

PROGRAM GUIDE

OCTOBER 1–13, 2011
BLACK SEA & E. MEDITERRANEAN
www.InsightCruises.com/SciAm-10

Saturday, October 1 (Rome)

11:30am **Boarding Begins**

1pm – 3pm **Hospitality Room**
[Kings Rooms]

Pick up your name badge, program guide, meet the Bright Horizons staff, and have your questions answered.

6pm – 7pm **Bon Voyage Cocktail Party**
[Crow's Nest]

Sunday, October 2 (At Sea)

8:30am – 10am **Quantum Man: Richard Feynman's Life in Science**
Lawrence Krauss, Ph.D. — [Main Show Lounge]

It took a man who was willing to break all the rules to tame a theory that breaks all the rules. Learn about the scientific legacy of one of the greatest and most colorful scientists of the 20th century, and in turn get insights into the questions driving the science of the 21st century.

10:30am – 3pm **Settling In**
[Kings Room]

InSight Cruises staff anchor a hospitality suite mid day. It's an optional, casual opportunity to touch base, ask cruise-related questions, and meet your fellow Scientific American travelers. We'll be offering complementary hot and cold beverages, the m.s. Rotterdam's inescapable and irresistible Dutch cookies, and sodas. See you there!

3pm – 4:15pm **Origins and Extinctions***
Michael Benton, Ph.D. — [Main Show Lounge]

Life has existed on Earth for four billion years, punctuated by origins and extinctions. Ever since Darwin, scientists have read the story of evolution from the fossil sequences in rocks. But also, ever since Darwin, paleontologists have been concerned about the quality of the fossil record. On the one hand, it is obvious that only a small selection of all the plants and animals that have ever lived may enter the fossil record and later be found. On the other, the sequence of fossils is more or less expected. From the origin of life to the origin of humans we'll explore the data and look at one of the grandest questions in science: where did we come from . . . and can we be sure? Dr. Benton then explores international research from North America, Russia, China, and Europe on the causes and consequences of extinctions.

4:30pm – 5:45pm **On the Origin of Species, Really***
Mohamed Noor, Ph.D. — [Main Show Lounge]

Although Darwin's book title suggested that he defined the origin of species, in fact, he only focused on the process of divergence within species and assumed the same processes "eventually" led to something that could be called a new species. Dr. Noor will talk about how species are identified (in practice and in principle), how modern evolutionary biologists use this type of information to get a handle on how species are formed, and what questions remain.

**free to watch after the cruise*

6pm – 7:30pm

Animal, Vegetable, Mineral?

Michael Wyssession, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. **Limited to 30 attendees.**

6pm – 7:30pm

Astronomy in Ancient Babylon*

John Steele, Ph.D. — [Wajang / Culinary Arts Center]

Cuneiform writing on thousands of clay tablets documents the astronomical activity of the ancient Babylonians. These texts, circa the first millennium BC, include lists of astrological omens, astronomical observations, and calculations of the positions and phenomena of the moon and the planets. Join Dr. Steele to investigate the astronomical traditions of the ancient Babylonians and their invention of scientific astronomy.

Monday, October 3

8am – 4pm

Katakolon

3:45pm — 5:15pm

Comets and Cometary Concepts in History*

Mark Bailey, Ph.D. — [Main Show Lounge]

Humans have a love-hate relationship with comets, intruders occasionally passing through the inner solar system from a distant source. On human timescales a rare bright comet can be the most prominent visible feature of the night sky, and in past millennia much larger, brighter comets were undoubtedly observed. These great comets must have been a formative influence on mankind's early understanding of the cosmos. We'll take a look at the oldest theories of the nature of comets and the role that they played in the development of astronomy.

Then we'll fast forward to modern cometary theory. The introduction of the 'Oort cloud' circa 1950 together with Whipple's icy nucleus model was a watershed in understanding the origin of comets. But scrutiny of the Oort theory revealed problems with it. Learn how wrestling with these issues ultimately led to greater understanding of cometary dynamics and the evolution of the Oort cloud. Blaze a trail with Dr. Bailey through the historic observations, arguments, and theories leading to the realization that comets are indeed largely Oort cloud products, formed with the Sun and planets 4.5 billion years ago.

5:30pm – 7pm

What is "Evolution" Anyway and Why Should I Care?*

Mohamed Noor, Ph.D. — [Main Show Lounge]

The mere word "evolution" conjures images in the public ranging from movie dinosaurs to something vaguely half-human-half-gorilla. What does the word "evolution" actually mean in the biological sciences, what is the evidence that it is "true", and why should the general public know and care? In fact, evolution affects your everyday life, from your health to your livelihood — come learn why!

