BRIGHT HORIZONS #8 PROGRAM

Thursday, Oct. 28, 2010 — All Aboard in Genoa (Noon)

6pm – 7pm **PARTY (in the Capri Lounge)**

Friday, Oct. 29, 2010 — At Sea

8:30am – 10am **Particle Physics — Using Small Particles to Answer The Big Questions**
James Gillies, Ph.D.

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.

10:30am – Noon **General Organization of the Central Nervous System**
Jeanette Norden, Ph.D.

We begin with an introduction to how the central nervous system is divided into structural and functional areas. This knowledge will allow us to understand why after a stroke an individual might be blind, but not know it; why an individual might lose the ability to speak, but not to understand language; why an individual might be able to describe his wife's face, but not be able to pick her out in a crowd.

1:30pm – 3pm **A Tour of the Universe: Astronomy's Three Kingdoms**
Steven Dick, Ph.D.

Our view of the universe has changed radically over the last century, from a static anthropocentric cosmos a few thousand light years in extent to a dynamically evolving universe encompassing billions of light years. An entire bestiary of exotic objects such as pulsars, quasars, and black holes has been unveiled. Journey from our solar system through billions of light years of space and time as we explore astronomy's three kingdoms: the planets, the stars, and the galaxies.

3:30pm – 5pm **Science Rules the Earth — OK?**
Michael Coey, Ph.D.

Robustly polemical, but insistently evidence-based, William Gilbert's De Magnete (c. 1600) was the first modern scientific text. His insight that the Earth was a great magnet and insistence that data trumps speculation led to the heroic magnetic crusade of the 1830s, an understanding of how the Earth moves by plate tectonics, sunspots, and a way to date pottery. As scientists gradually distinguished themselves from charlatans and artisans by the truth and predictive power of their magic, Galvani's animal electicity led to neurophysiology, Mesmer's animal magnetism led nowhere.

6pm – 7:30pm **Angels, Demons, Black Holes and Other Myths — Demystifying the LHC**
James Gillies, Ph.D.

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.

Saturday, Oct. 30, 2010 — Malaga, Spain (Noon – 6pm)

6pm – 7:30pm **The Large Hadron Collider — the World's Most Complex Machine**
James Gillies, Ph.D.

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.

Sunday, Oct. 31, 2010 — Casablanca (7:30am – 9pm)

No classes or InSight Cruises events this day

Monday, Nov. 1, 2010 — Cadiz, Spain (9am – 7pm)

6:30pm – 7:30pm **PARTY**

Tuesday, Nov. 2, 2010 — Lisbon, Portugal (9am – 7pm)

6:30pm – 7:30pm **Subatomic Frontiers of Radiation Therapy**
James Welsh, M.D.

The connection between quarks and cancer therapy might at first appear a bit obscure but hadrons may prove to be a critical component of twenty-first century oncology. As counterparts to the six leptons of the Standard Model, the six quarks (along with their antiparticles) combine into mesons and baryons — the so-called hadrons. Presently, proton therapy is gaining attention thanks to some technological advances that might make this formerly exotic treatment more widely available. The name hadron comes from the Greek word for "strong" because their interactions are dominated by the strong force. The name may prove doubly apt since it requires some strong medicine to battle our ancient enemy, cancer.
In this lecture we shall review the basic molecular and cellular mechanisms whereby normal cells transform into cancer cells and then discuss some of the means through which this understanding has been exploited, such as the advent of the molecular targeted therapies. We shall then briefly review some principles of radiobiology and radiation therapy. Finally we will review some basics of the Standard Model and how this relates to the next frontier in cancer management — hadron therapy.

Wednesday, Nov. 3, 2010 — At Sea

8:30am – 10am **Life on Other Worlds**
Steven Dick, Ph.D.

The discovery of life beyond Earth would be one of the greatest events in the history of science. Where do we stand in the search for life, both inside the solar system and beyond? What are the major questions as NASA's Kepler spacecraft stands on the verge of discovering thousands of extrasolar planets that may be similar to the Earth? And what would be the impact of the discovery of extraterrestrial intelligence on our society? We are at a unique time in history, and perhaps on the verge of a new world view.

