

General Assembly of the European Astrobiology Institute

3 June 2022

Motion 1

The General Assembly may approve the following Report of the Activities of the European Astrobiology Institute for the year 2021:

Report about the activities of the European Astrobiology Institute

Year 2021

Recruitments of institutions

The recruitment of member entities was continued during 2020. Up to the date of the report (September 2021) there were 6 Core Organisations (CNRS (FR), CNES (FR), DLR (DE), FNRS (BE), INAF (IT), Centro de Astrobiología (ES) and 18 participating institutions. We hope to welcome the first Swiss institution, namely the the University of Geneva.

Networking Activities

In 2021 the WG “*Formation and Evolution of Planetary Systems and Detection of Habitable Worlds*” together with the WG “*Planetary Environments and Habitability*” continued the work on a collaborative paper entitled: „Habitable Worlds: Formation, evolution, detection and characterization”. The aim of this undertaking is to write an article with a special focus on astronomical aspects of habitability and to initiate future research projects along the lines identified in this article. The first half of 2021 has been devoted to the reviewing and revising the content of the paper. There has been a series of on-line meetings dedicated to these tasks. During the second half of the year, WGs investigate the best option for the final format and publication of the paper. The outline of the article has been discussed with the editors in chief of few leading scientific journals. The final outcome of this dialogue was the invitation to submit our article to the Space Science Reviews. 9 EAI seminars were given by members of the WG “*Formation and Evolution of Planetary Systems and Detection of Habitable Worlds*” and one lecture of the EAI academy was also delivered.

The Working Group “*Planetary Environments and Habitability*” worked together with the WG on “*Formation and Evolution of Planetary Systems and Detection of Habitable Worlds*” towards a joint review/white paper. As mentioned above: The first half of 2021 was devoted to the intensive work on the contents of the paper to define chapter outlines and discuss chapter status. There has been a series of online meetings dedicated to this task. In August 2021, the working groups started to contact journals to identify the best option for the final format and publication of the paper. As of February 2022, the journal selected for publication is Space Science Reviews.

In 2021, the “*Planetary Environments and Habitability*” WG also has redefined the scientific questions to reflect the diversity of topics in the working group:

- How did life and habitability co-evolve on Earth
- Which parameters and processes determine the habitability of rocky and water-rich planetary bodies
- Which conclusions can we draw for other planets and moons from studies of the Earth and vice versa?

The working group monthly meetings, which take place on the fourth Monday of each month, included presentations from group members as follows:

- Fernando Gomez (CICTERRA-CONICET-Universidad Nacional de Cordoba): *The search for analogues for the Jezero crater carbonates: Lacustrine carbonates from the high-Andes to the deep south in Patagonia (Argentina)*
- Josep M. Trigo-Rodriguez (CSIC-IEEC): *Early protoplanetary disk chemistry preserved in an ancient cometary clast in the CR chondrite LaPaz Icefield (LAP) 02342*
- Ina Plesa (DLR, Berlin, Germany): *Mars’ Subsurface Environment: Where to Search for Groundwater?*
- Barbara De Toffoli (DLR, Berlin, Germany): *Mechanical layering of the Martian crust: identification of deep ice-bearing levels*

The working group also started to prepare a list of funding opportunities that could be relevant for its group members. This list together with information about previous meetings, and other documents relevant for the working group have been collected and made available for all group members via a Google Drive shared folder:

https://drive.google.com/drive/folders/1LOPx9_L1FUgE607HpxPN5N2cRJwuNqZJ?usp=sharing

The main activity of Working Group “*The Pathway to Complexity: From Simple Molecules to First Life*” was the planning of a workshop in Heidelberg (DE) to take place from 2 to 6 May 2022. The aim of the meeting was to forge links between the astrobiology and astrochemistry community. Such an event was already organised in Liblice with success by the previous COST Action “Origins and Evolution of Life in the Universe”. Due to the still ongoing pandemic the meeting was restricted to maximally 50 participants. The workshop was a great success with lots of positive resonance from the participants. During the meeting also the EAI was presented by the chair and future events were announced. The WG Leader then proposed several key themes for the WG to pursue. The workshop formed a good basis for planning the future work of the WG.

