

Setting Up the Astrobiology Ecosystem in India: Pitching the Subject at a Revamped Level.

Shivam Kumar Singh¹, Anuj Soni¹, Shraman Kumar Bohra¹, Yamini Tripathi¹, Soutik Nandy¹, KRISHNENDU GHOSH¹, and Shireen Mathur¹

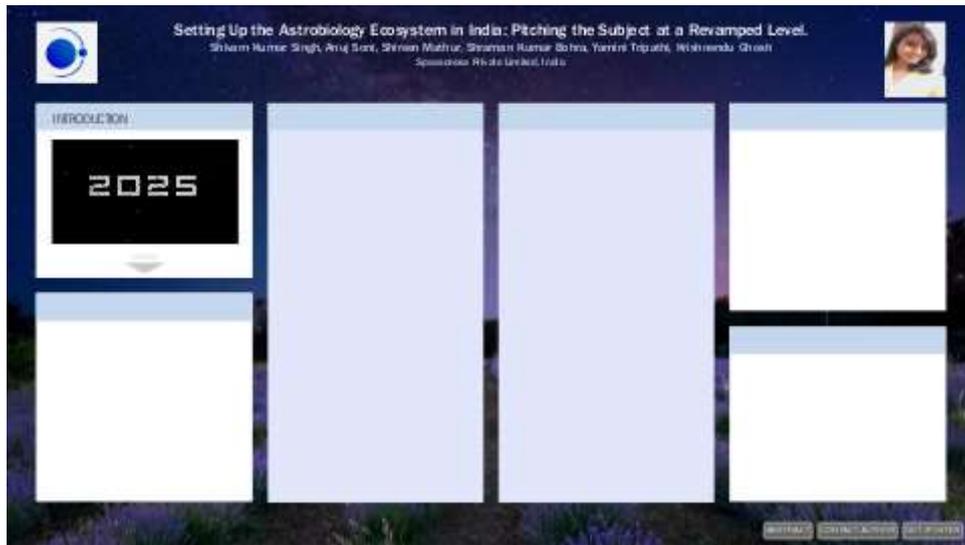
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Abstract

Though fascinating and multi-disciplinary in scientific horizon, Astrobiology, till date has not managed to make a commendable mark in Indian academia which raises the need of not reformation but transformation in the education system. As per our recent survey, 30.88% of 2455 participants claimed to have heard about Astrobiology for the first time, 47.01% reported to have scant knowledge, and 22.12% were familiar. In addition, the data suggests that more than 77% of enthusiasts have no access to proper guidance and resources to pursue a career in Astrobiology. Hence, to tackle such issues, Spaceonova conducted free webinars and two day workshops in collaboration with 13 renowned institutions in India like IIST, DU, VIT etc., that impacted 3869 students across 700+ unique colleges. Such an initiative introduced them to the various career opportunities in the field of Astrobiology using Bioinformatics tools like Artemis and RasMol to carry out independent in-silico analysis. To carry the momentum forward, Spaceonova seeks to collaborate with various organisations to introduce research driven Astrobiology clubs, training programmes and diplomas in India to create an Astrobiology ecosystem, where limit tends to infinity. Here, we have discussed the required methodologies and blueprint to execute the same.

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PRESENTED AT:



INTRODUCTION

[VIDEO] https://res.cloudinary.com/amuze-interactive/video/upload/vc_auto/v1651664646/agu/D8-C8-91-8E-59-5D-6B-CF-E5-B3-D7-69-98-36-3E-F2/Video/Vision2025__Spaceonova__Where_limit_tends_to_Infinity_yrhijr.mp4

SPACEONOVA

Spaceonova is a space education and research based company with a vision to create a space ecosystem where anyone can LEARN, CREATE, INNOVATE & IMPACT.

Spaceonova specialises in the field of Space Robotics and Astrobiology and have impacted more than 40,000 space enthusiasts across 45 countries by enabling them to pursue careers in the field of space sciences and exploration.

Find more about us at: www.spaceonova.com (<https://spaceonova.com/>)

Join our global community of space exploration at [spaceonova.com/discord](https://discord.com/invite/qqSB8gvsTV) (<https://discord.com/invite/qqSB8gvsTV>)

INTRODUCTION

At one point of time in our life, we've all gazed at stars and wondered what lies beyond, or perhaps had a great desire to become an astronaut someday, but as we grow older and join college, it all fades away or gets buried someplace deeper in our hearts under the pressure of pursuing a job that appears possible for us. However, pursuing a career in space sciences and exploration can be quite simple if we are aware of the correct opportunities and path that best suits us.