Tuesday, October 4

8am – 5pm

Santorini

4:45pm – 5:45pm

Questions of Comets and Small Bodies and their Impact

Mark Bailey, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. **Limited to 30 attendees.**

4:45pm – 5:45pm

The Dark Side of the Universe: From Black Holes, to Dark Matter, and Dark Energy*

Lawrence Krauss, Ph.D. — [Wajang / Culinary Arts Center]

The most interesting things in the universe apparently cannot be seen. Learn why scientists are fascinated by them, and why they hold the key to understanding our origins, and our future.

6pm – 7:30pm

Biology Repartee

Mohamed Noor, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. **Limited to 30 attendees.**

6pm – 7:30pm

Santorini and the History of Megatsunamis*

Michael Wyssession, Ph.D. — [Wajang / Culinary Arts Center]

3600 years ago, Thera/Santorini was the site of a large volcanic eruption, blowing away most of the island, leaving just the island ring and caldera we see today. The Thera eruption buried the Minoan city of Akrotiri under 60 feet of ash, and created a megatsunami that devastated the entire Mediterranean. The U.S. Northwest's 1700 M 9 earthquake, Lisbon's 1755 quake, Krakatoa's 1883 eruption, and the devastating Sumatra 2004 quake created similarly catastrophic tsunamis. Survey the science behind megatsunamis and learn of potential future tsunami triggers.

Wednesday, October 5

4pm – Overnight

Istanbul

8:30am – 10am

An Atom from Greece

Lawrence Krauss, Ph.D. — [Main Show Lounge]

Every atom in your body was once inside a star that exploded. Lawrence Krauss will present the life history of an atom in a glass of wine you will have with dinner, from the beginning of the universe to the end. The story is rich in drama, and surprises, and will leave you thinking differently about your place in the cosmos.

**free to watch after the cruise*

1:30pm – 3pm

Curbside Consultation with a Cosmologist

Lawrence Krauss, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. **Limited to 30 attendees.**

1:30pm – 3pm

**The Antikythera Mechanism:
An Ancient Mechanical Universe***

John Steele, Ph.D. — [Wajang / Culinary Arts Center]

In 1900 sponge divers off the tiny island of Antikythera discovered an ancient Roman shipwreck laden with works of art. Almost unnoticed were the poorly preserved remains of a small mechanical device — the Antikythera Mechanism. It contained gear work to move pointers around scales on its front and rear. Through painstaking reconstruction and analysis over the past century, including CT scanning and digital image processing, we now know the device was a mechanical astronomical computer. Get the details on how persistence and ingenuity revealed unique and surprising information about ancient Greek science and technology.

Thursday, October 6

5pm

Depart Istanbul

4:30pm – 5:45pm

The Dinosaurs of Eastern Europe and the Mediterranean*

Michael Benton, Ph.D. — [Main Show Lounge]

In the days of the dinosaurs, continental drift and sea level change led to ever-changing distribution of land and sea. Given that the areas we will visit on our cruise once consisted of an archipelago of islands like the Caribbean, with isolated dinosaur faunas on some of those islands, how do scientists know where to focus their explorations, and what they might find? Join Michael Benton as he shows you how geologists create paleogeographic maps to locate the dinosaur fauna of what is now Eastern Europe. You'll meet colorful characters from early days of paleontology. Learn how regional research changed during the Iron Curtain days and how new generations of researchers are bringing Europe's unique dinosaurs back to life.

6pm – 7:15pm

**Hiding in the Mirror:
Extra Dimensions, CERN, and the Universe**

Lawrence Krauss, Ph.D. — [Main Show Lounge]

The largest machine humans have ever built has turned on in Geneva, and happily has not created a black hole that has destroyed the world. But what might be discovered there, and will it tell us that there is, literally, infinitely more to the universe than meets the eye?

Friday, October 7

8am – 3pm

Varna

3pm – 4:30pm

The Life, Times, and Persistent Puzzles of Comets

Mark Bailey, Ph.D. — [Wajang / Culinary Arts Center]

Broaden your horizons delving into 20 years' worth of discoveries on comets and their origins — whether in the Edgeworth-Kuiper belt just beyond Neptune, the trans-Neptunian disc, or the Oort cloud. Survey the natural history of comets in the inner solar system, and discover the persistent puzzles and uncertainties in this vibrant, active field of solar-system research.

