Michael Axtell- Professor of Biology

Axtell's research focuses on the identification and functional characterization of small regulatory RNAs in plants. Unlike messenger RNAs that code for proteins, the role of these noncoding RNAs is to recognize certain target messenger RNAs that are degraded and thus prevented from translation into protein. One role of these small RNAs is to battle viruses by destroying viral messenger RNAs. Plants and animals also use these small RNAs to regulate their own genes.

Axtell's research looks at the amount of small RNA in a plant or animal, what are their structural requirements for targeted selection, how do they evolve and what is their role in plant development and pathogenesis.

"Axtell is unquestionably one of the foremost international experts on plant RNA biology and is a creative and innovative scientist who played an important role in identifying, annotating and functionally characterizing small RNAs and the genes they regulate in a diverse set of plant species," a nominator said.

Through a series of online resources and high-profile papers, nominators said Axtell's work made seminal contributions to our understanding and appreciation of the biological functions and importance of small RNA.

His key findings include:

- Describing a rapid computational screening test to determine minimal base pairing requirements for small RNA and the targets that are necessary for the RNA to act and degrade those targets.
- Discovering that some microRNAs are naturally transferred from one plant to another. This mechanism shows how host plants, when attacked by parasitic plants, defend themselves using small RNA "counter punches" to silence genes in the parasitic plant.

"Axtell has rapidly become one of the foremost international leaders in the small RNA field of molecular plant science," a nominator said. "He has developed enormously useful and already widely adopted online resources that facilitate progress in the plant research

community. His discovery of the trans-species microRNA activities has opened up a new understanding of plant parasite relationships that may yield practical benefits to agriculture."

Paola (Giuli) Dussias- Professor of Spanish, Linguistics and Psychology

Dussias approaches the study of language as a social science. The learning of language, including speed of learning, formulation of accents and depth of vocabulary, is influenced by social interactions and exposure to that language. The evolution of a language is also influenced by that process.

Dussias is a leader in creating a new field of learning, one that differs from the traditional study of linguistics, which analyzes language meaning, evolution, phonetics and grammar. Dussias' work is changing the way we study language, nominators said.

Dussias researches people who are learning a second language because she is interested in knowing how that second language influences the use of the first. Her research shows that extensive use of a second language can change first language syntax and usage. This finding demonstrates that there is far greater brain plasticity throughout the lifespan than previously understood.

She's also interested in learning how age affects the language learning process. Can adult second language learners achieve the same mastery of a second language as young learners? she asks in her research. "The common wisdom in the field was that the answer was 'no,'" said a nominator. "However, Dussias has shown through her research that adults can master grammar and attain near native fluency just as younger learners can."

Dussias also studies 'code-switching,' a common feature of bilingual discourse whereby bilinguals switch languages right in the middle of spoken or written sentences. Her research shows that code-switching is governed by rules that are not necessarily derived from either language. That finding "provides a fresh perspective on what bilingual speakers view as possible switch points in bilingual speech," a nominator said. For Dussias, the multilingual speaker is seeing as a model for understanding the way that language experience shapes the mind and the brain.

“To answer questions like this, Dussias has developed experimental methods that use eye-tracking and measure brain activity while bilingual speakers undertake specific kinds of tasks,” a nominator said. “These methods have transformed the research that bilingualism scholars do, allowing much broader generalization about the bilingual brain in different social contexts.”

Joan Redwing- Professor of Materials Science and Engineering and Electrical Engineering

Redwing is an expert in metalorganic chemical vapor deposition (MOCVD) for materials growth, a synthesis method of significant importance in semiconductor manufacturing. Her research focuses on understanding the underlying chemistry and mechanistic processes of MOCVD and developing new materials using this technique.

Redwing relied on her decades of experience with traditional materials to pioneer two-dimensional materials growth at Penn State. She solved a major hurdle in 2D film growth, the inability to produce single crystal monolayer films over large areas, by using MOCVD.

She then embarked on a series of studies to identify fundamental mechanisms of MOCVD growth and developed techniques for characterizing and benchmarking these new materials.

