



YALE INSTITUTE FOR BIOSPHERIC STUDIES

NEWSLETTER

FALL 2021

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A newsletter by the Yale Institute for Biospheric Studies.

For more information, please contact us at yibs@yale.edu or call 203-436-2301 fax 203-432-9927

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Yale

FROM THE DIRECTORS

In this first ever 'From the Directors,' we want to express our excitement to lead YIBS in a new, collaborative model. We look forward to working with everyone involved in YIBS, from the postdocs and staff to the faculty affiliates and board members. This is an especially exciting year to take the helm: YIBS is turning 30!

We have multiple goals, projects, and events planned for the next year, including:

- Working on the next iteration of the postdoctoral programs, building on their previous successes. In the fall, we will transition the Hutchinson program to an annual (rather than biennial) call for integrated project proposals, consisting of 2-3 postdoctoral fellowships each.
- The formation of a Diversity, Equity, Inclusion, and Justice committee that includes directors, staff, postdocs, and a YIBS-funded graduate student.
- Welcoming a new member to our external advisory board: Dr. Scott

Edwards, the Alexander Agassiz Professor of Zoology and Curator of Ornithology in the Museum of Comparative Zoology at Harvard.

- Moving the weekly Friday seminar to 3pm, to be followed by a happy hour. We're confident that this will build community within YIBS and allow us to get to know those affiliates we have yet to meet.
- Planning YIBS' 30th anniversary celebration to take place in Spring 2022. It will be a fantastic event to commemorate the many achievements of this wonderful institute.

We also want to extend our deepest gratitude to outgoing director Michael Donoghue for all he's accomplished for YIBS over the past 3 years. Michael has agreed to stay on as an *ad hoc* advisor and to help plan the 30th anniversary event (at which he'll also play the banjo!).

Finally, to Michael and the incredible YIBS staff, we offer our sincerest appreciation for your collaboration during this transition period. We encourage any questions, comments, or feedback concerning YIBS.

Eric Sargis and Carla Staver,
Directors

YIBS' HISTORY



Caitlin Kossmann,

*Ph.D. Candidate,
History of Science and Medicine*

The Yale Institute for Biospheric Studies (YIBS) was founded in 1991 with a gift from Texas businessman and philanthropist Edward P. Bass (B.A. '67), and design contributions from Professors Emeriti Leo W. Buss (of Ecology and Evolutionary Biology and the first YIBS director) and Dame Alison Richard (of Anthropology and a former Peabody Museum director and University Provost). YIBS was proposed as an autonomous institute to support interdisciplinary scientific research at Yale in the areas of “global change, the evolution and diversity of life, and the engagement of people with their planet and its other forms of life” and aimed “to facilitate an intellectual and physical community of scholars addressing fundamental questions that will inform our ability to generate solutions to the biosphere’s most critical environmental problems.”¹ Envisioned as a “catalyst” for uniting otherwise disparate entities at Yale, YIBS has retained strong relationships with science departments in the Graduate School of Arts and Sciences, the Yale School of the Environment (YSE), and the Yale Peabody Museum (YPM). To mark its 30th anniversary, YIBS has been revisiting its accomplishments.

YIBS has provided varied support for environmental research at Yale:

- seeding junior faculty lines (until 2014);
- seeding interdisciplinary research centers;
- funding > 250 graduate students through small research grants;
- funding ~ 100 postdoctoral fellows via the Gaylord Donnelley Environmental Postdoctoral Fellowship since 1997 and the G. Evelyn Hutchinson Environmental Postdoctoral Fellowship since 2020;
- bringing 40 scholars from other institutions to Yale for a semester or two under the Edward P. Bass

- Distinguished Visiting Scholar program since 2005;
- supporting the Yale Student Environmental Coalition since the 1990s;
- allocating a portion of the YIBS endowment to the YPM directorship since 1991;
- constructing the Class of 1954 Environmental Science Center, which opened in 2001;
- sponsoring conferences around Yale on topics related to biology and the environment.