10:30am – Noon **Cellular and Molecular Organization of the Central Nervous System**
Jeanette Norden, Ph.D.

In this session we will focus on the structure of individual neurons and on how neurons in the central nervous system are believed to be connected to each other by an estimated 100 trillion synapses. This understanding of the structure of individual neurons and on how neurons communicate with each other allows us to have insight into disorders as diverse as depression and multiple sclerosis.

1:30pm – 3pm **The End of an Aether**
Michael Coey, Ph.D.

The modern world began in 1820, when Hans-Christian Oersted stumbled on the connection between electricity and magnetism. The news spread like wildfire across Europe as electromagnetism spawned motors and generators, electric trains and mains power, telegraphs, radio and magnetic recording — all before 1900. If Maxwell's equations were the greatest intellectual achievement of the century, the origin of magnetism was one of its greatest puzzles — a puzzle that could only be understood with relativity, quantum mechanics, and Dirac's electrons with spin.

3:30pm – 5pm **Parkinson's Disease and Other Disorders of the Motor System**
Jeanette Norden, Ph.D.

Movement is a complex behavior controlled by a number of different subsystems in the brain and spinal cord. Knowing what each of these subsystems does to allow us to move in space will provide the knowledge necessary to understand the loss of normal motor movement in Parkinson's disease, spinal cord injury, and other disorders of the motor system.

6pm – 7:30pm **Exploration, Discovery, and Culture: The Importance of the Space Age**
Steven Dick, Ph.D.

Fifty years into the Space Age and 40 years after the Apollo program landed 12 men on the Moon, NASA and humanity are at a turning point. Should humans return to the Moon and go to Mars? Are our robotic emissaries enough? What are the motivations for spaceflight? Should we spend money on space with so many problems on Earth? In this session we will contemplate the importance of exploration to culture, comparing and contrasting the Age of Space to the Age of Discovery 400 years ago.

Thursday, Nov. 4, 2010 — Valencia, Spain (Noon – 7pm)

8:30am – 10am **What the Ancients Knew**
Michael Coey, Ph.D.

The mysterious behaviour of lodestones — rocks naturally magnetized by lightning strikes — and their strange love for iron was known in ancient China, Greece, Sumer, and Mesoamerica. The directional property, attributed to the heavens, was used first for geomancy and then, a millenium later when occult knowledge became public, for navigation. The great voyages of discovery of Africa by the Chinese and America by the Europeans all depended on the compass. The ancients dreamt of levitation and perpetual motion. So do we.

10:30am – Noon **Alzheimer's Disease**
Jeanette Norden, Ph.D.

Alzheimer's disease is the most common neurodegenerative disease in the United States. We will explore what is currently known about this devastating disorder, and about the specific areas of the brain which are affected. Next we discuss the risk factors associated with Alzheimer's disease. Finally, we will end this lecture series with a discussion of what you can do to decrease your risk of getting this disease and on how to keep your brain healthy!

6:30pm – 7:30pm **Tectonics of Continental Margins Around the Eastern Mediterranean Sea**
Zvi Ben-Avraham, Ph.D.

We know the fate of the Mediterranean basin. Nestled in the midst of Africa-Eurasia convergence, it is progressively shrinking and will eventually vanish. Basin margins record these dramatic events. Normally, after continental breakup, margin formation, sediment accumulation, and plate tectonics relax and the margins become passive for millions of years. The passive days of the Mediterranean's northern African margins are soon to be over. The Mediterranean seafloor is being consumed, sliding northward under the seismically active Calabrian, Ionic, Hellenic, and Cyprian margins. Tune in to Dr. Ben-Avraham's discussion of the geological, ecological, and human consequences of the geological evolution of the Mediterranean basin.

Friday, Nov. 5, 2010 — Barcelona, Spain (8am – 1pm)

1:30pm – 3pm **Billions of Magnets for Billions of People: How and Why**
Michael Coey, Ph.D.