The promising results on her preliminary research led to additional funding, including a $20 million Materials Innovation Platform grant from the National Science Foundation to establish the 2D Crystal Consortium user facility at Penn State.

Nominators said Redwing’s work improves our understanding of the relationship between the process of synthesizing materials and the underlying physical properties realized in these materials. Her work expands several areas of research of superconductors and semiconductors and in thin film and nanostructured materials.

Her work shows potential uses for creating a new class of ultra-thin semiconductors, setting the stage for large-scale chemical synthesis and development of next generation electronics, nominators said.

“Redwing is a premier example and role model of a highly productive researcher whose interdisciplinary work and impact has spanned the fields of physics, material science and chemical engineering with impact on electrical engineering and the technology of modern electronic and optical physics,” a nominator said.

Christopher Reed- Distinguished Professor of English and Visual Culture

Nominators said Reed’s award-winning 2016 book and other publications and exhibitions have been transformational.

His monograph, “Bachelor Japanists: Japanese Aesthetics and Western Masculinities,” published by Columbia University Press, won the highly competitive annual book prize from the Modernist Studies Association.

One art historian said Reed was already a premier scholar on Japanese art, but that his new book shows he is “a brilliant writer” and that “the rich harvests of his research comes together in scintillating narrative.” Another called the book “a tour-de-force demonstration of the richness of cultural analysis that can be produced by the simultaneous deployment of insights from queer studies, gender studies, global and ethnicity studies, and cultural studies.” A scholar of Japanese history called Reed “one of the most exciting, imaginative and highly productive scholars.”

Nominators praised Reed’s other work, both in volume and in impact. Reed has produced 10 academic books, three within the past five years, that cover his long-standing interests in American and British art history, global modernist studies and LGBT studies. His stature as a researcher of national and international renown within these interlocking fields is almost unparalleled, a nominator said.

“Quantity aside, the significance of his work is qualitative: all of it aims to articulate, with thoughtful erudition, theoretical sophistication, dense abstraction, and occasional wry humor grand unified theory weaving together art, literature, sexuality, racial and ethnic studies, and postcolonial globalism,” a nominator said.

Colleagues said Reed has long been known as a major art historian of the British Bloomsbury Group, but that his wide-ranging research talents create an eclectic body of work that's thoughtfully and uniquely approached.

"Reed has drawn together several research areas into a remarkable set of publications that have transformed his fields and, in turn, helped him launch new programs and initiatives at Penn State," a nominator said.

Marcos Rigol- Professor of Physics

Rigol is a theoretical physicist whose research centers on the understanding of the dynamic behavior of quantum many-body systems, or properties of microscopic systems made of a large number of particles interacting with each other through the laws of quantum mechanics.

One nominator called Rigol "one of the world leaders in the application of numerical methods to study nonequilibrium dynamics of many-body systems." Rigol's international impact is noted by the dozens of talks he's given at universities and international research conferences.

A challenging problem in this field is understanding how isolated complex quantum systems approach equilibrium. In a landmark paper published in 2008, Rigol revealed new insights into the mechanism underlying the thermalization of these systems. That work has been cited more than 1,000 times.

Since joining Penn State in 2013, Rigol has continued to publish influential research.

His work falls into two categories: theoretical advances that push the frontiers of the field by revealing new insights into complex problems in many-body physics and the theoretical interpretation of experiments carried out in some of the world's leading cold atom laboratories.

Rigol's key recent findings include advancing understanding of the long time behavior of periodically driven quantum many body systems, and demonstrating the exact description of the steady state of a quenched anisotropic Heisenberg chain that deepened knowledge of quantum integrability.

“Rigol’s scholarship as a theoretical physicist is profound, technically highly sophisticated and highly innovative,” a nominator said. “For example, Rigol has begun to make very important advances in an imaginative approach to the understanding” to a challenging problem on quantum entanglement that began to be studied decades ago at Penn State through an alumnus of Stephen Hawking’s research group.