The Research Centers and the ESC: YIBS as Startup Incubator

In 1992, YIBS established six interdisciplinary Centers, each with leadership from at least two academic departments. The intention was that YIBS would operate towards the Centers like a startup incubator, providing resources only for an initial period. However, not until 2020 was financial support for the Yale Center for Earth Observation (YCEO, founded 1992), the Center for Genetic Analyses of Biodiversity (CGAB, founded 1998), and the Yale Analytical and Stable Isotope Center (YASIC, founded 2011) transferred from YIBS to the Yale University Provost’s Office.

The University also built a physical hub for YIBS activity, which became the Class of 1954 Environmental Science Center (ESC), on the site of the old Bingham Laboratory. Mr. Bass emphasized the importance of this building in physically linking the Peabody Museum (it is built into the Peabody Museum and provides storage space for delicate Peabody collections²) with Science Hill and the Yale School of the Environment. This physical space has been the hub of YIBS operations since it opened, housing staff offices, the Friday seminar series, and laboratory space used by some of the research centers.

The Environmental Partnership: YIBS, YSE, and the YPM

The Environmental Science Center is a physical instantiation of the Yale Environmental Partnership. This Partnership is composed of YIBS, the Yale School of the Environment, and the Peabody Museum, and was an early scheme developed by YIBS leaders to strengthen ties across environmental units at Yale. From 1995 to 2012, the Partnership published the Yale Environmental News (YEN), a newsletter published twice a year covering

research, fellowship awardees, visiting scholars, and events. Although the YEN no longer exists, YIBS returned to publishing a newsletter in 2020. Mr. Bass has also continued to find new ways to support the Partnership, including contributions to the newest undergraduate colleges and to the renovation of the YPM. Many board members are also shared across the YPM, YSE, and YIBS, further linking these institutions, and two former YIBS directors, Michael Donoghue (Ecology and Evolutionary Biology) and Derek Briggs (Earth and Planetary Sciences) also served as directors of the YPM.

Faculty, Student, and Postdoctoral Support

In its early days, YIBS allocated seven “junior faculty equivalent” (JFE) positions for faculty hiring, with an emphasis on innovative and interdisciplinary faculty working in fields underrepresented at Yale. This seed funding pushed Yale in a more interdisciplinary direction.

Since then, YIBS has shifted to a stronger emphasis on postdoctoral fellowships and graduate research funding. Since 1997, YIBS has brought almost 100 postdoctoral researchers to Yale via the Gaylord Donnelley Postdoctoral Environmental Fellowship. Fellows have helped forge cross-departmental connections and bring innovative new techniques. As of 2020, the G. Evelyn Hutchinson Postdoctoral Fellowship program brings additional researchers to Yale in coordinated teams, often including Bass Visiting Scholars on their projects. These research clusters aim to further the YIBS mission of catalyzing creative and collaborative environmental science at Yale and beyond.

Students who have benefited from YIBS programs have gone on to start their own interdisciplinary centers. For example, Sarah Parcak, who took courses in remote sensing as an archaeology undergraduate through the YCEO, went on to become founding director of the Laboratory for Global Observation at the University of Alabama at Birmingham.³

Via these activities, YIBS has leveraged its position as funder and facilitator to connect students and faculty at Yale and beyond, encouraging experimentation and collaboration. After thirty years of catalyzing interdisciplinary science at Yale, YIBS retains its

founding vision, ready for new opportunities to facilitate groundbreaking environmental research in the years to come.

A longer account will be released at YIBS’s 30th Anniversary celebration in Spring 2022. Anyone interested in contributing, please contact Timothy Sandrey at timothy.sandrey@yale.edu.



ESC Dedication Ribbon Cutting Ceremony, 2001 (*Left to Right*) Richard Levin, Richard Gilder, Edward P. Bass, and Dame Alison Richard.

YIBS ARCHIVES



Environmental Science Center (ESC), 2021.

TIMOTHY SANDREY

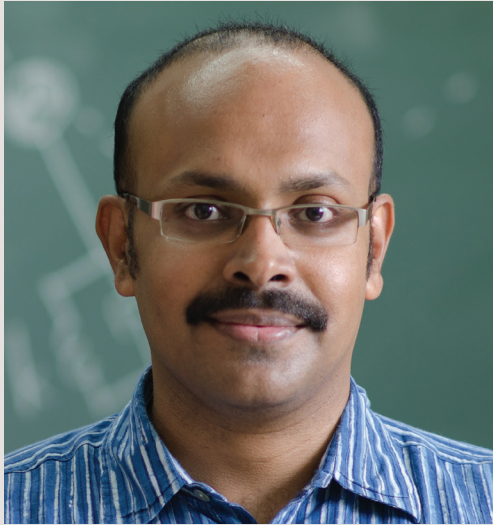
¹ “Description of the Yale Institute for Biospheric Studies,” internal report from YIBS files, West Campus, 1992, p. 1.