The WG “*Early life and life under extreme conditions*” participated in the preparation of CEACON 2022, which, unfortunately was postponed to next year due to the pandemic situation as well as the volcanic hazards. The Working Group is actively preparing a workshop “*Life in the Sub-Surface: Habitats, species, metabolism and survival strategies*” which will take place as a 3 days meeting on the Azores and will be organised in collaboration with researchers at EANA. After this workshop, the WG also will be a field trip to different

islands. The ISSI project "Towards a Universal Tracers Portal" funded by the International Space Science Institute is ongoing (see below). Members of the WG also participated to NASA Absicon 2022 in Atlanta (May) as SOC members, session conveners and speakers.

The Project Team: "*Tracing life and identifying habitable environment*" has succeeded to establish a working group at ISSI entitled "TOWARDS A UNIVERSAL TRACERS PORTAL". Work of this group started in November 2021 with a virtual kick-off meeting, to which in total 26 experts from different fields and perspectives were invited. The aim of this event was to discuss and brainstorm on tracers of habitability as well as tracers of life (together with potential problems regarding nomenclature, misunderstandings between different scientific fields, how to establish a common language) in three different domains: Earth, Solar System and exoplanets research. Through late 2021 and early 2022, cross-disciplinary discussions through online meetings on the ISSI platform were held to plan how to best establish the planned tracers portal, and to identify the formats (as review papers and public debates, website) for addressing philosophical definition of biosignatures, gaps of knowledge related to tracers of habitability as well as tracers of life. Preparation of the in-person first meeting in Bern in June 2022 is also ongoing. A talk (L Noack, IG Tenkate, E Javaux) at the GA will summarize these advances at the WG "Astrobiology and Society" in Hoor 2022.

The Working Group on *Historical Philosophical and Societal Questions in Astrobiology* focused on the preparation of two events in late spring 2022, namely a summer school entitled "Life on Earth and Beyond" to be organised on the island of Ven (SE) May 30–June 1, 2022, followed by an excursion to Stevns Klint in Denmark June 2, and a workshop on "Astrobiology and Society" to be organised in Höör June 3–4, 2022. The resonance of the summer school was very good with almost 40 people attending, including participants from outside Europe. Co-funding from Lund University was obtained in an amount of EUR 10000 for both events. A further workshop on legal, societal and ethical questions concerning the commercialisation of space is planned to take place in Kiruna (SE) in 2023 or 2024. The WG had two scheduled zoom meetings in 2021. On March 25, the members of the WG discussed the general features of the WG, research questions to be tackled, possible themes, and activities. October 6, the members of the WG discussed "Errors and misconceptions in astrobiology reaching out to the general public" in an on-line meeting. This topic has been debated since then through the mailing list.

The first team meetings of the Project Team "*Physical and Chemical Processes in Protoplanetary Disks (PPDs)*" were held in January 2021 and April 2021 via Zoom. The team membership has now expanded to include members of the exoplanet research community. The project team had planned an in-person meeting at Schloss Ringberg in March 2022; however, the remaining uncertainty over international travel in January 2022 meant that many team members were not able to confirm their participation. It was decided to hand back the slot, and to resubmit an application for an in-person meeting in summer of 2023. A substantial action completed in 2021 was the submission of a COST Action proposal "The birth of solar systems" in Autumn 2021, and for which we are yet to hear the outcome but it is expected to be imminent. The COST Action proposes four Working Groups bringing together the interdisciplinary expertise needed to answer fundamental questions on how planets form: i) Planet formation: laboratory perspectives; ii) Advancing planet formation models; iii) Planet formation theory confronts observations; and iv) Emerging habitable environments.

The COST Action proposal was broadened in participation and involved 40 proposers, 42.5% of which were female and 30% of which were early career researchers, from 17 countries, 53.3% of which were COST Inclusiveness Target Countries. A final note for the report is the stepping down of Dr Gesa Bertrang as joint coordinator of the project team. Dr Bertrang has decided to leave astronomy to pursue a career in science communication and engagement. We would like to thank Dr Bertrang for all her efforts and leadership of the team, and wish her well in her new career. A new team co-coordinator will be sought and appointed in 2022.

The Project Team “Science Fiction as A Tool for Astrobiology Outreach & Education” continues on its trajectory of science fiction-facilitated outreach, started with the e-book anthology titled *Strangest of All* in 2020 (aiming to increase interest in astrobiology and STEM overall via using science fiction stories accompanied by short science essays). The more ambitious print and e-book anthology *Life Beyond Us* was [successfully crowdfunded](#) in spring 2021, exceeding all three stretch goals to include more stories and essays (28 of each), and we are currently waiting for a few last essays, introduction and afterword before wrapping up the editing and copyediting phase and getting the book ready for publication (in autumn 2022 as planned).

