Serrapilheira/ICTP-SAIFR Training Program in Quantitative Biology and Ecology

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Instituto Serrapilheira and the International Centre for Theoretical Physics – South American Institute for Fundamental Research (ICTP – SAIFR) are jointly launching the Training Program in Quantitative Biology and Ecology. The goal of the program is to prepare future generations of Brazilian and Latin American researchers in the life sciences with a focus on the use of tools from mathematics, physics and computer science.

We seek students who wish to tackle major questions and develop cutting-edge research in biology and ecology. In the long-term, we aim to produce a generation of highly trained young Brazilian and Latin American scientists with quantitative skills who will study complex biological systems.

1. The Program

The program provides intensive training to students who are at the beginning of their academic careers. In addition to immersion in the main topics in biology and ecology through direct contact with scientists from international institutions at the forefront in their respective fields, participants will receive training in the use of quantitative methods for solving the most cutting-edge problems in the life sciences.

Starting in 2022 (health conditions permitting), the program will offer a six-month in-person course divided into introductory (January-February) and advanced (March-June) modules, to be held in São Paulo at the ICTP-SAIFR facilities on the IFT-UNESP (São Paulo State University) campus. At the end of the modules, participants will develop a research proposal to continue their studies at the doctoral level and will be ready to compete for admission in PhD programs in the main centers of excellence worldwide. Applications for the 2022 program will open in August 2021.

In light of today's necessary measures for dealing with the COVID-19 pandemic, the 2021 training program will be held online in a shorter one-month version. In July of this year, we will offer a four-week workshop for up to 50 participants.
2. Workshop (2021)

The goal of the workshop is to develop the critical thinking necessary for asking major biological questions, and to teach the mathematical and computational techniques necessary to answer them, encouraging participants to explore the latest advances in research. Major questions are those that examine current scientific knowledge, expand the horizons for progress or deepen knowledge in a field of science.

Throughout the workshop, which will be held online from July 5 to 30, 2021, students will immerse themselves in different fields of biological and ecological research through:

a) lectures and discussion sessions
The teaching staff will be made up of scientists who work in world-class research centers from different countries. Each faculty member will give two lectures. Since we will have lecturers from different parts of the world, all sessions will be taught in English.

Not only are our lecturers highly qualified, but their approaches to science through major questions illustrates how cutting-edge research is currently conceptualized and developed. Students will have a Q&A session with each lecturer to raise issues, discuss subjects that came up in the classes and interact directly with them.

The full list of lecturers and topics covered in the workshop is provided at the end of this document.

b) Project
At the beginning of the workshop, students will be divided into small groups to work on a project supervised by a post-doctoral researcher. Group work sessions will be scheduled every afternoon. The goal of this group project is to apply some of the materials covered in the lectures to a specific research question.

The fourth week will be exclusively dedicated to the projects, which will be presented and evaluated on the last day of class, thus bringing the workshop to a close.

What we expect from students
We expect participants in the workshop to make the most of the opportunity to interact with scientists who are leading the way with high-impact research in the global scientific community and who want to contribute to the process of training young researchers with great potential.

Therefore, participants must dedicate themselves fully to the workshop.
We seek curious students willing to plunge into each session and participate actively, asking questions, interacting, and collaborating to develop the group project, being open to new knowledge, approaches and perspectives.

Class rules for participants:

- All classes are mandatory. Students with unexcused absences may be dismissed from the workshop.

- Students commit to actively participating in classes and the group project throughout the workshop.

- Out of respect to the faculty, participants shall keep their cameras on throughout the class period.

3. Eligibility Criteria
Candidates must have graduated from an undergraduate program or be planning to do so by December 31, 2021, at an institution of higher education in Brazil or another Latin American country. Those who are already in a graduate program (either master's or doctoral) are also eligible.

Students with an academic background in any field are welcome. Although there is no requirement to have research experience in the biological sciences, students must be proficient in English, and have previous knowledge of differential and integral calculus. (these requirements will be checked during the selection process).

We seek ambitious students with quantitative skills who are willing to reach beyond traditional disciplinary boundaries and nurture a solid interest in the major questions in the life sciences.

Full-time dedication and participation in all activities is required (see what we expect from students on page 3).

4. Selective Process
Although excellent academic performance is a significant factor in the selection process, we are especially looking for young researchers who show they are capable of tackling challenging tasks with methodological rigor, a critical outlook and the potential to search for progress in the life sciences.
Registration

The first 500 applicants will gain preference in our selection process. Therefore, we recommend that candidates prepare the necessary documentation in advance and pay attention to the date the application window opens to be able to start the application process as soon as possible.

