The third category to be decided in the fifth edition of these international awards

Daubechies and Mumford win the BBVA Foundation Frontiers of Knowledge Award for work in pure mathematics that has influenced fields of application like data compression and medical imaging

- Belgian mathematician Ingrid Daubechies and U.S. mathematician David Mumford bring a multidisciplinary focus to scientific theory and practice

- The jury has recognized Daubechies, of Duke University (Durham), for her work on wavelets and her leadership in data compression, with a strong impact on technologies supporting efficient audio and video transmission

- Mumford, of Brown University (Rhode Island), takes the award for his contributions to algebraic geometry and the mathematics of computer vision, and his development of statistical models for imaging and pattern recognition

Madrid, January 22, 2013.- The BBVA Foundation Frontiers of Knowledge Award in the Basic Sciences category has been granted jointly to mathematicians Ingrid Daubechies and David Mumford "for their works in pure mathematics, which have strongly influenced diverse fields of application ranging from data compression to pattern recognition," in the words of the jury's citation.

The two have formulated solutions to varied and complex problems starting from the vantage point of pure mathematics, but guided by a multidisciplinary approach. Curiously, however, their paths have run in opposite directions: while Daubechies trained as a physicist but ended up in mathematics, Mumford's

mathematical research has had considerable influence among theoretical physicists.

The jury singled out Daubechies (Houthalen, Belgium, 1954), a professor at Duke University (United States), for her work on "wavelets, which resulted in a new approach to data compression, with a strong impact on a multitude of technologies, including efficient audio and video transmission and medical imaging."

Mumford (Sussex, United Kingdom,1937), Emeritus Professor at Brown University (United States), is recognized particularly for "his contributions to algebraic geometry and to the mathematics of computer vision. He has applied tools of variational calculus to the theory of vision and developed statistical models for imaging and pattern recognition. His work has had a lasting impact in both pure and applied mathematics."

The two scientists began their careers in strictly theoretical disciplines, but maintaining alert a spirit of intellectual inquiry that has led them into more applied domains.

Mumford, who declared himself "pleased and surprised" by the jury's decision, explained that he was drawn to pure mathematics by a teacher who "made the field of algebraic geometry seem almost magical." His own work, which he describes as "making maps" that offer "a bird's eye view" of algebraic geometry, was impressive enough to earn him the Fields Medal in 1974, aged just 37.

Mapping the brain mathematically

As early as adolescence, Mumford knew that he wanted to explore the workings of the human brain, and after his successes in pure mathematics he was clear that "the time had come to make a change." So after leading the field of algebraic geometry for all of 25 years, he turned in the 1980s to a new problem: how to mathematically render the human ability to understand an image.

"We take for granted the fact that when we enter a strange room, we immediately understand the layout and things we see there, but when people tried to get a computer to do that they discovered it was tremendously hard." One of his insights was that the brain operates by combining previous knowledge with what it is perceiving right now: "If I am walking in Boston and hear something like a growl, I know that it is unlikely to be a tiger, so I recognize, for instance, the engine of a truck." His mission, now being carried forward by his students, is to describe this human ability in mathematical terms.

It is the sheer sweep of Mumford's work that is singled out by his nominator Antonio Campillo, President of the Real Sociedad Matemática Española (RSME): "David Mumford represents all mathematical sciences, and all researchers in mathematics, independently of their field of interest in pure, applied, computational or other areas of mathematics."

A physicist drawn to the beauty of mathematics

Ingrid Daubechies is open in her delight at sharing this award with Mumford. She is a theoretical physicist and, as such, her career began a long way from the signal processing math for which she is now being distinguished. Her move into mathematics was a product of theoretical physics' urgent need for new mathematical tools and models. In her case too, the combination of basic research and applications came about naturally.

Indeed, although her work on wavelets has taken her towards applications, Daubechies refuses to forego the beauty of pure mathematics: "I wanted to preserve all that beauty and be practical at the same time."

Wavelets are a tool that allows to deconstruct a mathematical object, or an image, for example, into simpler components. In practical terms, this deconstruction means we can transmit information-rich images with no loss of quality: "This decomposition into building blocks makes it possible for a soccer game to be transmitted and for the players to be seen really sharply, though maybe not the grass where you don't care so much."

Daubechies' work on wavelets has one of its best known applications in the JPEG 2000 image compression standard, but it is also a powerful instrument for testing theorems in the ambit of basic research in pure mathematics.

Another point of contact between Mumford and Daubechies is their love of interdisciplinarity. Not for nothing does Mumford work in a field – computer vision – where "mathematics are just one small part; you also have engineers, neuroscientists…" And Daubechies will happily turn her mind to problems in other areas such as art: "Someone drew my attention to the fact that image analysis can be used to distinguish an artist's brushstroke," so we can tell, for instance, whether a painting is authentic.

She is now exploring this with art historians, a development that fascinates Mumford: "It's wonderful to see a rather abstract mathematical theory being used in such an unexpected way."