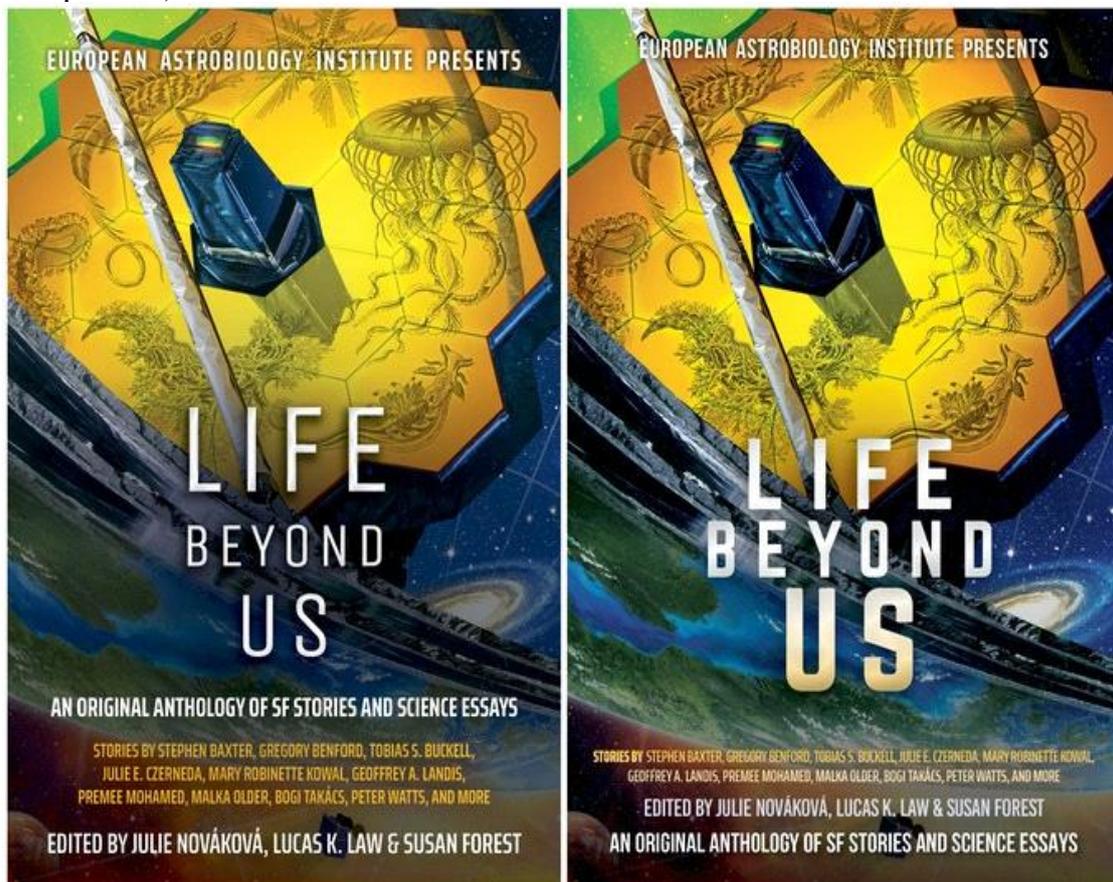


Image: *Life Beyond Us* cover (cover art Dan J. O’Driscoll, cover design Veronica Annis) for the paperback/hardcover editions.

The project team “*Impacts and their Role in the Evolution of Life*” focused on the planning of two events in 2023 and 2024, namely a summer school and a meeting on the subject, which will be held in Nördlingen, at the site of the Ries crater project. Local contacts have already been forged. Accommodation has been secured and a programme for the summer school is being drafted. An exhibition “*Impacts and Impactors in Art*” will be organised during the conference at a local arts museum and the newly to be created project team “*Astrobiology and Arts*”.