The issue is not that the industry is tough to pursue, but rather a lack of understanding about it. Many undergraduate students in India assume that space is exclusively for people who are good in physics and mathematics. Students in many Indian cities are not even aware of all the branches of space sciences, let alone pursue them. And to address the same issue, we embarked on a mission to satisfy the insatiable curiosity of our country's students and assist them in making their dreams a reality.

Our story dates back to the year 2019 when we were just a newly found Astro club of our university named "Vyoma". We operated as a club for one year and did our best to introduce students and faculties of our college with various fields of space sciences. We even organised various theatrical sessions (nukkad natak) to teach about Astronomy to underprivileged students in an interactive manner.

Though after an year we realised the problem which we are solving to create a space ecosystem where literally anyone can be a space technologist is something which is needed by our whole nation and many other enthusiasts outside of India and hence we emerged as a space education and research based company named Spaceonova in the year 2020 and till date we have impacted 45,000+ space lovers across 45 countries. We hold our expertise in the field of Space Robotics and Astrobiology.

Though exciting and multidisciplinary in scientific scope, Astrobiology has yet to make a significant impression in Indian academia, highlighting the necessity for transformation in the education system rather than reformation. To address these issues and raise awareness about the field of Astrobiology in India and other nations, Spaceonova has initiated various programmes such as free two-day Astrobiology Workshop, month long Astrobiology Training Programme, year long research internships, Mars Analogue Site Expeditions, Astrobiology Clubs for universities etc. to tackle the same.

We hope to launch more advanced programmes such as Astrobiology Diploma, Faculty Development Programmes in Astrobiology which will enable universities to introduce Astrobiology as minor degree or open electives, Analog Astronaut Training and Planetary Research Center, Microgravity Research and many more.

DISCUSSION

Astrobiology is a relatively new discipline, thus constant efforts in this domain are required. Our current understanding of this infant science is limited, and various gaps still persist, these include problems like:

- The ethical challenge of whether to exploit the newly discovered biosphere or protect ours?
- Lack of awareness- There is still a stigma around the themes that cover in and around astrobiology. Astrobiology as an interdisciplinary field is not out in the public in a full-fledged manner.
- Non-availability of a sufficient number of labs that are dedicated to astrobiological research. This in turn highlights indirect problems like lack of instrumentation, sampling, and storage facilities which further halt the discovery and development process.

CURRENT INITIATIVES & IMPACT

Astrobiology Workshop

About:

We at Spaceonova organise a two-day Astrobiology Workshop in collaboration with multiple universities and colleges in India to raise awareness about the field of Astrobiology among students of our nation and other developing countries. The two-day Astrobiology Workshop consists of an introductory session on the first day and a Hands-On session on the second day using bioinformatics tools like Artemis, Clustal Omega, NCBI, ProtParam, etc. to help students learn how they can use bioinformatics for research in Astrobiology.

Here are some important topics covered each day:

Day 1:

What is Astrobiology?

Origin of life on Earth

Life in an extreme environment

How can we detect life?

Human Spaceflight and its challenges

Astrobiological research examples

Career Opportunities

Day 2:

Case study of some Astrobiological missions

How to use Bioinformatics tools for research in Astrobiology?

Demonstration of a real project using Artemis, NCBI, and other bioinformatics tools.

Need for this initiative:

Many undergraduate students feel Astrobiology is only for people from the biological background as the name suggests but the reality is Astrobiology is a multidisciplinary field involving people from various backgrounds like Geology, Bioinformatics, Microbiology, Engineering, Cosmology, etc.

Hence to raise awareness about the field of Astrobiology and various career opportunities in the same, it's quite important to conduct such free workshops which give them a deep insight into the field of Astrobiology and how they can become an Astrobiologist and contribute their part in this growing ecosystem.

Concrete Audience:

Undergraduate and above

Impact Created:

- Collaborated with 19 colleges to conduct 20, two-day workshops across the nation.
- Reached a total of 3179 space enthusiasts and professionals.
- 569 unique colleges reached.
- 66.4% Undergraduates, 27.8% Post Graduates, 4.7% PhDs

Webinar on Careers in Astrobiology**About:**

We at Spaceonova conduct a specific one-day webinar on Careers in Astrobiology with different experts in the field of Astrobiology to help students get familiar with various career paths to become an Astrobiologist.

Need for this initiative:

Such Astrobiology webinars allow students to interact with industry experts in real-time and get their queries and concerns answered by experts from the comfort of their homes.