² “Press Release,” Yale Environmental News, vol. 6, no. 1 (Winter 2000/2001), 4.

³ This story was related to me in personal communication by Dr. Ronald B. Smith, director of the YCEO from 1992–2017, in an interview 7/12/21. More information on Dr. Sarah H. Parcak can be found here: <https://www.uab.edu/cas/anthropology/people/faculty-directory/sarah-h-parcak>

NSF CAREER AWARD GRANTS

The National Science Foundation (NSF) CAREER award is a prestigious honor for young faculty members and supports the early career activities of teachers and scholars who are most likely to become the academic leaders of the future. YIBS Affiliated Faculty Members Madhusudhan Venkadesan and Bhart-Anjan Bhullar both received the award in 2021!



Madhusudhan Venkadesan, Associate Professor,
Mechanical Engineering & Materials Science

WARREN PHOTOGRAPHIC



Mudskipper

WARREN PHOTOGRAPHIC

For a study on the fins of amphibious fish that walk on land, with the aim of gaining insight into the origins of land-dwelling animals, Madhusudhan Venkadesan has won a 2021 Faculty Early Career Development (CAREER) Award from the NSF. Venkadesan, associate professor of mechanical engineering & materials science, will use the \$685,000, 5-year grant to investigate the biomechanics of the fins of amphibious mudskippers and other fish. The long-term goal is to discover the biomechanical principles that enabled fins to function on land, a crucial step in the emergence of terrestrial vertebrates during the water-to-land evolutionary transition about 400 million years ago. The project will combine experiments with theory to investigate the multi-scale, hierarchical, and composite structure of the fins of amphibious (mudskippers and bichirs) and aquatic fish (gobies and mackerels) from the whole organism (~10–100 millimeters) down to the fin's internal structure (~10–100 micrometers). The central aim is to understand how the lightweight fins of amphibious fish like mudskippers are able to withstand ground forces when moving on land and what role the evolved internal structure plays in such ability. Such understanding also

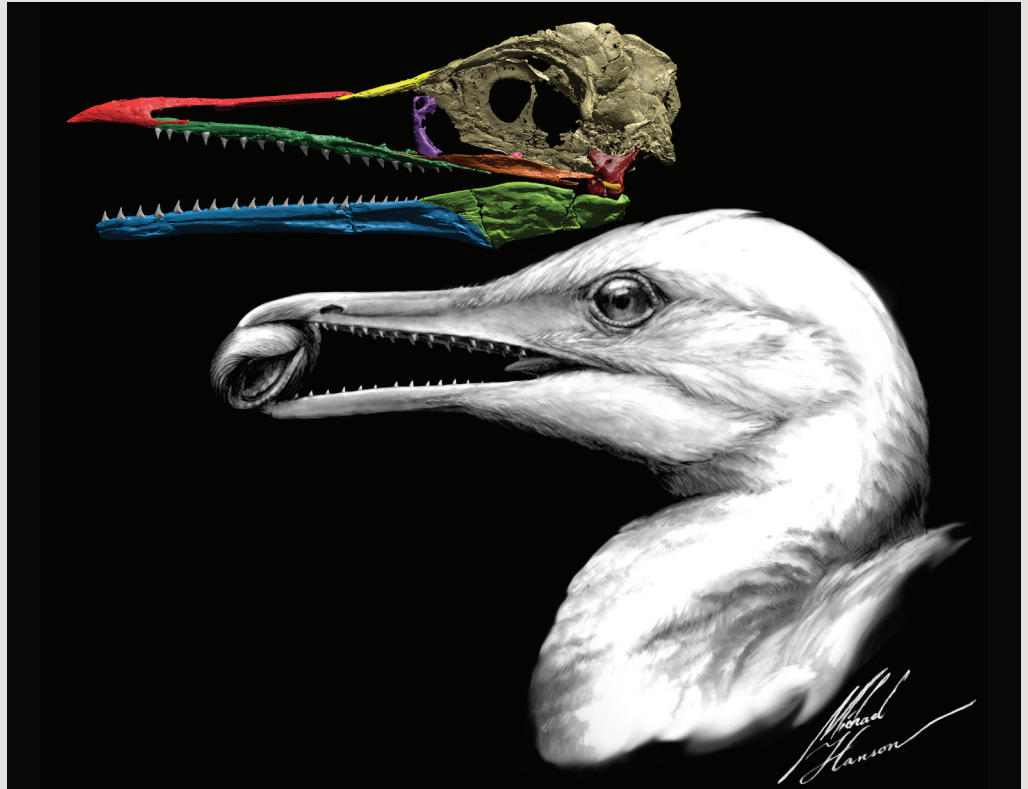
impacts other areas such as the design of mechanical appendages for use by robots that traverse on land and in water. The project also includes education and outreach activities in collaboration with the Yale Peabody Museum and the Yale Pathways to Science Program to engage students from K-12 through college in current biomechanics research.