3pm – 4:30pm

**Particle Physics — Using Small Particles to Answer
The Big Questions**

James Gillies, Ph.D. — [Main Show Lounge]

Particle physics is a science of extremes, studying the tiniest constituents of matter using the largest machines ever built. Human beings have always been curious about their surroundings. That's why Columbus sailed the ocean blue, why men have walked on the moon, and why particle physics labs like CERN exist.

In Western scientific tradition, particle physics traces back to the Greeks Leucippus of Miletus and Democritus who developed the idea of atomism. They wondered whether if a substance were repeatedly cut in half there would be a smallest indivisible unit of that substance: an "atom". Particle physics is the study of nature's true atoms — the smallest indivisible pieces of matter — and the forces that act between them. Focusing on CERN's latest research facility, the Large Hadron Collider (LHC), get the big picture of the state of the art and challenges that lie ahead in particle physics. James Gillies will outline some of the experiments at the LHC which may provide answers to big questions: Why do the fundamental particles have the masses they have? What is the nature of dark matter? What's the reason for nature's preference for matter over antimatter? Join the group and chart a course for CERN's exploration of persistent issues in particle physics.

4:45pm – 6:15pm

**Changing Climates, the Black Sea Flood,
and the Rise of Civilization**

Michael Wyssession, Ph.D. — [Main Show Lounge]

Near the end of the last Ice Age, 20,000 years ago, global sea levels were about 400 feet lower than they are today. Climates warmed, ice melted and the sea level rose, continuously flooding shoreline communities and forcing people inland. Many of our earliest settlements, the "Edens" of many different cultures, now lie underwater. About 7500 years ago the Mediterranean Sea rose high enough that it broke through the Bosphorus, past what is now Istanbul, and catastrophically flooded the Black Sea triggering mass migrations out of Eastern Europe toward the Middle East and Africa. This is only one example of a long sequence of geologic events triggered by changing climates that have shaped the course of human history.

The philosopher Will Durant said, "Civilization exists by geologic consent, subject to change without notice." The history of climate change richly illustrates this. Climate change is one of the most complex and politically charged areas of Earth science. Join Dr. Wyssession as he examines the many different natural factors that control the climate and how the his-

*free to watch after the cruise

tory of climate change has been the driving factor for the course of human history: causing famines, droughts, wars, plagues, and the rise and fall of human civilizations. Enrich your understanding of the natural causes and impact of climate change so you can discerningly examine contemporary issues.

6:30pm – 7:45pm Modern Questions, Ancient Answers

John Steele, Ph.D. — [Hudson]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. *Limited to 30 attendees.*

6:30pm – 7:45pm Origins of Modern Biodiversity*

Michael Benton, Ph.D. — [Wajang / Culinary Arts Center]

Life today is hugely diverse. Darwin wondered at this richness, and argued that life was more diverse than it had to be! Research efforts now concentrate on reconstructing the evolutionary 'tree of life' using genomes and fossils, bound by massive computing power. What do these new evolutionary trees tell us about modern biodiversity? Are some groups unusually rich in species, and others ('living fossils') perhaps not? Why should that be? Get the scoop on biodiversity and the latest on biogeographic investigations, fossil data, and number crunching of the new genomic sequences.

Saturday, October 8

8am – 5pm Odessa

4:30pm – 5:45pm Eclipses in History

John Steele, Ph.D. — [Main Show Lounge]

Throughout history eclipse have been observed with fear, excitement, astonishment, and scientific curiosity. Explore how eclipses have been observed, interpreted, and commemorated in different cultures around the world, and learn how scientists today actively benefit from ancient eclipse records.

6pm – 7:15pm Meteors, Meteor Showers, and the Draconids

Mark Bailey, Ph.D. — [Main Show Lounge]

Meteors or shooting stars are fragments of dust from comets, burning up in the Earth's atmosphere. The time of this lecture coincides with a predicted outburst of the annual Draconid meteor shower, caused by dust from comet Giacobini-Zinner. It is expected that activity will increase to a peak over a 2- to 3-hour period beginning around 8pm (ship time), with up to several hundred meteors per hour possibly being seen, depending on local weather conditions. After a brief introduction to meteors and meteor storms, we go up on deck to observe the "dragons'" fiery flame.

9:30pm DRACONID METEOR SHOWER !

