Life and Systems in Closed Worlds

Workshop at The University of Arizona / Biosphere 2

11-13 December 2019

The French *Centre National de la Recherche Scientique*, the *Ecole Normale Supérieure* in Paris, Paris Sciences & Lettres University and its research program “Origin and condition of Appearance of Life” (OCAV), and the University of Arizona are jointly launching a new research initiative on "Life and Systems in Closed Worlds" involving social and natural scientists. This is an interdisciplinary initiative between ecologists, anthropologists, biologists, geochemists, space and planetary scientists, engineers, architects, and experts in robotics and AI. The goal is to tackle novel disciplinary and interdisciplinary questions arising from the study of closed living systems across multiple scales of space and time, from the small and short of "micro-biospherics”, through macro-systems such as Biosphere 2, Ecotrons or Bios, to the large and long of terraformation.

On behalf of the supporting institutions, the International Research Laboratory iGLOBES will convene a small group of experts to address interdisciplinary challenges arising from life and systems in closed worlds, and explore the potential for national and international collaborations. The meeting will be held at the University of Arizona Biosphere 2, 11-13 December 2019.

The “Life and Systems in Closed Worlds” workshop at the University of Arizona / Biosphere 2 is organized by Regis Ferriere (regis.ferriere@ens.fr, iGLOBES International Research Laboratory, University of Arizona, Ecole Normale Supérieure, Paris Sciences & Lettres University, Centre National de la Recherche Scientifique), Perig Pitrou (perig.pitrou@college-de-france.fr, Centre National de la Recherche Scientifique, Laboratoire d’Anthropologie Sociale, Collège de France, Paris Sciences & Lettres University) and Joffrey Becker (joffrey.becker@college-de-france.fr, Laboratoire d’Anthropologie Sociale, Collège de France, Paris Sciences & Lettres University). Administration and management: Ruth Gosset (rgosset@email.arizona.edu, Centre National de la Recherche Scientifique, iGLOBES International Research Laboratory, University of Arizona, Ecole Normale Supérieure, Paris Sciences & Lettres University).

The full list of participants with one-two sentences bios is given hereafter.

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PARTICIPANTS

John Adams, Deputy Director of Biosphere 2. For two decades, John Adams has helped drive the evolution of Biosphere 2. A wildlife biologist by training, Adams is a key member of the team that plans and directs all research and related activities at Biosphere 2. Beyond research, he oversees biome management, energy management and facilities maintenance and he sets the vision for public outreach.

Joffrey Becker (co-organizer), research assistant in the Laboratory of Social Anthropology at Collège de France, Paris. An anthropologist whose work focuses on robotics and more particularly on the relationship between humans and machines. Becker's research is reported in scholarly articles, and a book published in 2015.

Regis Ferriere (co-organizer), professor of ecology and evolutionary biology and director of the iGLOBES International Research Laboratory at the University of Arizona, joint venture with France's CNRS and ENS (Paris Sciences & Lettres University). A mathematician by training, Ferriere investigates how biological and cultural evolution shapes the structure and function of ecological systems, from viruses in the ocean, through humans and Earth climate, to cells and the habitabilty of exoplanets.

Chris Impey, professor and deputy head of the Department of Astronomy at the University of Arizona. An expert on observational cosmology, galaxies, and quasars, Impey published several books on life in the universe, including "Beyond – Our Future in Space" where he addresses the rapid arc of progress in space travel and our prospects for setting up habitation on the Moon or Mars.

Lydia Kallipoliti, assistant professor at the Irwin S. Chanin School of Architecture, New York. Architect, engineer, curator, and scholar, author of "The Architecture of Closed Worlds" (see www.anacycle.com/CLOSED-WORLDS-1), Kallipoliti researches how material cycling and recycling affect architectural production, policy and design.

Jordan Okie, assistant research professor in the School of Earth & Space Exploration at Arizona State University. Ecophysiologist, complexity scientist, and astrobiologist, Okie investigates the role of energy and metabolism in ecology and evolution, seeking to discover the laws (and exceptions) of life across scales, from molecules to human social systems, on Earth and beyond.

Valerie Olson, associate professor of Anthropology at UC Irivine. An environmental anthropologist, author of "Into the Extreme: U.S. Environmental Systems and Politics beyond Earth", Olson uses the system concept as a cornerstone to understand how social groups interact to shape and remake environments.

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Ted Pavlic, assistant professor in the School of Computing, Informatics, and Decision Systems Engineering, and School of Sustainability, at Arizona State University. An engineer and life scientist, Pavlic develops decision-making algorithms for artificial autonomous systems. In Pavlic's research, biological models provide inspiration for novel engineering, while the engineering problems inspire new lines of biological inquiry.

Perig Pitrou (co-organizer), CNRS research director and "Anthropology of Life" team leader in the Laboratory of Social Anthropology at Collège de France, Paris. An anthropologist leading several research programs on human conceptions of life and the interweaving of vital and technical processes, Pitrou has published 10 collectives books and special issues on these topics.

Joaquin Ruiz, professor of geoscience and Vice President of Global Environmental Futures at the University of Arizona, director of Biosphere 2. A geochemist with broad interests, Ruiz is an expert in using stable isotopes to study Earth history as well as contemporary environmental problems. In his leading positions at the University of Arizona, he champions revolutionary science across disciplines, from space missions to Biosphere 2, at the forefront of global environmental research.

Roy Sleator, senior lecturer at the Department of Biological Sciences and a Principal Investigator at the Centre for Research in Advanced Therapeutic Engineering (CREATE) at Cork Institute of Technology. An expert in clinical microbiology and biosystems engineering, Sleator's research interests extend to exploring the frontiers of synthetic biology, up to the planetary scale of terraformation.

Kai Staats, research associate in the School of Earth & Space Exploration at Arizona State University and at Biosphere 2. A researcher, award-winning filmmaker, and entrepreneur, Staats works on the design of off-world human habitats, *e.g.* as project lead for the Interplanetary Initiative at ASU, and currently at Biosphere 2 with the SAM project, a "Study of Analog Missions for the Moon and Mars".

Blai Vidiella, doctoral candidate, representing Ricard Solé's Complex Systems Lab at the Universitat Pompeu Fabralab and the Catalan Institute for Research and Advanced Studies. The Solé lab uses synthetic biology to understand the evolutionary origins of complex systems. The team seeks to integrate synthetic biology and ecology to uncover general principles of living systems structure, function, and evolution, scaling up to global processes of life emergence such as terraformation.