The project on amphibious fish fins is part of a broader effort in Venkadesan's Biomechanics and Control Laboratory to study animal biomechanics and the role of evolved morphologies in achieving adept and robust movement in natural environments. Engineering has long derived inspiration from animals. Venkadesan's research program returns the favor by using physical applied mathematics and engineering to study the relationship between form and function in animals. Problems being pursued in his group include locomotion in animals, the geometry of joints, the topology of shape-changing skins, and the rheology of muscle. Motivations and applications for his work include biomedical sciences, evolutionary biology, robotics, and plain curiosity about everyday observations.



Bhart-Anjan Bhullar, Assistant Professor of Earth & Planetary Sciences and Assistant Curator of Vertebrate Paleontology and Vertebrate Zoology, Yale Peabody Museum of Natural History

PAOLO VERZONE, NATIONAL GEOGRAPHIC



CT-based 3D reassembly of the skull of the stem bird *Ichthyornis dispar*.

MICHAEL HANSON

With his research group, paleontologist and comparative morphologist Bhart-Anjan Bhullar studies the history and transitions of vertebrates. The title of the grant is “Investigating the deep origin and evolution of the bird beak by synthesizing the fossil record and comparative embryology of archosaurian reptiles.” It concerns one of the most celebrated evolutionary transformations in the history of life: the origin of birds, which are living dinosaurs, from their reptilian antecedents. The origin of major evolutionary radiations generally involves a series of profound structural transformations, and birds are marvels of biological engineering. Their big brained heads are endowed with a unique facial appendage, the beak, that serves as both mouth and hand and is part of a transformed feeding and respiratory apparatus. The research to be funded by this grant represents the first large-scale, detailed documentation of the origin of the bird head and face. It represents a synthesis of data from the fossil record and from embryonic development and will build upon a series of discoveries made by the Bhullar Lab. Never before has such a collection of important, exquisitely preserved fossils been assembled to illuminate the origin of birds, nor such comparative series of

embryos (fossil and extant) that can be used to examine the developmental genesis of distinctive avian features. In addition to tracing the evolution of form and function in the archosaurian “ruling reptile” face, the Bhullar Lab will investigate the origin of the unique mechanical architecture of the bird beak, which involves an intricate series of moving parts, including a series of integrated tissues. It will employ several state-of-the-art imaging techniques, including high-resolution CT scanning and laser-scanning confocal scanning of embryos cleared using a technique optimized in the Bhullar Lab. Funding from the grant will also allow enhancement with digital and physical specimens of several major Yale College courses that Dr. Bhullar teaches, including The History of Life, its accompanying laboratory, and Herpetology. Inherently hands-on, these courses have taken advantage of the vast collections at the Yale Peabody Museum of Natural History. With resources from the grant, Yale Peabody specimens will be supplemented by 3D printed versions of new data from the Bhullar Lab’s own research. Digital and physical media derived from those data are natural enhancements to education and outreach efforts, as well.