Starting March 9 candidates may apply for the workshop at www.ictp-saifr.org/qbioprogram, by filling out an application form online and submitting the following documents:

- **Curriculum vitae**
  In English, not to exceed two pages, in .pdf format.

- **Full undergraduate transcript**
  All applicants must submit their undergraduate academic transcript including grades obtained in the courses taken.

- **Graduate transcript**
  Applicable only for applicants who are currently enrolled in a master's or doctoral program.

- **Letter of Motivation**
  The letter of motivation will be critical in the selection process. We recommend candidates to dedicate time and thought to this part of the application. It must be written in English and not exceed 4,000 characters without spaces. The candidate must show affinity with the Training Program in Quantitative Biology and Ecology and point out the reasons they ought to be selected.

- **Names and emails of two senior scientists who will send letters of recommendation**
  At this stage the candidate only has to list the names of the scientists and their respective email addresses.

After submitting the application on the Program’s website, the scientists whose names were listed by the applicants will receive an electronic form that must be filled out and sent by May 3, 2021 at 5:00 p.m. (GMT-3; Brasilia Time) —the deadline for the application. **Note: the date we receive the letters of recommendation does not affect the date the application is submitted (by the applicant) and weighed in giving preference to the first 500 applicants.** In other words, regardless of the date the scientists send the letters of recommendation (as long as they meet the deadline), the first 500 applicants to be given preference in the selection process will be determined by the date and time the candidate fills in the form and submits the documents.
Selection
Applications will be evaluated in two stages by a committee made up of ICTP-SAIFR researchers and members of Instituto Serrapilheira: the first stage will consist of a pre-selection based on the application form and the documents submitted (we repeat: the letter of motivation will be critical at this stage). Pre-selected candidates will be interviewed remotely to evaluate their technical skills and their level of proficiency in English and mathematics.

After this stage, a maximum of 50 students will be invited to participate in the workshop. The accepted students will be notified on June 4, 2021.

5. Timeline

March 9
Application window opens

May 3, 2021 at 5:00 p.m. (GMT-3, Brasilia Time)
Application window closes

June 4, 2021
Accepted students are notified

July 5, 2021
Workshop begins

July 30, 2021
Workshop ends

6. Advisory Committee
The Training Program in Quantitative Biology and Ecology was designed and structured with the support of the Advisory Committee that systematically follows the development and coordination of the different stages of the program:

António Coutinho
Founder of the Doctoral Program of the Gulbenkian Institute of Science in Portugal.

Akiko Iwasaki
Professor at Yale University and Principal Investigator at the Howard Hughes Medical Institute (HHMI) in the United States.
Simon Levin
Professor at the Department of Ecology and Evolutionary Biology at Princeton University (USA) and director of the Center for BioComplexity at the Environmental Institute, also at Princeton.

Maria Leptin
Director of the European Molecular Biology Organization (EMBO), Germany.

Jordi Bascompte
Professor of Ecology at the University of Zurich, Switzerland, and director of the master's Program in Environmental Science at the same university.

Thiago Carvalho
Graduate Program Director of the Champalimaud Foundation, Portugal.

Stevens Rehen
Director of Research at the D’Or Institute for Research and Teaching and Full Professor at the Federal University of Rio de Janeiro (UFRJ).
ANNEX: Lecturers and topics
Serrapilheira/ICTP-SAIFR Training Program in Quantitative Biology and Ecology

Antonio Coutinho, Instituto Gulbenkian de Ciência
Antonio Coutinho is an immunologist with an extensive career and a comprehensive view of science and scientific thinking. In addition to leading groups and institutions in Sweden, Switzerland, and France, from 1998 to 2012 he directed the Instituto Gulbenkian de Ciência, in Portugal, considered one of the best research training centers in the world. He will be teaching history of biological concepts.

Oded Rechavi, Tel Aviv University
Oded Rechavi works on the transgenerational inheritance through epigenetic mechanism involving small RNAs. He will be teaching about genetics, epigenetics, and large genetic datasets.


Hanna Kokko, University of Zurich
Hanna Kokko works on evolutionary ecology of sexual and asexual reproduction, analysis and management of animal populations, evolution of reproductive and social strategies, and sustainability science. She will be teaching evolutionary biology.


