

Frontiers of Knowledge Award in Ecology and Conservation Biology

The BBVA Foundation recognizes Rosemary and Peter Grant for discovering evolutionary mechanisms vital for the conservation of threatened species

- For 40 years, the British biologist couple have studied the finches of the Galapagos Islands, the birds that inspired Charles Darwin, producing the stunning insight that natural selection can drive evolutionary adaptations in less than a decade in response to shifts in the environment
- Thanks to their findings, “we now know that evolution is a far more dynamic process than Darwin imagined,” in the words of the award jury, with changes in the birds’ body or beak size occurring over as short a time scale as one or two generations
- The two scientists, the jury adds, have incorporated “state-of-the-art advances in genetics,” into their research, “resulting in the most complete account of how evolution works in nature,” and “elucidating the mechanisms through which new species originate”
- The Grant’s insights into short-term evolutionary adaptations form the backbone of the “ecological replacement” and “assisted evolution” strategies that have proved of considerable worth for the conservation of threatened species

Madrid, February 6, 2018.- The BBVA Foundation Frontiers of Knowledge Award in the Ecology and Conservation Biology category goes, in this tenth edition, to evolutionary biologists Rosemary and Peter Grant “for their profound contributions to our understanding of the mechanisms and processes by which evolution occurs in the wild,” in the words of the jury’s citation. This husband-and-wife research team was the first to successfully document how evolution plays out in real time, uncovering mechanisms of utility for developing effective strategies to conserve threatened species.

Their painstaking work over the course of four decades with the Galapagos finches that inspired Charles Darwin has revealed that evolutionary changes can occur far faster than was ever thought possible. “Because of the Grants,” the citation states, “we now know that evolution is a far more dynamic process than

Darwin initially imagined.” Their work, it continues, has provided “the most complete account of how evolution works in nature, elucidating the mechanisms by which genetic diversity is maintained and through which new species originate.”

The jury also singled out the conservation implications of the Grants' work: “Their results add an evolutionary perspective to conservation biology by recognizing that rapid evolutionary changes can occur after the arrival of invasive species (including humans) or in response to catastrophic events.”

It was 1973 when Rosemary and Peter Grant arrived in the Galapagos Archipelago on the small island of Daphne Major – the crater of an extinct volcano, with barely enough space to pitch a tent – intent on studying how new species emerge. Encouraged by their first observations of the behavior of local finches, they decided to return for a few months each year to tag and measure the birds, record their behavior and collect samples – including blood samples for genetic analysis. And so the two continue at their eighty odd years of age, with their next visit to Galapagos scheduled for March this year.

The vast amount of data gathered in this period has enabled them to show how ecological and environmental changes shape the evolutionary fate of natural populations, at times giving rise to whole new species over a single generation. For Emily Bernhardt, jury chair and Professor of Biology at Duke University (United States), the Grants' labors “have led to one of the most dramatic paradigm shifts in evolutionary biology since Darwin himself.”

The discovery also has far-reaching implications in the conservation sphere, “because it demonstrates a way of measuring species' short-term evolutionary response to phenomena like invasive species or extreme climate events,” remarks jury secretary Pedro Jordano, a research professor at the Doñana Biological Station of the Spanish National Research Council (CSIC). “By documenting the dynamics and mechanisms of each stage of the process of species formation, the Grants have taught us to look afresh at species' evolutionary response, to understand how rapidly and in what situations we can expect it to occur.”

The Grants declare themselves inspired by Darwin's work. Both had read *On the Origin of the Species* in their youth, but their choice of the Galapagos to conduct their research was not about its symbolic value. In the early 1970s, the two found themselves at McGill University in Canada, studying speciation. As Peter Grant explained on the phone yesterday after hearing of the award, “we chose Darwin's finches because they form a group of 18 species derived from a common ancestor living in an environment where the human imprint is almost entirely absent. There aren't many places in the world that are interesting biologically and have barely been disturbed by humans. Also, in the Galapagos the climate varies considerably from one season to another. You also have very wet followed by very dry years, and that led us to think that we might find clues

as to what environmental factors were driving the maintenance of communities and the generation of new species in those communities.”

The decision, it turned out, was a good one. In 1977, after several years measuring characteristics like the size of the birds' bodies and beaks, they were able to observe what befell the finches during a period of severe drought: the environmental changes caused by the shortage of water favored birds with beaks of a certain shape, while the rest died off in large numbers. As a result, some genetic traits, but not others, were passed on to the next generation. In 2004, they witnessed a similar phenomenon.

