

Presentation ceremony for the 9th edition of the BBVA Foundation awards

The BBVA Foundation Frontiers of Knowledge Awards champion science's role as a keystone of culture

- “Together, the contributions of our laureates illustrate the immense wealth and diversity of scientific and creative practice: from predicting the onset of climate change to designing the most sophisticated form of artificial intelligence or the most precise techniques for genome editing. It is impossible not to feel a deep admiration for the achievements recognized here today and for the individuals who brought them about,” declared Francisco González, President of the BBVA Foundation
- Among these contributions is CRISPR, the most precise technique available for editing the genome; advances with the potential to avert millions of deaths from malaria; the discovery of how far ecosystems can be pressured by human action before they tip over into potentially drastic change; and powerful statistical tools that help transform information into knowledge in the age of Big Data
- The Frontiers Awards were established in 2008 to distinguish fundamental contributions with the power to transform our understanding of the world, and place their authors in the public light. Their eight categories are congruent with the knowledge map of the 21st century

Madrid, June 15, 2017.- Architects of some of the successes that best reflect the progress of knowledge in these past decades, the winners in the 9th edition of the BBVA Foundation Frontiers of Knowledge Awards collected their awards this evening in Madrid's Marqués de Salamanca Palace. “From predicting the onset of climate change to designing the most sophisticated artificial intelligence or the most precise techniques for genome editing, by way of modeling the impact of human aggressions on our planet, the Frontiers Awards reflect the bounty of science in all its diversity,” in the words of BBVA Foundation President Francisco González.

For González, the award ceremony was an occasion to champion “the rational thinking that underpins science, and which science, in turn, expands and refines through its role as a motor of culture and a foundation for decision-making.”

The President of the BBVA Foundation recalled that these awards were created almost ten years ago to recognize and give visibility to those who generate knowledge, a mission that is now more vital than ever: “It is essential that public policy-makers, private agents and society and its culture are guided in their relations with reality by trial and error reasoning, the interaction of theory and empirical evidence, the critical examination of ideas, and the subjection of outcomes to rational debate.”

“This is not about turning citizens into scientists,” he added, “but about something far more basic: the understanding that there is a line that demarcates subjective opinion from knowledge that has been tested and validated by the scientific community.” Because, in González’s view, “one of the most pernicious forms of inequality is that in which large sectors of society are excluded from knowledge. And when this ignorance or skepticism about validated knowledge extends to policy-makers with considerable influence in the modeling of the social agenda, the situation becomes especially disquieting. So much so, that we must redouble our efforts to have science viewed as culture.”

The President of the BBVA Foundation pointed to the example of the Frontiers laureates. “We need these models if we wish to reduce the grave cognitive inequality that divides today’s society, the breach between those who live immersed in the knowledge society and those who confine themselves to using its products, never thinking to inquire if what lies behind the screen or the click is magic or science.”

Both the laureates and González himself defend the importance of basic knowledge; the kind that does not seek immediate application but rather “determines our vision of the world we live in, our system of coordinates for interpreting reality and, therefore, the way we view and relate to others,” remarked the BBVA Foundation President.

The ceremony was attended by Spain’s Secretary of State for Research, Development and Innovation, Carmen Vela; the President of the Spanish National Research Council (CSIC), Emilio Lora-Tamayo, and numerous representatives of the Spanish and international scientific and artistic communities.

The awardees in this edition are mathematicians **David Cox** and **Bradley Efron**, for developing statistical tools that are fundamental to the advance of modern science; biologists **Emmanuelle Charpentier**, **Jennifer Doudna** and **Francisco Martínez Mojica**, for developing CRISPR, the most efficient and precise gene-editing technique; ecologists **Gene E. Likens** and **Marten Scheffer**, for alerting the world to the global impact of acid rain and discovering that human action can subject ecosystems to drastic and at times irreversible change; computer scientist

Geoffrey Hinton, for advancing the field of artificial intelligence by creating programs able to learn for themselves; economist **Daron Acemoglu**, for identifying the quality of institutions as a key determinant of countries' welfare and growth; composer **Sofia Gubaidulina**, for the spiritual quality and transformative dimension of her music; climatologists **Syukuro Manabe** and **James Hansen**, for creating the first computer models of climate, which predicted global warming induced by CO₂ emissions; and biomedical researchers **Pedro Alonso** and **Peter Myler**, for achieving vital advances against diseases like malaria that afflict hundreds of millions in developing countries.

A “mirror image” of the science and creative communities

The BBVA Foundation Frontiers of Knowledge Awards were established in 2008 to recognize contributions with the power to enlarge and transform our understanding of the world, and to train a spotlight on their creators. The awards adhere scrupulously to the rules and the culture of the international scientific and creative communities, both at the nomination stage, with entries received from the world's most eminent institutions, and in candidate evaluation. Each year, world-class scientists and creative practitioners nominate and choose the best from among their peers. Candidates are evaluated in two stages. In the first, eight technical committees formed by experts from the Spanish National Research Council (CSIC) draw up an initial ranking of the nominations received. Subsequently, eight international juries examine these rankings and select the candidate they consider deserving of each award. CSIC itself appoints the chair of each jury, and remaining members are decided in consultation between the BBVA Foundation and the public research organization.

The architecture of the awards, in their eight categories, contemplates a broad spectrum of areas mirroring the current organization of science. In the Frontiers Awards, classical areas like Basic Sciences or Biomedicine stand shoulder to shoulder with others drawn from younger disciplines. Two of this group, the interdisciplinary study of Climate Change and Ecology and Conservation Biology have supplied reliable knowledge for one of the great tests we face as a species in this 21st century: the protection of our own planet. In reserving two categories for this “hard core” of environmental science, the Frontiers Awards acknowledge their transcendental importance in confronting the ultimate challenge that is the conservation of life on Earth.

