

The tenth edition of a family of awards that “aspire to enlighten society about the constituent elements of the research and creative process,” says Francisco González

The presentation ceremony of the Frontiers of Knowledge Awards issues a call to strengthen scientific culture as a defense against post-truth and populist leaders

- The fourteen awardees in the eight award categories are authors of key contributions in the fight against climate change, the search for new anti-cancer therapies, the conservation of biodiversity, the synthesis of new materials, the safeguarding of security and privacy on the Internet, the development of empirical industrial organization and musical creation
- The ceremony was attended by Ecological Transition Minister Teresa Ribera and the President of the Spanish National Research Council (CSIC), Rosa Menéndez, along with numerous representatives from the national and international scientific and creative communities
- “Deliberate falsehoods and the concealment of the truth are nothing new. What is new is to find people shamelessly deprecating the best available knowledge,” remarked Francisco González, President of the BBVA Foundation. “The rise of populist movements is right now correlated with the ongoing assault on scientific rationalism and sound empirical evidence”

Madrid, 13 June, 2018.- A society deficient in scientific culture is a more vulnerable society. The presentation ceremony of the tenth edition of the BBVA Foundation Frontiers of Knowledge Awards, held this evening in the Marqués de Salamanca Palace in Madrid, issued a call to strengthen society's scientific culture as a bulwark against decision processes that disregard the evidence on issues of vital collective importance, and, in doing so, pave the way for populist leaders. “The science we have is immensely powerful, but its potential is not being harnessed in individual and, above all, public decisions, because of certain currents that deny its validity or accord it the same weight as mere uninformed opinion,” observed the BBVA Foundation President Francisco González.

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Francisco González recalled that the BBVA Foundation Frontiers of Knowledge Awards came into being ten years ago to “celebrate the endeavor to understand the natural and social world and artistic creation,” and to recognize the scientists and artists whose contributions serve to broaden our worldview and enlarge the opportunities available to us all. Through them, he added, “we aspire to enlighten society about the constituent elements of the research and creative process.”

These elements – like the principle that all statements must be tested and supported by evidence – are useful to any member of our digital society, where information flows free and unfiltered, making it “hard to distinguish validated knowledge” from stories deliberately fabricated to varnish “spurious interests,” Francisco González continued.

“In three decades, we have progressed from a situation of limited, asymmetric access to information and knowledge to one of overabundance,” a change that is “undoubtedly to be welcomed” but that poses the problem of how to “steer a course through an ocean of information whose sources and ends are diverse or impenetrable.” The task is made even harder by the rise of social networks, already the main news source for large segments of the population, in which verified data “are presented side by side with subjective or vested opinions.” For Francisco González, these social media “provide what looks like security at the expense of veracity.”

Nowadays “the impressive stock of cognitive capital accumulated over time has to contend with what has become known as post-truth.” Deliberate falsehoods, the concealment of the truth and propaganda are not new phenomena. But what is new is people shamelessly deprecating the best available knowledge. The resurgence of movements of a populist bent is today correlated with the ongoing assault on scientific rationalism and sound empirical evidence.”

The laureates in this edition were: chemist **Omar Yaghi**, for synthesizing new porous crystalline materials, MOFs and COFs, with potentially revolutionary applications; immunologist **James P. Allison**, for developing the first highly effective cancer immunotherapy; evolutionary biologists **Rosemary and Peter Grant**, who have observed evolutionary processes at work on the same Galapagos islands that inspired Charles Darwin; cryptographers **Shafi Goldwasser, Silvio Micali, Ronald Rivest and Adi Shamir**, for enabling the cryptographic techniques that are part of the fabric of our digital age; economists **Timothy Bresnahan, Ariel Pakes and Robert Porter**, for pioneering the new empirical industrial organization; composer **Kaija Saariaho** for the breadth and depth of her contributions to contemporary music; economist **William Nordhaus**, for founding the field of climate change economics; and epidemiologist **Nubia Muñoz**, who showed that the human papillomavirus is the principal and necessary cause of cervical cancer, and led the development of

an effective vaccine against the disease, the female cancer that claims most lives in the developing world.

The Frontiers Awards were established in 2008 with an architecture that includes the classical areas of knowledge while finding room for the great challenges that confront today's humanity. Hence Climate Change science and Ecology and Conservation Biology are assigned the same weight as Basic Sciences, Biomedicine or Economics. In order to faithfully reflect the knowledge map of the 21st century, the awards also reserve a category for Information and Communication Technologies, while Contemporary Music represents the human drive to extend the bounds of creativity and sensibility.

The fact that most of today's salient advances are a product of collaborative working is explicitly acknowledged by making the awards available to teams of any size, and even scientists working independently who have contributed to a convergent end. The nominations put forward by scientists and creative practitioners from institutions the world over are evaluated in two stages: first, a preliminary, non-binding shortlist is drawn up by eight committees formed by experts from the Spanish National Research Council (CSIC); then, eight international juries made up of specialists in each subject area decide on the winning candidate. The awards carry a monetary amount of 3.2 million euros, divided equally across their eight categories

“Harvesting water from the desert air”

In his acceptance speech, Omar Yaghi, the Basic Sciences laureate, recalled how he had always wanted to do “basic research, where one goes into the unknown, with no guarantee of success, looking for the thrill of discovery. I believed, and still do, that the independence of science is paramount to doing transformative science.”