The mystery of magnetism was solved in 1930, but it was only when the shape barrier was shattered in 1950 that the technology that serves our modern lives could emerge. Set free from the straightjacket of bars and horseshoes, the quality of magnets began to double every ten years. In this session you'll learn that small, powerful rare-earth magnets power countless gadgets from screwdrivers to carrot slicers but, more importantly, that one of the greatest modern miracles is magnetic recording.
Why and how have magnets multiplied a billion-fold? Is it true that today we now make more magnets than we grow grains of rice? In this session you'll get the answers to these questions, plus answers to questions you hadn't even pondered.

3:30pm – 5pm **The Dead Sea Fault and its Effect on Civilization**
Zvi Ben-Avraham, Ph.D.

The Dead Sea fault (DSF) is the most impressive geological feature in the Middle East. It is a plate boundary, which transfers sea floor spreading in the Red Sea to the Taurus collision zone in eastern Turkey. The DSF has influenced many aspects of this region, including seismicity and ground water availability. It may have even affected the course of human evolution — the DSF is an important part of the corridor through which hominids set off out of Africa. Join Dr. Ben-Avraham for a look at the remarkable paleoseismic history of the DSF, going back about 70,000 years. Learn how geological activity affected human history and politics in ancient days, and how the interplay of geology, ecosystem, and human activity are of ongoing concern and discussion.

6pm – 7:30pm **Cosmic Evolution and Human Destiny**
Steven Dick, Ph.D.

For the first time in history, we can see our true place in the universe in the context of 13.7 billion years of cosmic evolution, from the Big Bang to the present. What are the implications of our new understanding of space and time for humans, both in the short term and the long term? How does it affect our religions and philosophies? And what is the long-term destiny of humans? Join us in a journey through science fiction, science fact, and scientific extrapolation into the future as we ponder human destiny in the context of our new view of the universe.

SPEAKER PROFILES

Zvi Ben-Avraham, Ph.D. is Professor of Geophysics, the Mikhael Moshe Nebenzahl and Dr. Amalia Grossberg Chair in Geodynamics, and Director of the Minerva Dead Sea Research Center in the Department of Geophysics and Planetary Sciences at Tel Aviv University in Israel. Dr. Ben-Avraham is the Founding Director of the Leon Charney School of Marine Sciences at the University of Haifa, Mount Carmel, Israel, and is the Max Sonnenberg Professor of Marine Geoscience in the Department of Geological Sciences, University of Cape Town (now part-time).

Dr. Ben-Avraham was born in Jerusalem, Israel, and received his B.Sc. in Geology from The Hebrew University. He earned his Ph.D. in Geophysics from the Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. Ben-Avraham undertook a post doctoral fellowship at Woods Hole in 1973, followed by a senior research fellowship at the national research institution Israel Oceanographic and Limnological Research Ltd. in 1973–75. He worked in the Department of Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel as a researcher, 1975–76; senior researcher 1976–81, and Associate Professor, 1981–82. Dr Ben-Avraham was a Visiting Associate Professor, Department of Geophysics, at Stanford University from 1979–1982, and then a Research Professor of Geophysics there from 1982–1989. In 1982 Ben Avraham was appointed Associate Professor of Geophysics at Tel Aviv University, and from 1986 to the present, he has served as Professor of Geophysics. From 1989 to the present he has also served as the Max Sonnenberg Professor of Marine Geoscience, University of Cape Town. Dr. Ben-Avraham was a Visiting Professor at Vrije Universiteit, Amsterdam, the Netherlands in 2001, and at University of California, Los Angeles in 2005. In 2007 he founded the Charney School of Marine Sciences, University of Haifa. Known to tool around in, yes, a yellow submarine, Dr. Ben-Avraham studies regional and global tectonics. Currently, one of his main interests is the Dead Sea fault and its unique and fragile regional ecosystem. At the Minerva Dead Sea Research Center, Ben-Avraham collaborates with fellow experts from Jordan's National Research Authority in Amman, universities in Jordan, and Palestinian professors from Al-Najah University in Nablus and Al-Quds University in East Jerusalem, along with other Israeli, German, American, Jordanian and Palestinian scientists and graduate students. Fueled by the knowledge that the Dead Sea fault has implications for the daily lives of people living in related areas (Lebanon, Syria, Jordan, Palestinian Authority, Israel, Saudi Arabia, and Egypt) Dr. Ben-Avraham and his colleagues study the area's climate change, geological structure, tectonic evolution, and seismic history, as well as the region's man-made processes in order to advance and affect public awareness and decision policies bearing on the Dead Sea fault zone.