INCOMING YIBS ASSOCIATES

The Donnelley Postdoctoral Fellowship supports postdoctoral fellowships for research in biodiversity or a combination of biodiversity with conservation and public policy. This program was created to honor the memory of Mr. Gaylord Donnelley, Yale Class of 1931, a conservationist dedicated to advances in research and education. The Fellowship, which was established by Mr. Donnelley's widow, Dorothy, and son, Strachan, is funded by an endowment from the Gaylord and Dorothy Donnelley Foundation and the Donnelley Family and is administered by the Yale Institute for Biospheric Studies (YIBS).

Gaylord Donnelley Postdoctoral Associates 2021–2023

Catherine Hernandez



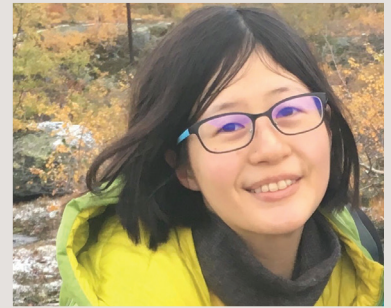
Erynn Johnson



Maya Stokes



Karen Chen



EEB

Appointment:

September 2021 –
August 2023

Advisor:

Paul Turner

Research description:

Catherine is interested in how environmental change will alter microbial interactions. Just like in macroorganisms, microorganismal physiology and fitness are impacted by abiotic factors, and their ecology and evolution will be shaped by global change. At Yale, Catherine will be particularly focused on how temperature impacts the interactions between environmental bacteria and the bacteriophage (phage) viruses that infect them.

SEAS & EPS

Appointment:

July 2021 –
June 2023

Advisors:

Madhusudhan
Venkadesan &
Derek Briggs

Research description:

Erynn uses interdisciplinary approaches and biomechanical experimentation to understand how predation pressures shaped the evolution of mollusk shells over deep time. She utilizes mathematical modeling, 3D printing, and computer-automated design to test the form and function of modern, extinct, and theoretical morphologies.

EEB

Appointment:

August 2021 –
July 2023

Advisor:

Thomas Near

Research description:

Maya works at the intersection of evolutionary biology and geology to understand how changes to Earth's surface over geologic timescales have influenced the evolution of aquatic life. Her current research is centered on the Appalachian Mountains.

YSE

Appointment:

September 2021 –
August 2023

Advisor:

Karen Seto

Research description:

Karen is a quantitative geographer studying how urban land cover and form change over time and their impacts on human well-being. Working with Prof. Karen Seto, she will use the synergy of deep learning, remote sensing, and Geographic Information Systems to characterize the 3-D built environment and urbanization in the Global South.

INCOMING YIBS SCHOLARS

The Edward P. Bass Distinguished Visiting Environmental Scholars Program was created in July 2002 with a generous gift by Edward P. Bass to YIBS. This program brings premier scholars in any field dealing with the study of the environment—past or present—to Yale for an extended period of time. The scholars are nominated by the YIBS Faculty Affiliates, and while in residence at Yale, scholars present seminars, interact with faculty, students and research groups, and participate in the life of one or more academic units.

Bass Visiting Scholars 2022

Caroline Strömberg



Professor, University of Washington

Caroline Strömberg, Estella B. Leopold Professor in the Department of Biology and Curator of Paleobotany in the Burke Museum of Natural History and Culture, University of Washington, Seattle, is a paleobotanist and paleoecologist. Her main interest is elucidating the evolution of grasses and the assembly of grassland ecosystems during the last 100 million years, but she is also broadly curious about how plants, and plant-animal interactions, have responded to environmental change in deep-time and what that can teach us about ecosystem function today.

Greg Wilson Mantilla



Professor, University of Washington

Greg Wilson Mantilla is a paleobiologist who aims to understand critical transitions in the deep-time history of life. One of the most captivating of these transitions is the early radiation of mammals, which ultimately led to their striking diversity today from the tiny (~2 g) flying bumblebee bat to the titanic (~100x106 g), fully aquatic blue whale. Greg Wilson Mantilla's lab research is collaborative and combines fieldwork to collect new fossils and associated geological data, description and systematic study of fossil specimens, and quantitative analysis of morphology, function, and ecology of extant and extinct taxa and communities.