Concrete Audience:

High School and above

Impact Created:

- Conducted 8 free webinars with various experts in the domain.
- Reached a total of 2889 space enthusiasts and professionals.
- 359 unique colleges reached.

Astrobiology Training Programme**About:**

"Astrobiology Training Programme" is a month-long online program designed for space enthusiasts and professionals alike who want to kick start their career in the field of astrobiology and understand how their field of interest can be utilised in the same. Space lovers could be physicists, geologists, engineers, biotechnologists, etc., and can still contribute to the field of Astrobiology.

In the training program, students gain an in-depth understanding of the origin of life and its evolution, get an insight into extraterrestrial life, especially intelligent life, and would explore the future possibilities of life in this cosmos.

Students will also be doing various hands-on activities to prove a hypothesis about the evolution of life on Earth.

The unique part about this Astrobiology Training Programme is that apart from the technical skills imparted it also focuses on helping students create opportunities for themselves by teaching them how to network with people, leverage LinkedIn to get job opportunities or boost their personal brand, how to

write a research paper and present in International conferences like IAC, AbSciCon, AbGradCon, IPSC, etc.

Need for this initiative:

This one-of-its-kind career-focused Astrobiology Training Programme will provide students with industry-level skills and help them gain opportunities that will enable them to pursue careers or higher studies in the field of Astrobiology or utilise their current expertise in the same.

Concrete Audience:

Undergraduates and above

Impact:

- 2 training programmes and masterclasses.
- Impacted lives of 64 trainees across 4 countries.
- 5 students were awarded 100% Scholarship.
- 2 research papers selected for presentation at AbSciCon 2022.

Research Internship**About:**

We pick research interns through year-long applications and from our Astrobiology Training Programme graduates, who subsequently collaborate with experts and mentors at Spaceonova on some novel research projects in the domain of Astrobiology covering topics like:

Origin of life, Ancient Mars Environment, Extremophiles, Cyano Bacteriology, Habitability of Tardigrades, Planetary Robotics Research, Ecological Niche Adaptation, and much more.

Need for the initiative:

Internship opportunities for various backgrounds of students are currently very limited in India.

Internship opportunities allow young individuals to experience a professional work environment in the area of their interest.

Concrete Audience:

Undergraduate and above students from backgrounds like Geology, Biochemistry, Microbiology, Zoology, Biotechnology, Planetary Geology, Aerospace Engineering, Chemistry, etc.

Impact:

- 17 internships provided to students and professionals from various domains in the field of Astrobiology.
- 2 research papers selected for presentation at IPSC 2022.
- 3 research papers selected for presentation at AbSciCon 2022.

- 2 research papers selected for presentation at IAC 2022.

Astrobiology Club

About:

In order to create a space ecosystem, we firmly believe that Astrobiology is an interdisciplinary science that should be promoted. From future space missions to finding life on Earth, Astrobiology plays a very important role. And thus, we are planning to establish Astrobiology clubs in universities that will bring students from diverse educational backgrounds under one roof. These clubs enrich the student's communication, management, and leadership skills along with their technical abilities in the subject area.

One such club is running successfully in collaboration with Spaceonova at the Shoolini University, Himachal Pradesh, India.

Need for the initiative:

Brings brilliant minds together on one platform.

A good networking platform for both students and experts.

Awareness about the field is increased.

Builds the nation's capacity in the field of Astrobiology.

Concrete Audience:

College students and faculties.

Impact:

Clubs create a significant impact in terms of their reach as the audience comes from diverse backgrounds.

At the Astrobiology club of Shoolini University, for instance; non-scholastic activities take place at regular intervals. Students in huge numbers have participated in quizzes, discussions, and other research activities that resulted in peer-reviewed research papers that got accepted in International conferences like IAC 2022.

Planetary Analogue Site Expeditions

About:

Planetary Analogue Site Expeditions are a real fieldwork scientific expedition developed for space lovers and experts alike who wish to start their career in Astrobiology and understand how their field of interest can be used in the same.

Students will gain experience in real geological fieldwork, biological sample collection, understanding the area's past history, why it is analogous to a certain planet, in-person meetings with experts and astrobiology enthusiasts from various backgrounds, and will explore future career and research opportunities in this expedition.

This year we have started with our first expedition named, Mars Analogue Site Expedition (MASE) 2022 from July 4 - 10, 2022 in Rajasthan, India with the following research objectives:

Geological Research (RTG1):

Sambhar Lake, Rajasthan, India: a potential analog site of Mars's ancient hypersaline depositional environment.