Zvi Ben-Avraham was awarded the Israel Prize in 2003 for his many contributions to the understanding of regional and global tectonics. This is the highest award that the State of Israel can bestow upon a citizen.

Michael Coey, Ph.D., Ireland's most highly-cited scientist, was born in Belfast, Northern Ireland. He is an experimental physicist who has studied magnetism and magnetic materials at Trinity College for the past 30 years, where he is Erasumus Smith's Professor of Natural and Experimental Philosophy. Dating from 1729, this was one of the first chairs of physics in the world.

Dr. Coey received his B.A. degree in natural science from Cambridge University in 1966, and a Ph.D. from the University of Manitoba in 1971. He worked as a researcher for the Centre National de la Recherche Scientifique in Grenoble the 1970s, with a spell at the IBM Research Center in Yorktown Heights, NY, before moving to Trinity College Dublin.

Dr. Coey has broad interests in magnetism, spanning almost every sort of magnetic material, as well as magnetic devices and phenomena; his interests extend to chemical and biological effects of magnetic fields. He coordinated the Concerted European Action on Magnets (1985 – 1995), a pioneering group of 80 academic and industrial researchers devoted to all aspect of the understanding, development, an application of rare-earth iron permanent magnets. In addition to his research and teaching at Trinity College, he founded the Science Gallery there, and promoted the establishment of CRANN, Ireland's nanoscience research centre, of which he was Deputy Director. Dr. Coey is the author of more than 500 scientific papers, 20 patents, and several books, including Magnetism and Magnetic Materials, published in 2010.

Dr. Coey is a Fellow of the Royal Society, a member of the Royal Irish Academy, and a foreign associate of the United States National Academy of Sciences. He holds an honorary doctorate from the University of Grenoble, and he was the recipient of the Royal Irish Academy's Gold Medal in 2005.

Steven J. Dick, Ph.D. served as NASA Chief Historian and Director of the NASA History Office from 2003–2009. He obtained his B.S. in astrophysics (1971), and M.A. and Ph.D. (1977) in history and philosophy of science from Indiana University. Before coming to NASA Headquarters he worked as an astronomer and historian of science at the U.S. Naval Observatory in Washington, D.C. for 24 years, including three years on a mountaintop in New Zealand. Among his books are Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant (1982) (translated into French), The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science (Cambridge University Press, 1996), and Life on Other Worlds (1998), the latter translated into Chinese, Italian, Czech, Greek and Polish. He is also the author (along with Dr. James Strick) of The Living Universe: NASA and the Development of Astrobiology (2004), and a comprehensive history of the U.S. Naval Observatory, Sky and Ocean Joined: The U. S. Naval Observatory, 1830–2000 (2003). The latter received the Pendleton Prize of the Society for History in the Federal Government. He served as editor of Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications (2000), and (with Dr. Keith Cowing) Risk and Exploration: Earth, Sea and Stars (NASA SP-2005-4701). His latest edited volumes are (with Dr. Roger Launius) Critical Issues in the History of Spaceflight (NASA SP-4702, 2006) and Societal Impact of Spaceflight (NASA SP 4801, 2007), as well as Remembering the Space Age (NASA SP-2008-4703) and Cosmos and Culture (NASA SP-2009). He is editor of the NASA 50th anniversary publications, America in Space (with Neil Armstrong, et al.) and NASA's First 50 Years: Historical Perspectives.