In the Working Group “*Fieldwork and Field Site Management*”, the capabilities of the currently existing field sites were surveyed and evaluated jointly again, from a point of view of their unique characteristics. The following aspects should be emphasized and put into the focus in a next proposal to provide financial support for field work there:

- **Pilbara area, Australia:** the best location of over 3 billion years old well preserved rocks with, fossil evidence for early life. This site should be exploited on a way to allow the long term activity of European scientists there, with continuation after sampling.
- **Mobile cave and Apuseni Mountains ice caves:** unique aspect in the subsurface closed character of the ecosystem. Future work plans should focus on the subsurface interaction and chemical circulation there.
- **Southern Italian volcanic region:** fresh lava fields: further exploitation of the way is needed how these hot springs and hydrothermal lakes related sites support testing the origin of life on early Earth and understanding of bio-signatures.
- **Azores:** composed of primitive basaltic rocks: the hydrothermal sites here provide ways to understand the exploitation of chemical energy, and specific fossilization, speleothems in lava tubes for bio-morpho features.
- **Iceland:** ice and volcanic interaction sites, colonization of lava caves and silica springs are unique here.

Having these field sites together, in case of financial support, synergies should focus on the followings (however these topics should be further discussed, and especially specific guidelines are needed):

- Fossilization and bio-morpho structure analysis: connecting the Italian volcanic regions and Iceland hot spring fields produced specific fossilization experience with searching for similar features at the Pilbara sites.
- Subsurface ecosystems and chemical energy exploitation: connecting the analysis of Mobile cave, Azores sites and Iceland lava caves regarding the used sources, their local release / sinks, and circulation.

Seminars

Since autumn 2020 the EAI organises a biweekly series of seminars by eminent astrobiologists. During 2021 more than 2w0 seminars were given which were livestreamed on our website (<https://europeanastrobiology.eu/streamed-seminars/>) and archived on a special Youtube channel. Attendance was very good (up to 70 participants) and the resonance very positive. The seminar series will be continued in 2022 and slots are already filled until summer. To attract more interest and to give an introduction into the topic a trailer was

produced before each seminar in cooperation with the speaker. These trailers are also available at the Youtube Channel.

General Assembly 2021

The General Assembly 2021, which was scheduled to take part from 25-24 April 2022 in Fuencaliente de La Palma (ES). Unfortunately, all that arrangement had to be cancelled due to the Covid-19 outbreak and the meeting was (again) adjourned to 8-12 May 2023, not only because of the pandemic, but also to the outbreak of the volcano, whose situation was very unclear. We also planned a meeting of early career astrobiologists in cooperation with AbGradE just before BEACON 2020 at the same location. It was planned to consist of 3 days of scientific programme and a day of excursions. A team of 7 early career scientists will act as the Scientific Organisation Committee for the event.

Nevertheless, the General Assembly 2022 had to be held on-line, which was done on 5 October 2021. However, we managed to get a one-day event with very interesting scientific talks from all fields of astrobiology together. The business meeting with the votes on the motions was held in the late afternoon. The layout and the programme was praised by quite a few attendees and the infrastructure was managed very well by the ESF office staff.

Training

The 16th edition of the Rencontres Exobio pour Doctorants/Astrobiology Introductory Course (RED'22: <http://www.exobiologie.fr/red/index.php/en/red16-astrobiology-course/>) have been successfully held on March 13-19th. Due to sanitary situation we had limited the number of attendees to 35, and finally due to positive Covid tests at the very last minute, 3 registrations have been cancelled. Among the 32 attendees, 25 were from French laboratories (French students or european ones) and supported by CNES (French National Space Center) grants, 7 were coming from European countries (Poland, Switzerland, Greece, Germany, UK, Ireland, Spain) and supported by EAI grants. Half of the speakers were coming from France (this choice was done on purpose in case it would have been impossible for our European colleagues to travel due to Covid-related constraints), the 7 others were from Switzerland, Poland, UK, Spain and Sweden. All lectures have been given in person, except one by a speaker from the UK which was given remotely for reason of travel constraints at the very last minute. All lectures have been recorded and will be published soon on the platform Astrobiovideo: <https://astrobiovideo.com/en/>.

No summer schools could be held during 2021 due to the pandemic situation. But preparations were underway for the summer school "Life on Earth and Beyond" in June 2022 (Ven Island, SE) as well as the one on "Volcanism, Plate Tectonics, Hydrothermal Vents and Life" on the Azores in October 2022.

The *EAI Academy was launched*, which is a new international educational program that has been broadcasted during the 2021-2022 academic year by the Center for Astrobiology (CAB), Madrid. It consisted of a series of 16 didactic talks on the following four topics:

- Trips to the Outer Solar System
- Habitability of exoplanets
- Life in the dark
- Co-evolution of planetary geospheres, atmospheres and biospheres".