The awards are funded with a total of 3.2 million euros, distributed equally across their eight categories.

From the 19th century to Big Data

Statisticians Cox and Efron, the laureates in Basic Sciences, declare themselves happy to retain “all our enthusiasm for the field,” and its long and passionate history. “Two great early 19th century mathematical scientists, Gauss and Laplace, made pioneering contributions, still relevant today, motivated by issues arising in

the analysis of astronomical data. Over the intervening period our field has expanded relentlessly in technical, conceptual and mathematical richness. The expansion has embraced and been driven by questions arising in the natural and social sciences and their associated technologies, engineering, agriculture and medicine, in particular."

"An endorsement of curiosity-driven science"

Mojica, speaking on behalf of the laureates in Biomedicine, greeted the award as "an outstanding endorsement of curiosity-driven, fundamental discovery science." "CRISPR," he continued, "is a result of that brand of science; of a search for knowledge which provides instruments that feedback into knowledge. As a side effect, this loop opens new ways to tackle and hopefully solve crucial issues like the treatment and prevention of incurable diseases. At a time when many countries are limiting funding for fundamental research, this award and the work that it honors serve to emphasize the intrinsic value of science to society. A reality that should be clear to all, but that unfortunately is not."

Work that "really matters"

Likens and Scheffer, who share the Ecology and Conservation Biology award, asked what it was that made their insights so special. "Of course, there is the element of exciting novelty. We saw things in a way that nobody had seen them before. (...) But there is something else. The kind of work we do really matters to society. Humans, like all other species, ultimately depend on the ecosystem services of clean air, land and water and nourishing food. We are therefore particularly pleased to have this award reflect our long-term work into understanding and protecting a healthy environment and in finding ways of sustaining these vital services into the future."

The internal battles of the AI field

ICT award winner Geoffrey Hinton talked about the "battle" waged for over fifty years between two visions of artificial intelligence: "The classical view was that intelligence was all about reasoning and that to make systems that reason sensibly in the real world we would need to enter a very large number of facts by hand, and also a large number of rules for when they should be applied. The rival view was that we should try to mimic the neural networks of the brain. In particular we should focus on how these networks learned from experience so that we would not have to specify all the knowledge by hand. The neural network approach was regarded as a ridiculous fantasy by most people in AI."

But Hinton and his postdoc students proved them wrong by developing neural network-based speech and image recognition systems that outdid all their predecessors: "Neural networks were finally accepted as the right way to solve many of the problems that had defeated classical AI. I think the moral of my career is simple: get yourself some very good graduate students."

Institutions, technology and prosperity

Daron Acemoglu, Economics, Finance and Management laureate, recalled how “the role of institutions in economic development, and the interplay of politics with economics,” was what attracted him to economic sciences. Back then he was “a high school student coming of age in Turkey, under military dictatorship and a dysfunctional economy, wondering whether the two were inexorably linked.”

And linked they were, as his later research would reveal. Acemoglu has also turned his attention to the study of technology, which he sees as in some way similar to institutions. “Technology isn’t just a source of prosperity, it also creates winners and losers. This bias of technology is fundamentally determined by the choices of economic actors. Technological advances can sometimes reduce wages and employment, even though at other times they act as the most powerful engine of prosperity.”

Music that “sparks a flame”

Sofia Gubaidulina gave thanks for “the love and support that today’s music needs so much.” Her speech turned on the process of interpreting a musical work: “It is not easy for a person who listens to a piece of music to perceive the essence of the sound material employed in the process of its construction. To perceive it in a way that sparks a flame inside the soul and calls forth a vibrating cloud that transports us upwards to another dimension of life, different from our daily routine. It is supremely hard to execute. It is a rare event. But it can be achieved thanks to the combined efforts of the people who create, who perform what has been created and who hear and perceive the performed work.”

She was convinced, she added, “without fear of exaggerating” that “our future depends on the existence of such initiatives; on this kind of selfless support for the arts.”

Strategies to combat climate change

Hansen and Manabe, Climate Change laureates, offered a historical perspective. “The atmospheric concentration of carbon dioxide has increased over 30% since the preindustrial era primarily from the combustion of fossil fuels. Global mean surface temperature, which has been relatively stable over 10,000 years, has already increased by about 1° C since the preindustrial era. And it is projected to increase an additional 2-3° C by 2100. Unless dramatic reduction of greenhouse gas emissions is achieved, global warming is likely to exert a far-reaching impact upon the ecosystem of our planet during the next few centuries. It is quite encouraging that climate models have been used not only for predicting global warming but also for developing strategies for dealing with it.”

“Science is a catalyst of development”

Pedro Alonso read the acceptance speech for himself and his co-laureate Peter Myler. Both men recalled that “human parasites and other communicable diseases are the largest contributors to the unacceptable burden of disease and death that entrap populations in many parts of the world in a vicious cycle of poverty and misery that are major impediments to economic development.” Malaria “is one of the biggest killers of mankind,” but the disease “has been fortunate – it has attracted attention and resources. This is in sharp contrast to leishmaniasis – a truly neglected tropical disease that affects the poorest of the poor. More than 60 thousand deaths and 8 million new infections occur every year, yet most people do not even know how to spell the name of the disease.”

Alonso and Myler see science as a key tool to combat these conditions. “It can be a true catalyst of economic development and ultimately reduce the unacceptable inequality that we have witnessed, where the place you are born determines your chance to live a healthy productive life.”

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