Geological Research (RTG2):

Hunting primitive bio-signatures from the rock records of Aravalli hills - A geological approach to searching Earth's ancient life forms and its astrobiological implications.

Biological Research (RTB1):

Characterization of extremophilic bacterial flora found in saltwater lakes and their surroundings with inter and intra-cohort comparative analysis of their biomolecular signature related to the respective geophysical conditions.

Biological Research (RTB2):

Collection and characterization of tardigrades (eukaryotic extremophile) from freshwater streams and nearby possible algae and lichen vegetation. The comparison would also be drawn related to the anthropogenic impact on this.

Biological Research (RTB3):

Comparison related to the characteristic abundance of tardigrades related to non-anthropogenic and anthropogenic impacts on the ecological habitability and niche specification (if any) in tardigrades.

Apart from the above-mentioned objectives, we will be conducting certain planetary robotics research, space architecture workshop, and stargazing activities as well. In fact, after the expedition ends, we will perform our sample analysis in the national institutes with whom we have collaborated and gather the possible data.

Need for the initiative:

This opportunity will act as a good holistic experience for students to learn Astrobiology from scratch and attend an intermediate level where they are able to conduct original research work in the same.

Concrete Audience: Undergraduate students and above

FUTURE INITIATIVES & IMPACT

Astrobiology Diploma

About:

The diploma is a certification program awarded by universities and educational institutions. In order to offer diploma certificates, we at Spaceonova will collaborate with potential universities and institutes. We are planning to curate a 6-month Astrobiology diploma program, which will constitute of:

A month-long Astrobiology Training Programme.

Assigned with the research project under mentorship.

A week-long fieldwork exposure and gathering samples for the research project.

Presenting research paper at the International Conference.

A Letter of Recommendation for getting into the Astrobiology industry.

Need:

In India astrobiology is very niche in terms of educational awareness. As per recent surveys conducted by Spaceonova in 2021, we asked students in multiple universities and institutes that “DO YOU KNOW SOMETHING ABOUT ASTROBIOLOGY” as a result out of 2455 students across the country only 22.12% are aware of this subject. 77.89% of students either know a little about this subject or haven't encountered the term “Astrobiology”.

Those who know this field of science keep looking for professional degrees either in Indian Institutes or ultimately foreign universities. That is why at Spaceonova we are planning to introduce an Astrobiology Diploma program in collaboration with universities to increase its credibility. This diploma program will provide in-depth knowledge of Astrobiology to kick start their professional career, internship opportunities will add additional value to early astrobiology careers.

Audience:

The target audience is Undergraduate students and above from any science discipline. This program is also open to enthusiastic students and professionals from other domains as well. Although, the prerequisite is to submit a research project being assigned to the student to earn this diploma.

POTENTIAL IMPACT:

The influence will be seen distinctly on all Astrobiology enthusiasts who will take this training. Their skills and knowledge of the subject will be upgraded. These flag bearers of Astrobiology can further take up this course full-time and pursue their career in the same. Thus, creating a wave of Astrobiology as a full-fledged course in India.

Faculty Development Programme

ABOUT:

It is aimed at upgrading the knowledge of the existing technologies for the faculties in order to enrich the teaching and research experience. It includes various seminars, workshops, and other hands-on activities for the teaching staff. We intend to establish a faculty development course to train the members with the latest skills and courses in Astrobiology.

NEED:

It is a very vital process to enrich the overall educational environment. Not only does it strengthen the existing skills but also fills the voids in current teaching practices.

AUDIENCE:

This program will directly benefit the faculty members who will in turn pass over the knowledge to our main flag bearers of Astrobiology, i.e. The young leaders.

POTENTIAL IMPACT:

This development program will not only impact the faculties but indirectly the students as well. Overall, the academic experience in terms of Astrobiology will be affected.

Analog Astronaut Training & Planetary Research Center**ABOUT:**

Analog Astronaut Training and Planetary Research Center will be established in India to perform experiments and conduct research on planetary analog sites. The center will be able to simulate the space environment or planetary geomorphic conditions, for example; the simulation of its surface terrain, rover testing, and the geological area will help scientists to comprehend the origin of the terrain and analyse the collected samples to help understand its composition and biological potential. Training will be provided by specialists in operational scientists, engineers, and future astronaut candidates. Participants at Analog Astronaut Training and Planetary Research Center will be given predefined problem statements or research projects that they have to complete within a certain timeframe during the training period. Collaborations between national and international space agencies, and private companies will also enhance nations' capabilities in this area.