The seminars have been offered for free and will be streamed online every two weeks. Each session included a 30-40 minute didactic talk given by an expert. The talk was followed by about 20 minutes of questions and answers. These online events have been very popular: the program has 350 subscribers and each seminar has had between 200 and 80 attendees from 32 countries and all continents. The talks are given by world-renowned experts, who answer the questions raised by the public after their talk. At the end of the academic year, CAB awards a certificate of participation to those who attend at least 10 seminars and the University of Tartu awards 3 ECTS and a digitally stamped certificate to those who also complete a short homework assignment. All past seminars have been recorded and are available on the CAB Youtube channel. The program, which has been a success, will be relaunched in September for the 2022-2023 academic year. For more information about the program, future announcements and to access past lectures consult the EAI Academy website: (<https://cab.inta-csic.es/en/training/academy/eai-academy/>). Preparations for the academic year 2022-2023 are already underway.

Dissemination and Intellectual Output

Since the field of astrobiology continues to expand at a rapid rate, the editors of the Encyclopedia of Astrobiology have decided that a new edition was needed to update the Second Edition published in 2015. The 3rd Edition of the Encyclopedia of Astrobiology is in production and its launch is planned in September 2022 in Granada, Spain during the EPSC/EANA conference. This 3rd edition, both on line and in paper, coordinated by 40 editors and written by more than 300 authors, contains 2200 entries, of which 40% are new ones or updated ones from the 2nd Edition (<https://link.springer.com/referencework/10.1007/978-3-662-44185-5>) The exciting new scientific results included in the encyclopaedia include the discovery of thousands of new exoplanets; data from a number of new spacecraft exploring the Solar System's planets, satellites, and small bodies such as asteroids and comets; new isotopic data that radically change our understanding of the formation of the Solar System in general and of the early Earth in particular; the identification of increasingly complex organic molecules in space and in protoplanetary disks; new techniques and discoveries in prebiotic chemistry; novel efficient methodologies to generate genomic information in phylogeny and evolution; characterization of new extreme environments and isolation of previously unknown microorganisms ; and the development of a next generation of facilities for sample analysis, sample curation, planetary simulation environments and remote observations from the ground. Moreover, this new edition includes new entries in the history, philosophy and sociology of astrobiology.

Outreach and corporate identity

The new EAI website was made public in summer 2021 with the same URL (www.europeanastrobiology.eu). It allows the Working Group leaders and project team coordinators to manage their own webpage or the webmasters of the Working Groups under the EAI website. Training events for the different Working Groups and Project Teams have already been offered and one-to-one meetings with ESF consultant Shorouk ElKobros (who has been creating the website) have been organised for the webmasters of the different Working Groups and Project Teams. This will enable them to manage the webpages of their entities on their own.

At Facebook we have now (May 2021) more than 3000 followers and usually get 10-20 “likes” for each entry. At Twitter we have over 1800 followers. The EAI is also present on LinkedIn.

The WG on “*Outreach, Publicity and Corporate Identity*” also engages in preparation of the exhibition at the Fuencaliente de La Palma, the venue of BEACON 2023. The exhibition will be displayed in the new visitors’ centre of Fuencaliente de La Palma and remain there, thus leaving a permanent heritage of BEACON 2023. The exhibition coordination team is already existing and cooperation with the community authority of Fuencaliente has been established. A first presentation of the exhibition concept was held at a meeting with island and community authorities in May 2021.

Administration

The administration was carried out by our host organisation (European Science Foundation). The following line of actions were undertaken for the period of the report:

EAI management

The ESF staff mainly undertook the following tasks for the EAI:

Maintaining of the EAI Participants Directory

- Participating Organisations: MoU (Reception, Archiving, Reminders)
- FOs: Invoices (generation and follow up)
- Discussions about the layout of the website
- Billing information retrieval

Website management

- Organisation of hosting
- Set-up of website
- Training of future webmasters of Project Teams and Working Groups

It is expected that in the future costs for meeting organisation will be reduced by introduction of a commercial registration/billing system (in order to avoid double checking payment/billing details, which took a lot of personnel time). This new system has already been used for the Ven summer school.

A detailed financial and administrative report from ESF will be distributed to delegates at the EAI and presented at the EAI General Assembly.