national efforts that are already in progress over the world 2 MOOCs have been produced or are still in progress : Chris Impey : *Astronomy : exploring Time and Space* : <https://www.mooc-list.com/course/astronomy-exploring-time-and-space-coursera> Charley Linneweaver : *Are we alone?* (in progress) ;

- To develop outreach for the general public and high school teachers. One book has been recently published in French for the general public and will be translated soon in different languages: *La plus grande histoire jamais contee* , Belin Publisher : <https://www.belin-editeur.com/la-plus-grande-histoire-jamais-contee>;

- To create an annual international astrobiology training school (TS) lasting 1-2 weeks, which would train the young generation in the basics of astrobiology. In 2016 the annual Training School *Rencontres Exobio pour Doctorants/Astrobiology Introductory Course* has got the recognition of IAU. The next TS will be organised in march 2018: <http://www.exobiologie.fr/red/index.php/en/red16-astrobiology-course/> In addition to this annual TS, we have organized twice a 2-days TS before one international conference to let the local students (and also the conference PhD students) have a basics course in astrobiology : in Vietnam in 2016, just before the conference *Search for life : from early Earth to exoplanets* <http://rencontresduvietnam.org/conferences/2016/search-for-life/program/> and in Chile in 2017, just before the C.F3 *Astrobiology Conference* : <http://astrobiology2017.org/training-school/> Lectures of all these TS are recorded and are available on the *Online courses in astrobiology* The next 2 days-TS will be organised in Vienna on August 17-18th just before the IAU S345 symposium *Origins: from the protosun to the first steps of life* . Lectures will be recorded too;

- To organize a regular international workshop on education in astrobiology in order to discuss how to carry out multidisciplinary training in astrobiology, how to evaluate students, and above all to share all training materials that each country may have developed but kept in its national drawers. The first International Symposium on Education

in Astronomy and Astrobiology (ISE2A) has been co-organised in Utrecht in July 2017 in collaboration with the C.C1 Education commission : <https://ise2a.uu.nl/>. It gathered 100 participants, the next one will be organised in Malaga in 2020.

9. Prospective 2018-2021

For the period 2018-2020 we plan to go on with all these goals and in particular, we plan :

- to develop further the platform online courses in astrobiology , to implement the display of MOOCs and to add lectures in languages other than English, French and Spanish.

- to organize, as often as possible, a 2-days astrobiology TS before each important international astrobiology conference, in addition to the Rencontres Exobio pour Doctorants/Astrobiology Introductory Course which is organised in France in English every year

- to develop outreach for the general public and high school teachers - to train the trainers, specifically in countries where astrobiology is not developed a lot.

For these reasons, we ask the WG to be continued for the period 2018-2021

Muriel Gargaud
*Chair of Inter-commission WG C1-F2-F3-H2
Education and Training in Astrobiology*