Daubechies' nomination comes from another Spaniard, Manuel de León, a Research Professor with CSIC and Director of its Institute of Mathematical Sciences (ICMAT). León calls her work "a clear example of the power of mathematics," since "anyone who uses computers, internet or digital imaging benefits directly from her achievements."

Mumford and Daubechies have both given proof of their commitment to the mathematical community, as presidents of the International Mathematical Union (IMU). Daubechies has occupied this position since 2010, while Mumford served from 1994 to 1998.

Daubechies stated her main goals on taking up the presidency as to contribute to the growth of mathematics in both developing and rich countries and to improve math teaching at all levels: "Children in high school say they hate mathematics, but what they really hate is the way it is presented to them. Because mathematics

is really just common sense thinking but pushed further. Math explanations start with saying obvious things, then you progress in little steps to get to a non-obvious result."

Bio notes

David Mumford was born on June 11, 1937 in Three Bridges (Sussex, United Kingdom) to an English father and American mother. He thinks his talent for mathematics came from his paternal grandmother, who studied math at the University of Cambridge.

In 1940 his family moved to the United States, and in 1953 he entered Harvard University to study pure mathematics. Among his teachers there was future mentor Oscar Zariski, who would encourage his interest in algebraic geometry. After completing a doctorate at Harvard in 1961, he stayed on in a series of posts before taking up the chair of the Department of Mathematics in 1981. It was during this period that he received the Fields Medal (1974) for his achievements in the field of algebraic geometry.

By the early 1980s, Mumford had turned his attention to computing and brain processes, with the ultimate ambition of developing a mathematic model capable of simulating human thought. He joined the Division of Applied Science at his alma mater in 1985 then, eleven years later, moved to the Division of Applied Math at Brown University, attracted by its interdisciplinary culture. It was here that he conducted his pathbreaking work in the application of mathematics to computer vision.

He was awarded the Wolf Prize in Mathematics in 2008 and two years later received the U.S. National Medal of Science, the highest scientific honor the country can bestow.

He has supervised around fifty PhD theses.

Ingrid Daubechies was born on August 17, 1954 in Houthalen, Belgium, the daughter of a criminologist mother and engineer father. It was her father who got her interested in science, though she also recalls her own eagerness as a child to understand the operation, for instance, of mathematical rules.

Daubechies studied theoretical physics at the Free University of Brussels, where she earned her PhD in 1980. The next year she moved to the United States to pursue a two-year postdoctoral fellowship, after which she returned home supposedly for good. In 1987, however, two years after meeting her future husband, she settled definitively in the United States. He first job was as a member of the technical staff at AT&T Bell Laboratories , where she stayed until 1994. That same year she took up

a professorship in the Department of Mathematics at Princeton University – at age 40, becoming the university's first ever woman appointee to this post.

Daubechies spent the next 16 years at Princeton, where she was active especially in the Program in Applied and Computational Mathematics.

In 2010, she was elected President of the International Mathematical Union, and the next year obtained the Benjamin Franklin Medal for Electrical Engineering and left Princeton to take up her current appointment at Duke University.

BBVA Foundation Frontiers of Knowledge Awards

The BBVA Foundation primarily engages in the generation and diffusion of scientific knowledge and culture, through ongoing programs in the areas of basic sciences, biomedicine, ecology and conservation biology, social sciences, literary and musical creation, and the visual arts.

Its focus on the core concerns of today's society, like health or the environment, has materialized in major research projects, including those involving the study of cancer. The Foundation's support for research, advanced training and knowledge dissemination is also manifest in a series of award families which not only honor the winners' contributions but also shed a wider light on their fields of work, the values they represent and the combined endeavors of the research and creative communities.

The BBVA Foundation established its Frontiers of Knowledge Awards in 2008 to recognize the authors of outstanding contributions and radical advances in a broad range of scientific and technological areas characteristic of our times. They are in this sense a prize family congruent with the knowledge map and central challenges of the 21st century.

The nominations received from leading universities and research and cultural centers all round the world, the independence and objectivity of the prize juries formed by reputed specialists in their respective fields, and the excellence of the laureates in their earlier editions have earned these awards, devised and organized from Spain, a firm place among the world's foremost award schemes. The BBVA Foundation is assisted in this initiative by the country's premier multidisciplinary research organization, the Spanish National Research Council (CSIC), and by the presence of Spanish scientists and creative practitioners on the international juries.

The CSIC collaborates in the appointment of Technical Evaluation Committees for each prize category made up of acknowledged experts in the relevant domain. This Committee undertakes an initial assessment of candidates and draws up a reasoned shortlist for the consideration of the juries.

