

2019 American Society of Naturalists Awards

Sewall Wright Award

Jonathan B. Losos

The Sewall Wright Award, established in 1991, is given annually and honors a senior but still active investigator who is making fundamental contributions to the goals of the American Society of Naturalists, namely, promoting the conceptual unification of the biological sciences. The 2019 Sewall Wright Award honors Jonathan B. Losos, William H. Danforth Distinguished University Professor at Washington University and director of the Living Earth Collaborative, a collaboration among Washington University, the Missouri Botanical Garden, and the Saint Louis Zoo.

Jonathan is known for his integrative approach to the study of evolutionary diversification and for his seminal work with *Anolis* lizards. This work spans field and laboratory studies of rapid evolution and includes studies of behavior, ecology, and phylogenetics. One of his best-known and most widely cited publications is his 1998 *Science* article that addresses the enduring dichotomy between historical contingency and predictability in evolutionary biology. In this study, Jonathan and collaborators studied *Anolis* lizards and elegantly demonstrated that they have repeatedly and independently evolved the same ecomorphs on different islands in the Caribbean when they are faced with the same ecological conditions. This and subsequent work on the evolution of other traits, including performance, biomechanical, and behavioral traits, in these populations have resulted in *Anolis* lizards literally becoming a textbook example of the repeatability of adaptive radiation in natural populations.

Jonathan has made numerous other fundamental contributions to the study of adaptive radiation and biodiversity, including the evolutionary genetics of biological invasions. However, his influence is not restricted solely to studies published in the primary scientific literature. For example, he is a coauthor of the widely used textbook *Biology* (Raven et al., McGraw-Hill) and has also published books and articles targeted toward the more general reader, the latest being the beautiful and highly readable book *Improbable Destinies: Fate, Chance, and the Future of Evolution* (Penguin Random House, 2017).

Jonathan served as president of the American Society of Naturalists in 2010 and as editor-in-chief of the society's flagship journal, *The American Naturalist*, from 2002 to 2006. His career has taken him from his first faculty position at Washington University, to Harvard University as the curator in herpetology at the university's Museum of Comparative Zoology, and, in 2018, back again to Washington University as the founding director of the Living Earth Collaborative. He is a member of the National Academy of Sciences and a fellow of the American Academy of Arts and Sciences as well as the recipient of the Daniel Giraud Elliot Medal, the Theodosius Dobzhansky Prize, the Edward O. Wilson Naturalist Award, and the David Starr Jordan Prize.

Troy Day and Monica Geber, on behalf of the
Sewall Wright Award Committee

Edward O. Wilson Naturalist Award

Anurag Agrawal

The Edward O. Wilson Naturalist Award is awarded annually to an active midcareer scientist who has made significant contributions to the knowledge of a particular ecosystem or group of organisms and who through this work has illuminated key principles of evolutionary biology and an enhanced appreciation of natural history. In 2019, the award

was conferred upon Anurag Agrawal, James A. Perkins Professor of Environmental Studies at Cornell University.

In chapter 3 of *On the Origin of Species* ("Struggle for Existence"), Charles Darwin argued that the primary cause of evolution is antagonistic interactions among species. Anurag Agrawal's career has been built on the elaboration of this

argument in the context of interactions between plants and insects. The sum of his life's work to date is a mapping of the fantastic complexity of the ongoing arms race between plants and their diverse chemical and physical defenses against herbivores as well as the ways herbivores overcome those defenses and then turn them into weapons for their own protection against predators. To this complexity he adds the interactions among different species of herbivores as they compete for the common plant resource. His research program thus captures the multidimensional network of interactions originally envisioned by Darwin but with the modern dimensions of chemistry, physiology, genetics, epigenetics, phylogenetics, and community ecology that shape how these interactions occur. He embodies the ideal of the E. O. Wilson Naturalist Award with his characterization of this complexity, motivated by his observations of natural history. He expands on this ideal with synthetic reviews that address the underlying principles and create bridges among disciplines. He has gone even further by making this science accessible to a general audience in the form of a prize-winning book, *Monarchs and Milkweed* (Princeton University Press, 2017).

Agrawal has sustained a special focus on milkweed (*Asclepias* spp.) and their specialized herbivores, including monarch butterflies (*Danaus plexippus*), aphids (*Aphis* spp.), and beetles (*Tetraopes* spp.). He has developed and deployed research tools for characterizing these interactions at levels that range from microevolutionary studies of populations to macroevolutionary studies of the entire *Asclepias* genus to even broader studies of flowering plants and insects. At one level, he and his students and collaborators have performed detailed experimental studies that characterize the details of the physical and chemical defenses plants mount against insects and how the insects deal with them. This interaction includes assessing the diversity of cardenolides produced by milkweed and the enzymatic defenses of the insects. The plant side involves a combination of constitutive and induced responses, which are in turn shaped by trade-offs between them and other features of the plant life cycle, such as regrowth after herbivore damage. The insect side includes the enzymatic detox-

ification of plant poisons, the sequestration and modification of the poisons in their own defense, and their direct and indirect interactions with each other as they consume a shared resource. At a higher level of complexity, he has explored the consequences of genetic diversity among plants within a population and discovered that there is safety in diversity in the form of reduced herbivore damage. At yet a higher level of complexity, he has characterized the evolution of defense mechanisms across the dozens of species that comprise the genus *Asclepias* and characterized the relationship between the evolution of plant defenses and species diversity.

In spanning this range of biological organization, he has characterized the importance of phenotypic plasticity and trade-offs among different defenses in shaping evolution. He has amplified our understanding of coevolution, constraint, and convergence in shaping both microevolution and macroevolution. He has addressed all of these general issues in perspectives, synthetic reviews, symposia at national and international conferences, and special issues in leading journals, often in ways that create bridges among otherwise unconnected areas of endeavor. He has been a successful mentor to a large number of graduate students and postdocs who have developed independent research programs and gone on to successful careers of their own. His leadership in promoting science includes serving as a special features editor of *Ecology* and chairing a review of the National Science Foundation's Population and Community Ecology Panel. His research has appeared almost exclusively in the most highly ranked journals in our discipline and the most exclusive interdisciplinary journals.

Anurag Agrawal's appreciation of natural history, translation of that appreciation into diverse forms of empirical studies of adaptation and evolution, skilled communication of his ideas to technical and general audiences, and leadership in the scientific community are what define him as this year's recipient of the E. O. Wilson Naturalist Award.

David Reznick (chair), Jenn Rudgers, and Joseph Travis, the Wilson Award Committee