[Sky Deck, Forward (above the Crow's Nest)]

"Every year around Oct. 8th, Earth passes through a minefield of dusty debris from Comet Giacobini-Zinner, source of the annual Draconid meteor shower. On Oct. 8, 2011, Earth will have a near head-on collision with a tendril of dust, setting off a strong outburst of as many as 750 meteors per hour. People in Europe, Africa and the Middle East will have a front-row seat for what could be the strongest shower since the Leonid storms a decade ago." **From SpaceWeather.com**

Sunday, October 9

8am – 5pm Yalta

4:30pm – 6pm Curbside Consultation with a Particle Physicist

James Gillies, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. *Limited to 30 attendees.*

**4:30pm – 6pm Genetics, Genomics, and You:
Don't Fear Your Genotype! (Part 1)***

Mohamed Noor, Ph.D. — [Wajang / Culinary Arts Center]

The missing element to Darwin's theory was how it worked in terms of inheritance. Genetics answered that. Today we can't imagine a time without genetic science. "Personal genomics" issues span medical, legal, ethical, and other areas and pose big questions: possible benefits? what to watch out for? and what the hairy heck does it all mean? Get ready for discussion and "lab exercises" (Part 2, Monday, October 10) to help understand the lingo, opportunities, and issues associated with living in the genomics era.

6:15pm – 7:45pm Mass Extinction of Questions

Michael Benton, Ph.D. — [Hudson Room]

Here's a relaxed opportunity to ask questions, exchange ideas, and kibitz with Bright Horizons speakers and fellow attendees. You can nibble on hot hors d'oeuvres and Crudit , partake of cold beverages (soda, juice, cocktails, wine, and beer — on the house!) and temporarily quench your thirst for answers. *Limited to 30 attendees.*

**6:15pm – 7:45pm The Large Hadron Collider —
the World's Most Complex Machine***

James Gillies, Ph.D. — [Wajang / Culinary Arts Center]

Colder than outer space, yet hotter than the heart of the sun, and the fastest particle racetrack on the planet: the LHC is a machine of superlatives. It is a triumph of human ingenuity, possibly the most complex machine ever built, and its primary function is to produce new knowledge.

Three ingredients are necessary to carry out research at the high-energy frontier of particle physics: an accelerator to boost particles to almost the speed of light and make them collide, detectors to observe those collisions, and computing infrastructure to analyze the results. When the LHC was first dreamed up in the 1980s, the technology for all of these things did not exist, but that kind of detail has never deterred particle physicists in the past.

For the computing, a new paradigm — Grid computing — is being forged. The detectors are larger and more complex by orders of magnitude than their predecessors. And the accelerator itself is pushing back the frontiers of innovation in many domains.

Refine your understanding of the lineage of particle physics technologies from the invention of particle accelerators in the 1920s up to today. Then we'll focus on the LHC itself, laying out how accelerators and related tools have both allowed us to make phenomenal progress in understanding the Universe, and revolutionized our every day lives.

**free to watch after the cruise*

Monday, October 10 (At Sea)

8:30am – 10am **The Life and Times of the Dinosaurs***

Michael Benton, Ph.D. — [Main Show Lounge]

Many people think the pictures of dinosaurs, and their moving images in museums and media, are largely imaginary. Go behind the scenes with Dr. Benton and dig in to the modern scientific methods used to understand how these amazing animals functioned. Paleobiologists meld three methods: (1) Fossil information; (2) Analogy with modern animals; and, (3) Biomechanical testing. Fossils show us the bones and skeletal structures. But they also show less expected things such as tracks (and so speeds of movement), eggs and nests, gut contents, and excrement. Some experiments include close comparisons with modern animals to judge which behaviors were likely and unlikely. You'll be able to look at dinosauria with heightened awareness of both the biological nuance and engineering tools that bring these ancient giants to life for us.

10:30am – Noon **Noor Genetics Lab — Part 2 of Genetics, & 1:30pm – 3pm **Genomics, and You: Don't Fear Your Genotype!****

Mohamed Noor, Ph.D. — [Kings Room]

The missing element to Darwin's theory was how it worked in terms of inheritance. Genetics answered that. Today we can't imagine a time without genetic science. "Personal genomics" issues span medical, legal, ethical, and other areas and pose big questions: possible benefits? what to watch out for? and what the hairy heck does it all mean? Get ready for discussion and "lab exercises" to help understand the lingo, opportunities, and issues associated with living in the genomics era.