Rees Kassen



Professor, University of Ottawa

Rees Kassen tests foundational theories in evolution directly through experiments using microbial populations as experimental models. In other words, asking big questions with really little things. His group also combines this approach with genomic analyses and microbial genetics to investigate the evolutionary processes underlying the management of pathogenic microbes, including those that cause chronic infections of the cystic fibrosis lung, the spread of antimicrobial resistance, and the evolution of SARS-CoV-2, the virus that causes COVID-19.

José Paruelo



Instituto Nacional de Investigación Agropecuaria (Uruguay) & IFEVA-Facultad de Agronomía, Universidad de Buenos Aires and CONICET

José Paruelo is an ecologist interested in the impact of human activities on ecosystem structure and functioning. Currently, his research focuses on areas of South America that are experiencing a profound transformation due to agricultural expansion. Combining remote sensing, modelling, and field work, his studies seek to describe the changes in carbon and water dynamics across agricultural intensification gradients and to build hypotheses on the biophysical and human drivers of land-use and land-cover transformations.

YIBS FRIDAY SEMINAR SERIES, FALL 2021 3 PM (EASTERN)

For Zoom links, more information about YIBS seminars & lectures, or to join our mailing list visit yibs.yale.edu/seminars-lectures

September

- 10** Carla Staver, Associate Director, Yale Institute for Biospheric Studies, Associate Professor, EEB
and
Eric Sargis, Director, Yale Institute for Biospheric Studies
Professor, ANTH
Curator of Vertebrate Paleontology and Vertebrate Zoology (Mammalogy), Yale Peabody Museum of Natural History
A conversation about the Yale Institute for Biospheric Studies
- 17** Brandon Ogbunu, Assistant Professor, EEB
Sit and W.A.I.T. (Waterborne, abiotic, and indirectly transmitted) Infections: from football, to addiction, to modern disease ecology
- 24** Yuan Yao, Assistant Professor, YSE
Life Cycle Decision Support Tools for Sustainable Biomass Utilization

October

- 1** Maya Stokes, Donnelley Postdoctoral Associate, EEB
Dynamic rivers drive landscape change and fish diversification in the Appalachian Mountains
- 8** Allison Karp, Postdoctoral Associate, EEB
Herbivore-fire interactions across spatial and temporal scales
- 15** Liza Comita, Professor of Tropical Forest Ecology, YSE, Co-Director, YCNCC
and
David Bercovici, Frederick William Beinecke Professor and Chair, EPS, Co-Director, YCNCC
A conversation about the Yale Center for Natural Carbon Capture
- 29** Erynn Johnson, Donnelley Postdoctoral Associate, SEAS and EPS
Understanding what shapes mollusk shell strength

November

- 5** Catherine Hernandez, Donnelley Postdoctoral Associate, EEB
The relevance of context for understanding environmental and host-associated bacteria-phage interactions
- 12** Narasimha Rao, Associate Professor of Energy Systems, YSE
Household contributions to and impacts from air pollution in India
- 19** Karen Chen, Donnelley Postdoctoral Associate, YSE
From pixel to people: 3-D urban form and mental health

December

- 3** Craig Brodersen, Professor of Plant Physiological Ecology, YSE and Kyra Prats, Ph.D. Candidate, YSE
Xylem network failure and the death of a leaf



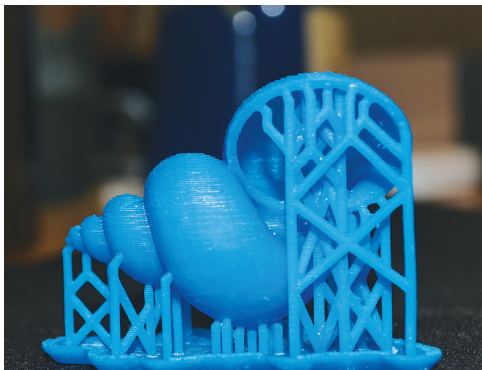
Maya Stokes: Biodiversity inventory with the Tennessee Valley Authority biologists in the Pigeon River, North Carolina.

PHOTO BY SEAN GALLEN (CSU)



Catherine Hernandez: Koskella lab crew planting peppers, beans, and tomatoes for a microbiome experiment.

PHOTO BY REENA DEBRAY



Erynn Johnson: 3D printed theoretical gastropod shell.

PHOTO BY ERYNN JOHNSON