

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

call 2021

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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).

7. Final considerations

Serrapilheira reserves the right to cancel, suspend, modify, review or postpone the selection process under this call, at any time and its sole discretion, by simply posting an announcement in the same communication channels where this call has been published. No payment or compensation of any sort shall be due to any applicant participating in this call, should it be cancelled, suspended, modified or postponed.

In order to preserve the unbiased and equitable nature of the criteria guiding the analysis and choice of candidates for the Training Program in Quantitative Biology and Ecology and as a way of preventing potential conflicts of interest and/or breach of the rules under the Serrapilheira Code of Ethics and Conduct, individuals who are married, living under common law marriage, or are kin by blood or affinity, whether by linear, collateral or cross bonds, up to the second degree, with employees, directors, members of the Board of Directors and of the Science Board are not eligible to participate directly or indirectly in the calls for the Program. Deliberate violation of the restriction rule above by anyone qualifying to the Program's calls shall confer the institute, at its sole discretion in terms of convenience and time, the right to exclude the candidate.

Exceptions to the rules provided herein shall be decided by Serrapilheira's Board of Directors.

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.**

Recent publications: *Three Rules Explain Transgenerational Small RNA Inheritance in C. elegans.* Houri-Zeevi L et al. *Cell.* 2020; *Neuronal Small RNAs Control Behavior Transgenerationally.* Posner R et al. *Cell.* 2019; *A Tunable Mechanism Determines the Duration of the Transgenerational Small RNA Inheritance in C. elegans.* Houri-Ze'evi L et al. *Cell.* 2016.

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.**

Recent publications: *Optimal germination timing in unpredictable environments: the importance of dormancy for both among- and within-season variation.* Ten Brink H et al. *Ecol Lett.* 2020; *Transmissible cancers and the evolution of sex under the Red Queen hypothesis.* Aubier TG et al. *PLoS Biology* 2020; *The rate of facultative sex governs the number of expected mating types in isogamous species.* Constable GWA et al. *Nat Ecol Evol.* 2018.

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.**

Recent publications: JARID2 and AEBP2 regulate PRC2 in the presence of H2AK119ub1 and other histone modifications. Kasinath V, et al. *Science* 2021; Structure of human TFIIID and mechanism of TBP loading onto promoter DNA. Patel AB et al. *Science*. 2018; Near-atomic model of microtubule-tau interactions. Kellogg EH et al. *Science*. 2018.

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.**

Recent publications: ATF4-Induced Warburg Metabolism Drives Over-Proliferation in Drosophila. Sorge S et al. *Cell Rep*. 2020; Multi-level and lineage-specific interactomes of the Hox transcription factor Ubx contribute to its functional specificity. Carnesecchi J et al. *Nature Commun*. 2020; The Hox transcription factor Ubx stabilizes lineage commitment by suppressing cellular plasticity in Drosophila. Domsch K. et al. *Elife* 2019.

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.**

Recent publications: A Thalamic Orphan Receptor Drives Variability in Short-Term Memory. Hsiao K et al. *Cell*. 2020; Targeting Neural Circuits. Rajasethupathy P et al. *Cell*. 2016; Projections from neocortex mediate top-down control of memory retrieval. Rajasethupathy P et al. *Nature*. 2015.

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

transcription factors Runx3 and ThPOK regulates intestinal CD4+ T cell immunity. Reis BS et al. Nature immunology 2013; T Cell Receptor Is Required for Differentiation, but Not Maintenance, of Intestinal CD4+ Intraepithelial Lymphocyte. Bilate AM, et al. Immunity 53 (5), 1001-1014. e20

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.**

Recent publications: *Coarse Graining, Fixed Points, and Scaling in a Large Population of Neurons. Meshulam L et al. Phys Rev Lett. 2019; Collective Behavior of Place and Non-place Neurons in the Hippocampal Network. Meshulam L et al. Neuron. 2017; Thermodynamics and signatures of criticality in a network of neurons. Tkačik G et al. Proc Natl Acad Sci U S A. 2015.*

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.**

Recent publications: *Ubiquitous abundance distribution of non-dominant plankton across the global ocean. Ser-Giacomi E et al. Nat Ecol Evol. 2018; The evolution of adhesiveness as a social adaptation. Garcia T et al. Elife. 2015; Can we detect oceanic biodiversity hotspots from space?. De Monte S et al. ISME J. 2013.*

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.**

Recent publications: *Spatial patterning among savanna trees in high-resolution, spatially extensive data. Staver AC et al. Proc Natl Acad Sci U S A. 2019; Forest extent and deforestation in tropical Africa since 1900. Aleman JC et al. Nat Ecol Evol. 2018; Top-down determinants of niche structure and adaptation among African Acacias. Staver AC et al. Ecol Lett. 2012.*

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.**

Recent publications: *Eco-evolutionary significance of 'loners'*. Rossine F, et al. *PLoS Biology*. 2020; *Emergence of diverse life cycles and life histories at the origin of multicellularity*. Staps, M. et al. *Nature Ecology & Evolution*. 2019; *A theoretical foundation for multi-scale regular vegetation patterns*. Tarnita CE et al. *Nature*. 2017.

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.**

Recent publications: *Indigenous knowledge networks in the face of global change*. Cámara-Leret R et al. *Proc Natl Acad Sci U S A*. 2019; *Ecological networks. On the structural stability of mutualistic systems*. Rohr RP et al. *Science*. 2014; *The sudden collapse of pollinator communities*. Lever JJ et al. *Ecol Lett*. 2014.

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.**

Recent publications: *Individual and collective encoding of risk in animal groups*. Sosna MMG et al. *Proc Natl Acad Sci U S A*. 2019; *Heterogeneous Preference and Local Nonlinearity in Consensus Decision Making*. Hartnett AT et al. *Phys Rev Lett*. 2016; *Revealing the hidden networks of interaction in mobile animal groups allows prediction of complex behavioral contagion*. Rosenthal SB et al. *Proc Natl Acad Sci U S A*. 2015.

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.**

Recent publications: *The effect of climate change on the resilience of ecosystems with adaptive spatial pattern formation.* Bastiaansen R et al. *Ecol Lett.* 2020; *Multistability of model and real dryland ecosystems through spatial self-organization.* Bastiaansen R et al. *Proc Natl Acad Sci U S A.* 2018; *Self-organized patchiness and catastrophic shifts in ecosystems.* Rietkerk M et al. *Science.* 2004.

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.**

Recent publications: *Climate-driven shifts in marine species ranges: scaling from organisms to communities.* Pinsky ML et al., *Annual Review of Marine Science.* 2020; *Greater vulnerability to warming of marine versus terrestrial ectotherms.* Pinsky ML et al. *Nature.* 2019; *Preparing ocean governance for species on the move.* Pinsky ML et al. *Science.* 2018.