1:30pm – 3pm **Relax, chat, free drinks!**

[Hudson Room]

3pm – 4:15pm **Ancient Greek Astronomy**

John Steele, Ph.D. — [Main Show Lounge]

How could Ptolemy insist that the Earth was the center of the Universe? The ancient Greeks didn't invent astronomy, but they were the first to combine philosophy with mathematics to model the motion of the heavens using geometry. Along the way they figured out the size of the Earth, the distance of the moon from the Earth and developed geometrical methods for modeling the motion of the planets that formed the basis of astronomy until Kepler in the 17th century. Get all the angles on Greek astronomy (including why Ptolemy insisted the Earth was the center of the universe) so you can spot its influence in medieval Islamic astronomy, Renaissance developments, and far more.

4:30pm – 5:50pm **The Eruption of Vesuvius and the Impact of Volcanoes**

Michael Wysession, Ph.D. — [Main Show Lounge]

Our trip starts in Italy, home of the first documented volcanic eruption. When Vesuvius erupted in the year 79, Pliny the Younger recorded the details of this catastrophic and unforeseen event.

Named in his honor, the "Plinian" style of volcanic eruption can eject many cubic miles

of ash high in the atmosphere, but the greatest impact is not locally, but globally through a change in climate. The ash and aerosols injected into the atmosphere block out sunlight and can cause a drop in global temperatures for many years. For example, if you've studied Modern European History, you might think of several reasons why the French Revolution occurred. However, it was actually triggered by extensive volcanism in Iceland that caused terrible famines in France. The "year without a summer" in 1816, when starving Americans moved westward across the Mississippi, was caused by the Tambora eruption in Indonesia. A Peruvian eruption in 1600 led to famines in Russia and the collapse of the rule of Boris Godunov. The giant eruption of Toba (also in Indonesia) 74,000 years ago may have nearly wiped out humans and many other large mammals. And the site of some of largest eruptions in geologic history, Yellowstone, sometimes rises at a rate of 7cm/year as magma upwells under the caldera again. Michael Wysession syncs up history and geologic destiny to give you a new understanding of the large number of volcanic eruptions that have impacted human history.

6pm – 7:15pm **Angels, Demons, Black Holes and Other Myths — Demystifying the LHC**

James Gillies, Ph.D. — [Main Show Lounge]

Along with humankind's natural curiosity comes a fear of the unknown. As we approached the LHC's first beam day in 2008, a handful of self-proclaimed experts struck up an end-of-the-world tune. (In a wonderfully ironic twist, the vehicle that carried the message was made at CERN: it was the World Wide Web.)

Like its predecessors, the Large Electron-Positron Collider (LEP) and Relativistic Heavy Ion Collider (RHIC), the LHC never posed the slightest risk to humanity. However, the dangerous scientist has always made for a good story and that's something that Dan Brown exploited to the full when writing *Angels and Demons*. Dr. Gillies will cover the fact behind the fiction of *Angels & Demons* and black holes at the LHC, and share the behind-the-scenes on how CERN lived with the hype.

6pm – 7pm **Life in the US Academic Sciences**

Mohamed Noor, Ph.D. — [Wajang / Culinary Arts Center]

What happens behind closed doors in the "Ivory Tower" of an academic scientist? Scientists at universities juggle multiple roles spanning lecturing and course management, executing an independent research program, service to the university and their profession, and outreach to the broader public. So what do these scientists actually do all day? What are these people trained well to do and in what areas are they really not trained well? What is a typical career trajectory in the sciences, and how are academic scientists evaluated? If you're game to expand your politics/sausage/academic science knowledge, get an insider's orientation from Professor Mohamed Noor.

Tuesday, October 11

8am – 5pm **Kusadasi**

4:30pm – 7:30pm **Relax, chat, free drinks!**

[Hudson Room]

*free to watch after the cruise

4:30pm – 6pm

Fermi's Paradox and the Likelihood of Finding Another Planet Like Earth*

Michael Wyssession, Ph.D. — [*Wajang / Culinary Arts Center*]

During a discussion on the likelihood of intelligent civilizations existing elsewhere, the physicist Enrico Fermi asked "Well, where is everybody?" From woolgathering to NASA research, the question of whether we are alone in the Universe has long occupied us. Geologic research shows that the conditions required for life to exist continuously for nearly 4 billion years are stringent, and may rarely occur in the galaxy. Astronomy has identified more than 400 planets revolving around other stars, but not one of them is Earthlike. Get the recipe for the right stuff and learn all of the Goldilocks factors that had to occur to produce Earth's spectacular and potentially unique diversity of geologic and biologic environments.