He also spoke of the importance of MOF and COF crystals: “They are useful in a myriad of applications, not the least of which are harvesting water from desert air and capturing carbon dioxide from the atmosphere. They are being studied by over 1,000 researchers worldwide.”

“Still a lot of work to do”

James P. Allison, winner in the Biomedicine category, shared one of the most moving chapters in his professional life: “As a basic scientist, I have been blessed to see my research findings translate into a powerful new strategy for cancer therapy. In 2006 I met a 24-year old melanoma patient named Sharon. More than a year earlier, her doctors told her that she had only a few months to live. She had received multiple prior therapies but her cancer continued to grow. As a last resort, she joined a clinical trial of a then experimental drug called anti-CTLA-4 therapy. Within three months, her tumors shrank and disappeared. When I met her a year later we hugged and cried after her doctor said she showed no evidence of recurrent cancer. Sharon and I have become good friends. She is

now almost 13 years out from her battle with cancer and enjoying life with a vibrant family."

"Of course, we still have a lot of work to do. We have not been able to successfully treat cancers such as pancreatic cancers and glioblastoma. We're continuing our efforts and hope to make progress in the near future."

"Evolution is the link between ecology and conservation"

Rosemary and Peter Grant, awardees in Ecology and Conservation Biology, explained why their findings on evolution, achieved over decades of work with Galapagos finches, hold the key to biodiversity conservation: "Understanding how to maintain biodiversity in a fragile world experiencing environmental degradation on a global scale is one of the most critical challenges facing us today. One message from our research is that neither species nor environments are static entities, they are constantly changing, and we must find ways to keep them both capable of further, natural, change. Hence evolution is the link between ecology and conservation."

"One of the most pessimistic branches of science"

Shafi Goldwasser, Silvio Micali, Ronald Rivest and Adi Shamir, co-laureates in Information and Communication Technologies, remarked that their contributions have helped cryptography to make the transition from "an old art form" to "a young science." In their view, "cryptography is one of the most pessimistic branches of science: It assumes the existence of extremely powerful adversaries, who can read all your messages, generate fake messages, or modify your keys and your random bits. However, it is also one of the most optimistic branches of science, showing how you can overcome such difficulties by using the power of mathematics and computer algorithms of the type we and our colleagues have developed."

Imperfectly competitive markets

Timothy Bresnahan, Ariel Pakes and Robert Porter, who shared the award in Economics, Finance and Management, represent "empirical industrial organization, a field of microeconomics that studies imperfectly competitive markets; that is, almost all markets." Their research, they explained, deals with "the regulation of markets when competition is imperfect, such as antitrust enforcement," and the tools they developed have enabled "the analysis of the effects on consumer welfare, productivity, and profitability of phenomena such as mergers, deregulation, the design of auction and insurance markets, and much more."

Technology as a microscope to explore music

Composer Kaija Saariaho, winner in the Contemporary Music category, has employed computers in her music writing since 1982 or, as she put it, "I have used technology as a microscope to learn more about sound." She talked in her

speech about “music's fundamental role for humanity,” while noting that music and science have much in common, and “have often fed off each other.” And yet, she added, “where science relies on facts, music enters us without words, sometimes deeply and unexpectedly, like a smell (...) Music has its own logic that we perceive over time, often through several senses simultaneously; we hear instruments having different roles, we see musicians reacting to the music they perform, we are moved, feel happiness, sadness, loneliness or a sense of community. We forget ourselves and learn about others, and discover different ways of perceiving the world around us.”

“If you wake an economist in the middle of the night...”

Climate Change laureate William Nordhaus declared himself firm in his conviction that the world needs a tax on carbon: “Climate change is occurring because industrial processes produce an undesirable byproduct, what is called an externality, in the form of greenhouse gases like carbon dioxide. If you wake up economists in the middle of the night and ask, what should be done about externalities, they will generally say, ‘Please tax them, and let me go back to sleep.’ If the economists were to stay awake a little longer, they would add, ‘It is called a carbon tax.’ People who are serious about slowing climate change are gradually coming to the view that putting a price on carbon emissions is the single most important step for slowing climate change. An easy way to think of this is the adage, ‘Tax bads not goods.’ Simple and correct.”

Eradicating cervical cancer is possible

Nubia Muñoz, winner in Development Cooperation, drew attention to the high death rates from cervical cancer among women in the developing world: “Perhaps because the very fact that this is cancer that eminently affects women in poor countries means it has not been given the importance it deserves.” She underscored the effectiveness of the vaccine against the agent causing this type of cancer, and the urgency of boosting take-up where it is most needed: “The tragedy is that, despite these two weapons having been available for over 10 years, cervical cancer remains a major public health problem. Each year, over half a million cases are diagnosed worldwide and 280,000 women die of the disease. Even more tragically, 85 percent of cases affect young women in developing countries, whose deaths leave a family unprotected and likely to slide deeper into poverty.”

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