Eva Nogales, HHMI/University of California at Berkeley
Eva Nogales studies macromolecular assemblies of whole units of molecular function by direct visualization of their architecture, functional states, and regulatory interactions using state-of-the-art cryo-electron microscopy (cryo-EM) and image analysis, as well as biochemical and biophysical assays. She will be teaching molecular, structural, and cell biology.

**Ingrid Lohmann, University of Heidelberg**

Ingrid Lohmann is a developmental biologist, and her team works on the fundamental role of Hox proteins in the process of development of the fruit fly. More specifically, their interest goes from the control of stem cell proliferation to neurogenesis and metabolism during the process of development. **She will be teaching developmental biology.**


**Priyamvada Rajasethupathy, The Rockefeller University**

Priya Rajasethupathy’s team bridges systems genetics and systems neuroscience to provide unique cross-disciplinary insights into memory. She aims to reveal the molecular, structural, and functional changes governing the evolution of a memory, and ultimately further understand cognitive processes during health and disease. **She will be teaching neurobiology.**


**Daniel Mucida, The Rockefeller University**

Daniel Mucida studies how the immune system associated with intestinal mucosae maintains a careful balance by generating efficient protective responses without jeopardizing its tolerance to innocuous foreign substances. **He will be teaching about host-pathogen interactions and disease ecology and epidemiology** together with his research team members Angelina M. Bilate and Bernardo Reis.

**Recent publications:** Microbiota-modulated CART+ enteric neurons autonomously regulate blood glucose. Muller PA et al. Science. 2020; Adrenergic Signaling in Muscularis Macrophages Limits Infection-Induced Neuronal Loss. Matheis F et al. Cell. 2020; Mutual expression of the

William Bialek, Princeton University
William Bialek works on the dynamics of individual biological molecules, the decisions made by single cells in a developing embryo, and the system that the brain uses in representing information. He will be teaching biophysics.

Silvia De Monte, ENS Paris/Max Planck Institute for Evolutionary Biology
By combining mathematical models, experiments in controlled conditions and environmental data analysis, Silvia De Monte and her team explore the interplay of cellular-level properties and collective function on the ecological and evolutionary time scales. She will be teaching microbial ecology.

Carla Staver, Yale University
Her work focuses on the dynamics and distribution of biomes, especially within and at the intersection of savanna and forest. Her team uses a combination of empirical and modeling approaches to understand how local interactions of trees with their resource and disturbance environment scale up to predict landscape- and continental-scale patterns in tree cover and the distributions of biomes. She will be teaching ecology and introduction to ecological theory.
Corina Tarnita, Princeton University
Corina Tarnita’s research examines the organization and emergent properties of complex adaptive systems at multiple scales, from single cells to entire ecosystems. Simultaneously, her team uses empirical data to identify and catalog patterns in nature and, within the general frameworks, they develop models whose predictions they attempt to empirically test using eco-evolutionary experiments, molecular and genomic analyses, and field manipulations. **She will be teaching game theory in ecology and evolution.**


Jordi Bascompte, University of Zurich
Jordi Bascompte combines mathematical models, simulations, and data set analyses to address fundamental and applied questions in ecology. His current major research interest focuses on the structure and dynamics of ecological networks. Jordi is also a member of the Advisory Committee for the Training Program in Quantitative Biology and Ecology. **He will be teaching about community ecology and biodiversity, and ecological networks.**


Iain Couzin, Max Planck Institute of Animal Behavior
Iain Couzin focuses on revealing the principles that underlie collective animal behavior. By developing an integrated experimental and theoretical program, his research aims to understand how, and why, social behavior has evolved in a large variety of systems, from swarming locust, to schooling fish, to flocking birds. **He will be teaching behavioral ecology.**


Max Rietkerk, Utrecht University
Max Rietkerk’s team has discovered that spatial vegetation patterns in dry ecosystems follow certain mathematical laws, which can provide insight into how close the ecosystem is to a threshold value for sudden desertification. The team studies the mechanisms leading to these patterns, through which they understand how sudden desertification can be prevented and how areas already affected can be restored. **He will be teaching spatial ecology.**


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**Malin Pinsky, Rutgers University**

Malin Pinsky studies population and community dynamics in primarily coastal marine ecosystems with the goal of understanding the impacts of global change and the actions that could foster abundant wildlife and healthy ecosystems. His team uses statistical tools, field ecology, population genomics, and mathematical modeling to understand general patterns that extend across larger spatial scales, deeper in time, and across a wider range of species than would be possible with more traditional techniques. **He will be teaching climate change impacts of biodiversity, and conservation, management and decision-making.**