6:15pm – 7:30pm

Risks Posed by Comets and Asteroids and Their Wider Impact*

Mark Bailey, Ph.D. — [*Wajang / Culinary Arts Center*]

Comets and cometary debris, as well as 'rocky' material from the main asteroid belt, occasionally descend on the Earth with catastrophic effect. At one extreme, such impacts can change the course of evolution of life on our planet, disrupting normal 'Darwinian' evolution caused by small adaptations to a slowly changing environment. At another extreme, relatively small impacts may have important implications for the evolution and development of civilization. Find out how the risk of rare, high-consequence events is assessed. That's the easy part. Next, delve into the big questions. Is the 'risk' of cometary impacts one that we — either as individuals or as part of the global village — should take seriously? Is humanity wise enough to control technology that could, at some time in the future, enable a potentially hazardous comet or asteroid to be deflected away from Earth? Or is it better, given all the uncertainties, to accept the risk of living in a cosmic shooting gallery without practical means of defense? While they seem the stuff of science fiction, Dr. Bailey deems these technological and philosophical questions legitimate food for thought, and gives you the tools to consider them.

SPEAKER PROFILES

Mark Bailey, Ph.D., the Director of Armagh Observatory, is an Honorary Professor at Queen's University Belfast, and a former Vice President of the Royal Astronomical Society. He obtained his first degree in Physics at the University of Cambridge, and a Ph.D. at the University of Edinburgh in 1978 with a thesis on the evolution of active galactic nuclei. In recent years his research has focused on areas closer to home: the dynamical evolution of comets, asteroids, and meteoroid streams; solar-system/terrestrial interrelationships; and aspects of the comet and asteroid impact hazard. He has published nearly 100 scientific papers and several books, notably *The Origin of Comets* (co-authored with Clube and Napier) and *Border Heritage*, describing the work of the Armagh Observatory and the heritage of the City of Armagh and Monaghan County. Highlights of this work include the first paper to describe a new method to detect small solar-system objects at large heliocentric distances; early work on the inflow of stellar mass loss in elliptical galaxies and the bulges of spiral galaxies ultimately to fuel nuclear activity; and calculations of the velocity dispersion profiles of galaxies and clusters of galaxies in which the visible and dark matter have different assumed density distributions. The asteroid (4050), discovered in 1976 by C.I. Lagerkvist, was named "Me Bailey" in 1990 for his work on the dynamics and origin of comets. He was awarded an MBE for services to astronomy in 2007 and elected a Member of the Royal Irish Academy in 2010.

Mike Benton, Ph.D. is Professor of Palaeontology at the University of Bristol, where he has been on the staff since 1989. He was Chairman of the Department for seven years. His research interests focus on the diversification of life, mass extinctions, and dinosaur evolution, and he has written over 200 scientific papers. He has led field expeditions to collect dinosaurs and other fossil reptiles to Romania, Tunisia, Russia, and China. He also has a strong commitment to public engagement, and has written over 50 books, mainly for children, as well as the two standard textbooks in the field. He has been honored by numerous awards, including the Lyell Medal of the Geological Society of London and Fellowship of the Royal Society of Edinburgh, and he is currently President of the International Paleontological Association.

James Gillies, Ph.D. is head of communication at CERN, the European Organization for Nuclear Research. He holds a Doctorate in physics from the University of Oxford, and began his research career working at CERN in the mid-1980s. His thesis covered the internal structure of the proton, and was carried out in a multi-national collaboration of mainly European universities. As a post doctoral researcher, he moved on to the OPAL experiment at CERN's flagship research facility, the Large Electron Positron collider (LEP), which ran from 1989 to 2000.

In 1993, he left research to become Head of Science with the British Council in Paris. After managing the Council's bilateral programme of scientific visits, exchanges, bursaries, and cultural events for two years, he returned to CERN in 1995 as a science writer. His work at the British Council ranged from negotiating student exchange programmes for top French and UK Universities, to organizing a drawing competition for school children in conjunction with the BBC's youth magazine programme, Blue Peter, and the French magazine Science et Vie Junior.

He has been Head of the Organization's communication group since 2003, a period in which CERN has celebrated its 50th anniversary and launched its latest research facility, the Large Hadron Collider. The 2008 LHC first-beam media campaign run by his team made CERN and the LHC household names around the world, and with an estimated global audience of a billion viewers, the LHC start-up was possibly the most visible scientific event in history.