In the Basic Sciences category, Committee members were Francisco Javier Rojo Marcos, scientific researcher at the Institute for Chemical Research, CSIC-

University of Seville and coordinator of the Council's Chemical Sciences and Technologies Area; Pedro A. Serena Domingo, scientific researcher in the Institute of Materials Science of Madrid (CSIC) and coordinator of its Materials Science and Technology Area; Manuel de León, Research Professor with the CSIC and Director of its Institute of Mathematical Sciences; Francisco José Guinea López, Research Professor in the Institute of Materials Science of Madrid (CSIC); Javier García de Abajo, Research Professor in the Rocasolano Institute of Physical Chemistry (CSIC) and Enric Canadell Casanova, Research Professor in the Institute of Materials Science of Barcelona (CSIC).

The Frontiers awards provide an international showcase for the best qualities of Spain and Spanish science, and have achieved the endorsement of the world scientific community, whose members have served on the juries and put forward nominations from their posts in eminent Spanish and international academic and research institutions.

In their fifth edition, the BBVA Foundation Frontiers of Knowledge Awards wish to offer support and recognition to the individuals and teams working for a better future for people through the advancement of knowledge, innovation and culture and their dissemination to society; goals and practices that are also at the center of the BBVA Group culture.

In an economic context marked by a prolonged economic crisis and the adoption of short-term measures to tackle its multiple causes and manifestations, science, the environment and culture have dropped further down the list of public priorities. The BBVA Foundation Frontiers of Knowledge Awards, and the Foundation's broader program to foster scientific knowledge and culture, wish to drive home the message that these three areas are of transcendental importance for our collective wellbeing and individual opportunities.

The eight categories of the BBVA Foundation Frontiers of Knowledge Awards, each carrying prize money of 400,000 euros, respond to the knowledge map of the early 21st century, but also to key global challenges that have never before merited a specific honor on this scale, as with the two environmental categories – Ecology and Conservation Biology and Climate Change – and the category of Development Cooperation. These stand alongside the classic categories of Basic Sciences, Biomedicine and Economics, Finance and Management. Finally, the award family is completed by Contemporary Music, an art at the leading edge of cultural innovation to which the BBVA Foundation devotes a broad-ranging support program, and where Spain is home to a wide and talented community of authors, conductors and performers.

International jury

The jury in this category was chaired by **Theodor W. Hänsch**, Head of the Division of Laser Spectroscopy at the Max Planck Institute of Quantum Optics (Germany) and Nobel Physics laureate, with **Avelino Corma**, Research Professor in the Department of Catalysis of the Instituto de Tecnología Química, CSIC-Universidad Politécnica de Valencia (Spain) acting as secretary. Remaining members were **Douglas Abraham**, Professor of Statistical Mechanics in the Rudolf Peierls Centre

for Theoretical Physics at the University of Oxford (United Kingdom); **Ignacio Cirac**, Director of the Theory Division at the Max Planck Institute of Quantum Optics (Germany); **Trevor Hastie**, Professor of Statistics and of Health, Research and Policy at Stanford University (United States); **Nigel Hitchin**, Savilian Professor of Geometry at the University of Oxford (United Kingdom); **Hongkun Park**, Professor of Chemistry and Chemical Biology and of Physics at Harvard University (United States); **Martin Quack**, Professor of Physical Chemistry at ETH Zurich (Switzerland); and **Sandip Tiwari**, Charles N. Mellowes Professor of Engineering at Cornell University and Director of the National Nanotechnology Infrastructure Network.

The winners in the previous edition were Swiss astrophysicists **Michel Mayor** and **Didier Queloz** "for their pathbreaking development of new astronomical instruments and experimental techniques that led to the observation of planets outside the solar system."

The award in the third edition went to **Gabor A. Somorjai**, "for his pioneering experimental and conceptual contributions to the understanding of surface chemistry and catalysis at a microscopic and molecular level." In the second edition, the award was shared by **Richard Zare** of Stanford University (United States) and **Michael Fisher** of the University of Maryland (United States), for their fundamental contributions to describing the world at molecular level. Finally, the winners in the inaugural edition were physicists **Ignacio Cirac** and **Peter Zoller** for their contributions to quantum information science.

The BBVA Foundation Frontiers of Knowledge Awards, spanning eight prize categories, recognize research and creative work of excellence as embedded in theoretical advances, technological developments or innovative artistic works and styles, as well as fundamental contributions in addressing key challenges of the 21st century. The Foundation has been assisted in the selection of jury members and candidates by the Spanish National Research Council (CSIC), the country's premier research organization. Nominations have been put forward by the world's most prestigious teaching and research institutions.

UPCOMING AWARD ANNOUNCEMENTS

CATEGORY	DATE
Biomedicine	January 29, 2013
Ecology and Conservation Biology	February 5, 2013
Contemporary Music	February 12, 2013
Economics, Finance and Management	February 19, 2013
Development Cooperation	February 26, 2013

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 name and coordinates.

Server: **213.0.38.61**
Username: **agenciaatlas1**
Password: **amapola**

The name of the video is:
"FBBVA PREMIO CIENCIAS BÁSICAS"

In the event of connection difficulties, please contact Alejandro Martín at ATLAS:

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Fundación **BBVA**

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8