NEED:

This opportunity will help to experience space condition simulation, and planetary analog condition. To understand the lack behind it that needs to be resolved and can directly contribute to the scientific community by their research studies in these simulated conditions. This helps the nation's students to look at space as a career.

AUDIENCE:

Undergraduate, Postgraduate, Post doctoral students, Researchers, Engineers, and Scientists can be the potential audience for the meaningful research experience.

POTENTIAL IMPACT:

To develop the scientific studies and research projects, gives the holistic understanding of human spaceflight and planetary analog mission for future exploration.

Microgravity Research:

ABOUT:

In order to learn what happens to organisms and equipment in space, the study of Microgravity is required. It alters the basic processes of fluid mixing, separation and crystal growth, etc. Moreover, it affects the human body in various ways. Thus, to make space more accessible to humans and for upcoming missions, Microgravity research is the need of the hour. And to contribute to the same, we have collaborated with launch service providers to send our first life science experiments aboard.

NEED:

Unlike in the petri dish where cells grow flat, the microgravity allows the growth of our culture in a 3D manner, thus mimicking the in-vivo environment.

Microgravity stimulators don't provide access to all the other variables due to the ground-based facilities. So, one of our main future initiatives is to spare some time for microgravity research that would help early drug discovery and development for various chronic diseases like cancer and ageing.

AUDIENCE:

Data from microgravity research would be a driving force of many R&D centres in the Biotech, Pharma, Agricultural, and Healthcare industries. Individual research organisations require science-backed, reproducible results from microgravity-like conditions.

POTENTIAL IMPACT:

The direct effect will be on the Research and development process of any organisation. It will enhance our understanding of how physical systems and the human body react to space opening new ways for drug development.

FUTURE PROSPECTS

- Continue creating the impact at a physical level while focusing our research on current trends.
- More research-oriented analog site expeditions to characterise environmental parameters that could influence life on other planets.
- Value-added and authenticated short courses and diplomas in astrobiology to kindle interest and attract students from interdisciplinary backgrounds to pursue a career in this field.
- Collaborate with Universities and research centres that work in the fields of geology, microbiology, botany, and biotechnology in order to facilitate translational research focusing on products and services.
- Collaborate with Systems Biologists and Bioinformaticians to address the issue of Data Management in Astrobiology.
- A major area that needs to be focused on, in order to bring out the best of astrobiology is microgravity research and development. Microgravity is a one-of-a-kind environment that influences scientific experiments in ways that numerous unique characteristics that might normally be obscured by gravitational effects would be revealed. This exceptional environment provides enormous potential for innovation as well as substantial technological research prospects. By facilitating life science-based microgravity research, one can obtain relevant data in order to study life at the cellular level and understand the foundational principles of Astrobiology in a broader sense.

CONCLUSION

The ecosystem from ground zero is indeed tough to deal with. Even in nature, a continuous process of succession needs to be there for reaching into a fluvial ecosystem with a number of food chains and webs. We, at Spaceonova, are in the process of this succession phase with an array of indulgences. The pathway has been and will be bumpy though pay-off is high. This has been the vision of Spaceonova by making a conundrum of advocacy catering to young and naive minds of academia for becoming the future torch-bearer. All our modalities embed a hope, a hope of having a gushing of change into which the astrobiology would not only be considered as a mere subject but an art of science where caste, colour, and boundary will be demeaned by the passion of knowledge heralding an infinite limit of academic solitude.

AUTHOR INFORMATION

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ABSTRACT

Though fascinating and multi-disciplinary in scientific horizon, Astrobiology, till date has not managed to make a commendable mark in Indian academia which raises the need of not reformation but transformation in the education system. As per our recent survey, 30.88% of 2455 participants claimed to have heard about Astrobiology for the first time, 47.01% reported to have scant knowledge, and 22.12% were familiar. In addition, the data suggests that more than 77% of enthusiasts have no access to proper guidance and resources to pursue a career in Astrobiology. Hence, to tackle such issues, Spaceonova conducted free webinars and two day workshops in collaboration with 13 renowned institutions in India like IIST, DU, VIT etc., that impacted 3869 students across 700+ unique colleges. Such an initiative introduced them to the various career opportunities in the field of Astrobiology using Bioinformatics tools like Artemis and RasMol to carry out independent *in-silico* analysis. To carry the momentum forward, Spaceonova seeks to collaborate with various organisations to introduce research driven Astrobiology clubs, training programmes and diplomas in India to create an Astrobiology ecosystem, where limit tends to infinity. Here, we have discussed the required methodologies and blueprint to execute the same.