He is co-author of the Oxford University Press title, *How the Web was Born*, a history of the Internet published in 2000 and described by the London Times as being among the year's ten best book for inquisitive minds.

Lawrence Krauss, Ph.D. is Foundation Professor, Director, Origins Initiative, and Co-Director, Cosmology Initiative of the School of Earth and Space Exploration, Beyond Center, and Department of Physics, Arizona State University.

Dr. Krauss was born in New York City and shortly afterward moved to Toronto, spending his childhood in Canada. He received undergraduate degrees in Mathematics and Physics from Carleton University in 1977, and his Ph.D. from the Massachusetts Institute of Technology in 1982. He became an assistant professor at Yale University in 1985. He was named the Ambrose Swasey Professor of Physics, Professor of Astronomy, and was Chairman of the Department of Physics at Case Western Reserve University from 1993 to 2005.

His research has been based on an attempt to explore how phenomena at various extremes of scale can be used to probe fundamental physics. Dr. Krauss has become increasingly interested in utilizing the Universe as a laboratory to study fundamental physics. He has been active in the emerging field of particle astrophysics, in which both the cosmological implications of ideas concerning fundamental interactions, and astrophysical and cosmological constraints on particle physics are explored.

Among the areas in which Krauss' research has focused are: neutrino physics and astrophysics, big bang nucleosynthesis, gravitational lensing, dark matter theory and detection, particle physics phenomenology beyond the Standard Model, axions and the strong CP problem, symmetry breaking in the Standard Model and the cosmology and physics of the electroweak phase transition, ultra-sensitive laboratory probes of new physics at high energy scales, stellar evolution, general relativity and gravitation, early universe physics, gravitational waves, and the physics of black holes and quantum gravity. Krauss is a critic of string theory.

Among Dr. Krauss' honors are the highest awards of all three major U.S. Physics Societies: the American Physical Society, the American Association of Physics Teachers, and the American Institute of Physics. Krauss received the Gravity Research Foundation First prize award in 1984, the Presidential Investigator Award in 1986, the American Association for the Advancement of Science's Award for the Public Understanding of Science and Technology in 2000, the Julius Edgar Lilienfeld Prize and Andrew Gemant Award in 2001, the American Institute of Physics Science Writing Award in 2002, the Oersted Medal in 2003, and the American Physical Society Joseph P. Burton Forum Award in 2005.

Dr. Krauss believes that science is in part a vital cultural activity and so regularly appears in national media for public outreach in science and has written many editorials for *The New York Times*. In 2009–10 he wrote a monthly column for *Scientific American*. He has been particularly active in issues of science and society, leading the effort by scientists to defend the teaching of science in public schools and is co-chair of the Board of Sponsors of the *Bulletin of the Atomic Scientists*, and on the Board of Directors of the Federation of American Scientists.

Dr. Krauss has written non-academic books, among them:

- *Quantum Man*
- *The Fifth Essence*
- *Fear of Physics*
- *The Physics of Star Trek*
- *Beyond Star Trek*
- *Quintessence*
- *Hiding in the Mirror*

Mohamed A.F. Noor, Ph.D., Professor and Associate Chair of the Duke University Department of Biology, tells us that one of the greatest unsolved questions in biology is how continuous processes of evolutionary change produce the discontinuous groups known as species. With the continued loss of species worldwide from human activities, work arising from this question will become increasingly important in identifying the processes that generate and maintain biodiversity on the planet.

Dr. Noor has focused on understanding the processes that cause the evolution of barriers to gene exchange between diverging species, particularly hybrid sterility and species mating discrimination. The work has strong evolutionary and medical implications. Understanding the nature of genetic interactions causing sterility gives direct insights into what makes one species different from another, and hence, can explain the process of the origin of new species. In addition, insights on genetic interactions causing sterility can help identify other genes whose disruptions in humans may cause infertility.

Dr. Noor earned a B.S. in Biology from the College of William and Mary, 1992 and a Ph.D. in Ecology & Evolution from the University of Chicago in 1996. He was a postdoctoral resident in Genetics & Development at Cornell University from 1996–1998. He served on the faculty at Louisiana State University from 1998 to 2005 and received a College of Basic Sciences Research Award, an LSU Phi Kappa Phi Untenured Faculty Award in Natural and Physical Sciences, and a Louisiana State University, College of Basic Sciences Undergraduate Teaching Award. Dr. Noor won the 2007 Gordon G. Hammes Faculty Teaching Award and a 2010 Dean's Award for Excellence in Mentoring from Duke University, and in 2008, he was one of 13 evolutionary biologists to be honored with the Darwin Wallace Medal — an award given by the Linnean Society of London only once every 50 years!

