

COMMISSION F3

ASTROBIOLOGY

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COMMISSION F3 WORKING GROUP

Inter-Commission WG C1-F2-F3-H2 Education and Training in Astrobiology

TRIENNIAL REPORT 2018–2021

1. Activities of IAU Commission F3 during 2018-2021

by Masatoshi Ohishi (President) and Joseph A. Nuth (Vice President)

Commission F3 (Astrobiology) was established in 2015, as a successor to the former Commission 51 (Bioastronomy). It aims to develop a coherent picture of the synthesis of the basic ingredients of life in stars and planets, in the interstellar medium, and in the solar system such as Mars, Europa, Titan and Enceladus, and to study the interrelationships between these findings and the results from studying the early Earth to obtain an understanding of the origin of life and the possibility of other life in the Universe.

"Where and how did life begin?", "How has life evolved?", "Are there other living beings in the Universe?", "What is the future of life?" These are fundamental questions to everybody. Astrobiology is an interdisciplinary research field that attempts to solve these questions through collaboration among astrophysics, physics, chemistry, planetary science, geophysics, biology, philosophy, history of science, and others.

Astrobiology research includes:

- the search for extant life, evidence of past life, and evidence of prebiotic chemistry on solar system bodies;
- the search for spectroscopic evidence of life, habitability, and/or biological activity on extra-solar planets;
- 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 intelligent signals of extraterrestrial origin;
- the study of the origin, early evolution, and environmental constraints for life on Earth.

As of March 2021, Commission F3 counted 204 members, including one associate member from Peru who joined us in 2018. This information is accessible via the Commission's

web page at https://www.iau.org/science/scientific_bodies/commissions/F3/info/.

During the past triennium, Commission F3 worked towards holding an astrobiology conference; it is a tradition for Commission F3, since Commission 51, to hold an astrobiology conference once every three years, where researchers in the relevant science fields gather. 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), Nara, Japan (2014), and Coyhaique, Chile (2017). The commission organizing committee reviewed the successful astrobiology conference where many researchers in South America were able to participate. It was concluded that our astrobiology conference was the first true international one and that it contributed to the advancement of astrobiology research in South America. It was also agreed that next continent where Commission F3 should hold an astrobiology conference would be Africa.

The commission organizing committee members contacted relevant, active researchers in South Africa, and succeeded to find a person who agreed to work as the LOC chair. It was decided to hold the next astrobiology conference in November, 2020, at a venue near Johannesburg. It was possible to get confirmation from several very busy invited speakers. However, because of COVID-19, the organizing committee reluctantly decided to postpone the conference to late 2021 or early 2022. At the writing of this report, it is not possible to decide meeting dates due to the uncertainty caused by the possible mutations of the COVID-19 virus in South Africa.

The following scientific meetings were organized during this reporting period:

- *Basics of Astrobiology*, 17 – 18 August 2018, Vienna, Austria
- *IAU Symposium S345 “Origins: from the protosun to the first steps of life”*, 20 – 23 August 2018, Vienna, Austria
- *The Fourth Astrobiology Congress*, 25 – 27 October 2018, Lima, Peru
- *Astrobiology Training School*, 22–23 March, 2019, Hanoi, Viet Nam
- *XVe Rencontres du Vietnam: Life3E ’2019 - Search for life: from early Earth to exoplanets*, 25–29, March 2019, Qhy Nonh, Vietnam

During the past triennium, Commission F3 actively supported the work by the inter-commission WG ”Education and Training in Astrobiology”; the report on its activities can be found in section 2.1 below.

Based on the positive evaluation of the Commission’s application for continuation by the IAU Executive Committee, Commission F3 (Astrobiology) will continue its effort during the upcoming term 2021-2024.

2. Working group report

2.1. *Inter-Commission WG C1-F2-F3-H2 Education and Training in Astrobiology*

by Muriel Gargaud (Chair)

This Working Group has been created in October 2015 and renewed in 2018 in order to coordinate training, education and outreach activities in astrobiology at the international level.

Five goals were identified in 2015, and continued over the period 2018-2021:

- 1) **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" launched in November 2017: <http://astrobiovideo.com/en/> have been enriched by 38 videos:

- Training School RED'18/Astrobiology Introductory course, Le Teich France, March 2018: 13 lectures
- Training School RED'19/Astrobiology Introductory course, Le Teich France, March 2019: 15 lectures
- Training School Basics in Astrobiology, IAU GA Vienna, August 2018: 10 lectures

2) 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 during 2018-2021: <https://astrobiovideo.com/fr/search?t=moooc>

- Chris Impey : Introduction to Astrobiology, 6 modules of 6-7 lectures each (39 lectures)
- Alessandro Morbidelli/Sean Raymond: Modeling the origin of Jovian Planets (12 lectures)

Another one is in progress and should be available in 2021:

- Charley Lineweaver: Are we alone in the Universe?

The 3rd edition of the Encyclopedia of Astrobiology (45 thematic editors, 300 authors, 3000 entries) is in progress and should be achieved end of 2021.

(<https://link.springer.com/referencework/10.1007/978-3-662-44185-5>)

3) To develop outreach for the general public and high school teachers

The book "**La plus grande histoire jamais contée**", Belin Publisher : <https://www.belin-editeur.com/la-plus-grande-histoire-jamais-contee> has been translated in Chinese and published by *Editions Bocaïyaji (Chine), 2019*. The book "**Young Sun, Early Earth and the Origins of life**" published in English by Springer in 2012 has been updated/translated in Japanese and published by *Nishimura Edts (Japan), 2021*.

4) To create an annual international astrobiology training school (TS) lasting 1-2 weeks, which would train the young generation in the basics of astrobiology.

The Training School "Rencontres Exobio pour Doctorants/Astrobiology Introductory Course" has been created in 2016 and take place every spring in France.

The program of the 2018 and 2019 editions can be found here:

<http://www.exobiologie.fr/red/index.php/fr/programme-red18/>

<http://www.exobiologie.fr/red/index.php/fr/programme-red19/>

50 students, essentially from Europe, have participated to each of these Training Schools. Unfortunately RED'20 has been cancelled because of the Covid pandemics.

In addition to this annual TS, we have organized twice a 2-day TS before one international conference to let the local students (and also the conference PhD students) have a basics course in astrobiology :

- in Vienna in 2018 just before the IAU S345 symposium "Origins: from the protosun to the first steps of life": <https://astronomy2018.univie.ac.at/symposia/symposium345/>
- in Hanoi in 2019, just before the conference "Search for life : from early Earth to exoplanets" <https://icisequynhon.com/conferences/2019/search-for-life/>

Lectures of all these TS (except Hanoi) are recorded and are available on the "Online courses in astrobiology".

5) 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, how to train the trainers 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 200 participants. We thought to organize one in 2020, but its organisation has been postponed to the 2021-2024 period.

In collaboration with NASE (Network for Astronomy School Education, a WG of IAU-C1) the first *Astrobiology courses for High School Teachers* were developed , online and synchronous

along 2020 in 4 continents , as part of the regular workshops of NASE (Workshop 10). The materials are available at the website of NASE www.naseprogram.org.

Masatoshi Ohishi
president of the Commission