“Our research in the Galapagos showed that evolution can happen in just ten years when the environment changes,” explains Rosemary Grant. “And by persisting in our study for forty years we discovered that this is not just a singular event, but that evolution recurs. We found that changes in beak morphology and body size can take place in the order of one significant event a decade.”

Over the years of their career, the Grants have incorporated new knowledge in molecular and genetic biology into their study data. What this has revealed is that the things they were seeing in the field and recording in their notebooks were also occurring at genetic level. Specifically, they were privileged to document what they call “a new lineage” of finches. As Peter relates, “our second big finding was that two species, under certain circumstances, can hybridize and produce a third in as little time as three generations.”

For Rosemary, “this shows that we can study the process of species generation in our own lifetimes, provided we pick the most suitable places to study. And we can follow the consequences of those events. Darwin was concerned that the evidence for change was not obtainable within a human lifespan.”

Conservation implications

The Grants' work has been fundamental in connecting the study of ecology with evolution and, as such, has major implications for biodiversity conservation. “The environment,” explains Peter, “is the theater where evolution takes place. Neither the theater nor the play are fixed. Rather, they are dynamic processes in which the scenery and characters change from one act to the next. In the same way, the interplay of ecological and evolutionary dynamics is essential to our understanding of how biodiversity is generated and what forces can promote or subvert those processes.”

For the Grants, the knowledge unlocked in their forty years researching in the Galapagos can help direct conservation priorities: “In conservation biology, most people are concerned about preserving endangered species. But much less attention is being paid to the conservation of the habitats where these species live,” Peter warns. “We need to think more broadly about how to conserve biodiversity in general, and not just focus on rhinoceroses, tigers or elephants. Unless we make a serious effort to preserve the habitats where these

endangered species live, I won't say we are doomed to fail, but we are making things very difficult for ourselves."

In Spain, as Jordano explained yesterday, insights from the Grants' work are being put into practice as part of efforts to conserve the Iberian lynx. The strategy in question is known as assisted evolution, and consists of accelerating a species' natural evolutionary process to favor certain traits that improve its resilience to environmental alterations. This is called for when a population exhibits adaptive limitations in the face of change. The idea, essentially, is to use genetic variability as a conservation tool. As Jordano explains, "in the case of the Iberian lynx, we have been able to address the problem of genetic impoverishment by introducing individuals with better adapting genotypes, that, for instance, exhibit better resistance to diseases like feline leukemia virus."

Another conservation strategy now in development that draws on the Grants' work is the identifying of the coral varieties most resistant to changes in the reef environment, so as to hasten the system's recovery after alterations like temperature increases, water acidification, etc. The introduction and propagation of hardier strains favors a speedier adaptation to these drastic environmental changes.

"We have been able to show that both species and environments change. So the essential lesson for biodiversity conservation is that if we are to have a sustainable environment we must take both the change of environment and the change of species into consideration," Rosemary concludes.

Bio notes

Rosemary Grant (Arnside, United Kingdom, 1936) received a BSc in Zoology in 1960 from the University of Edinburgh. That same year, she took up a teaching appointment at the University of British Columbia (Canada), where she met Peter Grant.

Peter Grant (London, United Kingdom, 1936) graduated from the University of Cambridge in 1960 then went on to earn a PhD at the University of British Columbia in 1964, by which time he had met and married Rosemary Grant.

The couple have worked shoulder to shoulder throughout their research and teaching careers, with positions at the universities of Yale, McGill, Michigan, Uppsala and, finally, Princeton, where Rosemary is Senior Research Scholar and Professor of Zoology Emeritus and Peter is Class of 1877 Professor of Zoology Emeritus.

Parallel to their scientific enterprise, the Grants stand out for the efforts they have invested in mentoring new generations of researchers and in interesting lay people in ecology. The Society of the Study of Evolution has created an award scheme for young investigators that bears Rosemary Grant's name. And the couple's adventures in science are narrated in *The Beak of the Finch: A Story of*

Evolution in Our Time, a book by Jonathan Weiner which won the Pulitzer Prize for General Nonfiction. They have also been the subject of TV and radio documentaries by the BBC, National Geographic and the Public Broadcasting Station (PBS).

Ecology and Conservation Biology jury and technical committee

The rigor, quality and independence of the judging process has earned these awards the attention of the international scientific community and a firm place among the world's foremost prize families.