Dr. Noor is currently on the editorial boards of *PLoS Biology*, the *Proceedings of the Royal Society of London*, and *BMC Evolutionary Biology*. He serves as chair of the Genetic Variation and Evolution grant review panel at the NIH and is an elected Council member for both the Society for the Study of Evolution and the American Genetics Association. Noor was editor of *Evolution* 2006–2007 and associate editor of *Evolution* 2001–2005.

Among other endeavors, Dr. Noor and his Noor Lab team are now examining the fine details of the genetic architecture of the chromosomal rearrangements that occur when one animal species becomes two. In the few minutes per week he doesn't find himself working, Noor relaxes by running, spending time with his family, or watching movies, particularly science fiction.

John Steele, Ph.D. is Associate Professor of the Exact Science in Antiquity in the Department of Egyptology and Ancient Western Asian Studies at Brown University. He is a specialist in the history of ancient astronomy, in particular the astronomy of the ancient Babylonians. His books include *Observations and Predictions of Eclipse Times by Early Astronomers* (2000) and *A Brief Introduction to Astronomy in the Middle East* (2008), and he has published research papers in journals including *Nature*, the *Journal for the History of Astronomy*, *Annals of Science*, and the *Journal of Cuneiform Studies*.

Steele received his B.Sc. in Physics and a Ph.D. in History of Astronomy from the University of Durham and has held research and teaching positions at the University of Durham, the University of Toronto, and the Dibner Institute for the History of Science and Technology at MIT. In 2008, Steele was recruited by Brown University to continue their long record of research into the history of ancient mathematics and astronomy.

Steele's research has included the reconstruction of Babylonian methods of predicting eclipses of the sun and moon, the discovery of Babylonian theories for modeling the latitude of the planets, and he has worked with members of the Antikythera Mechanism Research Project on the ancient Greek geared-computer known as the Antikythera Mechanism.

Michael Wyession, Ph.D. is an Associate Professor of Geophysics in the Department of Earth and Planetary Science at Washington University, St. Louis, who has established himself as a world leader in the area of seismology and geophysical education. He has developed several means of using the seismic waves from earthquakes to “see” into the Earth and create three-dimensional pictures of Earth's interior. Wyession is lead scientist author of Pearson Prentice Hall's new national K-8 science textbook program and lead author of Prentice Hall's 9th grade physical science book, *Physical Science: Concepts in Action*, and has supervised, in the role of primary book writer, several other secondary education textbooks such as Prentice Hall's 9th grade text *Earth Science*, and their 6th grade-level texts *Earth's Interior*, *Earth's Changing Surface*, and *Earth's Waters*. Wyession is the creator and lecturer of an acclaimed 48-lecture video course with The Teaching Company entitled *How the Earth Works*. He is coauthor of *Introduction to Seismology, Earthquakes, and Earth Structure*, a leading graduate-level textbook used in geophysics classes around the world. Wyession constructed the first computer-generated animation of how seismic waves propagate within the Earth from an earthquake, creating a 20-minute movie that is used in many high school and college classrooms. He is also the designer and instructor of an intensive 3-day course, *Earth, Moon, and Mars*, which he regularly teaches to NASA engineers at the different NASA centers.

Wyession was recently Chair, for four years, of the Education and Outreach program of the Incorporated Research Institutions for Seismology (IRIS), and is Chair the NSF-sponsored Earth Science Literacy Initiative, where he led the creation of a single document of big ideas and supporting concepts that every citizen should know about Earth science (www.earthscienceliteracy.org). The National Academy of Science is currently revising the 15-year-old National Science Education Standards, and Wyession is Earth and Space Science Team Leader for the standards framework.

Wyession's research and educational efforts have been recognized through several fellowships and awards. He has received a Science and Engineering Fellowship from the David and Lucille Packard Foundation, and a National Science Foundation Presidential Faculty Fellowship, awarded by President Clinton (both awarded to only 20 American scientists across all disciplines for the year). Wyession has also received two Distinguished Lectureships: from the Seismological Society of America and Incorporated Research Institutions of Seismology in 2005, and from the National Association of Geoscience Teachers in 2009. Wyession has also been given the Innovation Award of the St. Louis Science Academy and the Distinguished Faculty Award of Washington University.

