

Helping African nations combat deadly new malaria strains

by Jonny Hart

PHOTO: CONNOR MCVAIL

Maciej Boni, a biology professor who joined CST in January 2024, works with Rwanda, Tanzania and Uganda to design strategies to slow down a growing drug resistance in malaria.

An internationally recognized evolutionary epidemiologist, Boni's work investigates how diseases evolve during epidemics. His lab is one of just a handful of labs in the world conducting the kinds of highly specialized disease modeling that can help African countries develop strategies to slow down drug resistance in malaria.

Slowing down malaria's drug resistance can be done by extending the period that a patient receives artemisinin, deploying multiple drugs in combination with artemisinin or treating patients with a different drug entirely, among many others.

Boni and his team are using an advanced computing cluster to run thousands of simulations that test the effectiveness of different strategies in African countries. These results are shared with a country's national malaria control program (NMCPs) to help design and implement effective strategies.

Modeling drug resistance in malaria is tricky because malaria has developed multiple mutations to not just artemisinin, but to other treatment drugs. To accurately model the progression of drug resistance, simulations must account for as many of these mutated malaria genotypes as possible. Accounting for those mutations is what sets apart Boni's lab from the few other modeling teams around the world doing similar work.

"There are now probably 20 to 30 mutations in malaria parasites that have been identified and characterized as having important effects on drug resistance, which means that there are millions of mutational combinations (or genotypes) out there," Boni said. "We have done all of the legwork over the last five to six years to define the parameters of tens of thousands of these genotypes, and they're all in our simulation."

Rwanda is expected to begin implementing drug resistance strategies soon. Boni's team is currently running simulations for Tanzania and Uganda, and he is in conversation with other African countries as well.



PHOTO: JOSEPH V. LABOLITO

ANTONIO GIORDANO EARNS GOLDEN LION AWARD

Antonio Giordano, director of the Sbarro Institute for Cancer Research and Molecular Medicine, received Italy's Golden Lion for Legality award for his research that demonstrated the connection between the illicit landfiling of waste and tumor pathologies in the Campania region. The award represents recognition for scientific research on cancer and for the courage to have revealed the links between waste management, controlled by organized crime, and the incidence of cancer in the Campania region.



PHOTO: JOSEPH V. LABOLITO

NEW SUSTAINABILITY PROGRAMS WILL HELP TACKLE GLOBAL ISSUES

by Deirdre Childress Hopkins

The College of Science and Technology and College of Liberal Arts introduced a new professional science master's and graduate certificate in sustainability as part of a broader effort to establish a Sustainability and Environmental Justice Collaborative between the two colleges.

The new degree and certificate program are designed to meet the needs of employers seeking highly trained leaders. The field is rapidly growing, with increasing demand for professionals who can integrate sustainability principles into business, government, non-profits and academia.

Students can take courses in one of five concentrations, including biodiversity and conservation, urban sustainability, energy systems and natural resources, climate justice, and geospatial technologies. The program emphasizes professional development and communication skills, policy and ethics, understanding complex systems and the ability to collaborate across fields and stakeholders.

Along with faculty from the College of Liberal Arts, CST's Department of Earth and Environmental Science, the PSM Steering Committee includes Biology's Erik Cordes and Rob Jennings. Jennings will be a co-director of the program, working with an external advisory board of representatives from the Pennsylvania Department of Environmental Protection, National Oceanic and Atmospheric Administration and other agencies.



PHOTO: GREG FORNIA

INVESTIGATING MICROBIAL SYMBIOSIS

by Greg Fornia

Previously a research scientist at the California Academy of Sciences, Alison Gould joined the Biology Department in summer 2024 as an assistant professor. Gould's work seeks to identify key mechanisms regulating the specificity and stability of microbial symbioses from an evolutionary scale down to the molecular level.

As a postdoc at University of California, Berkeley, Gould investigated microbial symbiosis in the *Drosophila melanogaster* gut microbiome and was lead author on a study published in Proceedings of the National Academy of Sciences that quantified the effects of symbiont interactions on host fitness. She received a National Institutes of Health Director's Early Independence Award to launch her lab and further develop the *Siphania-Photobacterium* symbiosis as a vertebrate-bacteria model for symbiosis research.

Gould's lab investigates an experimentally tractable symbiosis between a coral reef cardinalfish and a luminous bacterium. "All organisms are dependent on microbes for their success, yet very little is known with respect to how these essential symbiotic partnerships form and persist through time," she said. "My ultimate goal is to help untangle the complexities underlying beneficial host-microbe interactions and, in doing so, provide the research community with a powerful new vertebrate model for symbiosis research."

CLIMATE CHANGE MAJOR CAUSE OF AMPHIBIAN DECLINE

by Bruce E. Beans

Professor S. Blair Hedges is part of a major study by more than 100 researchers that shows climate change is a major driver of amphibian declines globally.

Habitat destruction and disease are both well-documented causes of the decline of amphibians—among the most threatened animals on the planet. The study, which analyzes two decades' worth of data from around the world, concludes that climate change is emerging as one of the biggest threats to frogs, salamanders and caecilians.

"This work demonstrates how another major group of organisms on Earth is declining because of human impact," said Hedges, director of the Center for Biodiversity and a Laura H. Carnell Professor. "Our evidence shows that climate change is an emerging threat."

According to the study, published in *Nature*, nearly 41% of amphibian species assessed are currently globally threatened, critically endangered, endangered or vulnerable—compared to 26.5% of mammals, 21.4% of reptiles and 12.9% of birds.

Conservationists will use information from the study to prioritize global conservation action, seek additional resources and influence policy to reverse the negative trend for amphibians.