The jury in this category was chaired by **Emily Bernhardt**, Jerry G. and Patricia Crawford Hubbard Professor in the Department of Biology at Duke University (North Carolina, United States). The secretary was **Pedro Jordano**, Research Professor in the Department of Integrative Ecology at Estación Biológica de Doñana, CSIC (Spain). Remaining members were **Jordi Bascompte**, Professor of Ecology in the Department of Evolutionary Biology and Environmental Studies at the University of Zurich (Switzerland); **Paul M. Brakefield**, Professor of Zoology at the University of Cambridge (United Kingdom) and Director of the University Museum of Zoology; **Julia Fischer**, Professor of Primate Cognition at the University of Göttingen (Germany) and Head of the Cognitive Ethology Laboratory at the German Primate Center; **Anna Liisa Laine**, Professor in Plant Ecology on the Research Program in Organismal and Evolutionary Biology at the University of Helsinki (Finland); **Joanna Lambert**, Professor of Biological Anthropology and Environmental Studies at the University of Colorado Boulder (United States); **Rik Leemans**, Professor of Environmental Systems Analysis in the Department of Environmental Sciences at Wageningen University & Research (Netherlands); and **Guangchun Lei**, Dean of the School of Nature Conservation at Beijing Forestry University (China), where he is also a Professor of Ecology.

The **CSIC Technical Committee** was coordinated by **María Victoria Moreno**, the Council's Deputy Vice President for Scientific and Technical Areas, and formed by: **Eulalia Moreno**, Coordinator of the Natural Resources Area and Research Professor in the Arid Zones Experimental Station (EEZA); **Daniel Oro**, Research Professor in the Mediterranean Institute for Advanced Studies (IMEDEA); and **Anna Traveset**, Research Professor in the Mediterranean Institute for Advanced Studies (IMEDEA).

Previous awardees in this category

The **Ecology and Conservation Biology** award in last year's edition went to ecologists **Gene Likens and Marten Scheffer** for contributing decisively to one of the major challenges of this scientific discipline: to understand and, where possible, anticipate ecosystem responses to human-induced alterations of the natural environment.

Five of the 83 winners in earlier editions of the BBVA Foundation Frontiers of Knowledge Awards have gone on to win the Nobel Prize. Shinya Yamanaka, the 2010 Biomedicine laureate, won the Nobel Prize in Medicine in 2012; **Robert J. Lefkowitz**, awardee in the same Frontiers category in 2009, won the Chemistry Nobel in 2012. In Economics, Finance and Management, three Frontiers laureates were later honored with the Nobel: **Lars Peter Hansen**, winner of the Frontiers Award in 2010 and the Nobel Prize in 2013; **Jean Tirole**, Frontiers laureate in 2008 and Nobel laureate in 2014; and **Angus Deaton**, 2011 Frontiers laureate and Nobel laureate in 2015.

About the BBVA Foundation Frontiers of Knowledge Awards

The promotion of knowledge based on research and artistic and cultural creation, and the interaction of these domains, forms a core strand of **the BBVA Foundation's** action program, along with the recognition of talent and excellence across a broad spectrum of disciplines, from science to the arts and humanities.

In line with these objectives, the **BBVA Foundation Frontiers of Knowledge Awards** were established in 2008 to recognize outstanding contributions in a range of scientific, technological and artistic areas, together with knowledge-based responses to the central challenges of our times. The areas covered by the Frontiers Awards are congruent with the knowledge map of the 21st century, in terms of the disciplines they address and their assertion of the value of cross-disciplinary interaction.

Their **eight categories** span classical areas like Basic Sciences (Physics, Chemistry and Mathematics), Biomedicine and other areas characteristic of our time, like Biomedicine, Information and Communication Technologies, Ecology and Conservation Biology, Climate Change, Economics, Finance and Management and Development Cooperation, and the particularly innovative realm that is Contemporary Music.

The BBVA Foundation is aided in the evaluation process by the **Spanish National Research Council (CSIC)**, the country's premier public research organization. As well as designating each jury chair, the CSIC is responsible for appointing the technical evaluation committees that undertake an initial assessment of candidates put forward by numerous institutions across the world and draw up a reasoned shortlist for the consideration of the juries.

CALENDAR OF UPCOMING AWARD ANNOUNCEMENTS

Contemporary Music	Tuesday, February 13, 2018
Economics, Finance and Management	Tuesday, February 20, 2018
Development Cooperation	Tuesday, February 27, 2018

LAUREATE'S FIRST DECLARATIONS AND IMAGES

A video recording of the new laureate's first interview on receiving news of the award is available from the Atlas FTP with the following coordinates:

Server: **5.40.40.61**

Username: **AgenciaAtlas4**

Password: **mediaset17**

The name of the video is:

“PREMIO ECOLOGÍA”

In the event of connection difficulties, please contact **Miguel Gil** at production company Atlas:

Mobile: +34 619 30 87 74

E-mail: mgil@mediaset.es

Fundación BBVA

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