Dr. Dick is the recipient of the NASA Exceptional Service Medal, the Navy Meritorious Civilian Service Medal, the NASA Group Achievement Award for his role in NASA's multidisciplinary program in astrobiology, the NASA Group Achievement Award for the book America in Space, and the 2006 LeRoy E. Doggett Prize for Historical Astronomy of the American Astronomical Society. He has served as Chairman of the Historical Astronomy Division of the American Astronomical Society, as President of the History of Astronomy Commission of the International Astronomical Union, and as President of the Philosophical Society of Washington. He is a corresponding member of the International Academy of Astronautics. In 2009 minor planet 6544 Stevendick was named in his honor.

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 multinational 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.

Jeanette Norden, Ph.D., is a Neuroscientist and Professor of Cell and Developmental Biology in the Vanderbilt University School of Medicine. For over 20 years, she conducted research on nerve regeneration, focusing on GAP-43, a protein involved in nervous system development, regeneration, and plasticity. Since 1998, she has devoted her time to medical/graduate/undergraduate education. Dr. Norden is currently the Director of Medical Education in the Department of Cell and Developmental Biology. She has been a maverick in Medical Education, stressing not only intellectual, but also personal and interpersonal development in students. Her emphasis on personal development and her innovative approach in integrating 'humanity' into a basic science course has been recognized at Vanderbilt and nationally.

Dr. Norden has won every award given by medical students, including the Shovel (twice; given by the graduating class to the faculty member who has had the most positive influence on them in their four years of medicine), the Jack Davies Award (seven times; for teaching excellence in the basic sciences), and the Outstanding Teacher of the Year Award (four times). She was also awarded the first Chair of Teaching Excellence at Vanderbilt University, and was the first recipient of both the Gender Equity Award of the American Medical Women's Association, and the Teaching Excellence Award given by the Vanderbilt Medical School. In 2000, Dr. Norden was the recipient of the Robert J. Glaser Award, a national teaching award from the Alpha Omega Alpha Honor Society of the American Medical Association. In recognition of her devotion to helping medical students develop into caring, compassionate physicians, she was awarded the 2008 Professional Award from The Compassionate Friends, an international support group for bereaved parents.

Dr. Norden participates in numerous outreach programs in Nashville and the surrounding communities by going to schools or by giving public talks on psychoactive drugs, the aging brain, and other topics related to the Neurosciences. For a number of years, she has taught extremely popular courses in Neuroscience as part of Retirement Learning at Vanderbilt. She has traveled extensively to foreign countries to give scientific presentations, talks and workshops on teaching, or to teach Medical School (Nepal); in 2004, she was a delegate to AIDS clinics in rural South Africa as part of a cross cultural humanitarian and educational program in palliative care. Dr. Norden served as the external reviewer for a Keck Foundation grant to revise undergraduate science education in 16 colleges in the South. She was highlighted as one of the most effective teachers in America in What the Best College Teachers Do (K. Bain, Harvard University Press, 2004), and was the focus of a documentary made by the Korean Public Broadcasting network on Teaching Excellence in America. Dr. Norden has been invited to give nearly 100 presentations on teaching at Universities and Medical Schools. In 2007, she completed a 36-lecture DVD Understanding the Brain as part of the Great Courses series for The Teaching Company in an effort to help inform the public about the brain and common neurological disorders.

James Welsh, M.D. is a Clinical Professor in the Departments of Medical Physics and Human Oncology at the University of Wisconsin School of Medicine and Public Health in Madison, Wisconsin and is board certified in Radiation Oncology and Neuro-Oncology. He received his B.A. from SUNY Binghamton and his Master's degree in molecular biophysics and biochemistry from Yale University. He obtained his M.D. from SUNY Stony Brook in 1994 and went on to residency training at The Johns Hopkins Hospital. He stayed on faculty at Johns Hopkins as an Assistant Professor of Oncology and was awarded the Johns Hopkins Oncology Center Director's Teaching Award in Clinical Science in 1999. He has taught or lectured in numerous courses at the college, graduate school, and medical school levels.

Dr. Welsh is presently on the Board of Chancellors for the American College of Radiation Oncology and is Associate Editor for the American Journal of Clinical Oncology. Dr. Welsh has served as the Scientific Program Chair for the American College of Radiation Oncology and Chair of the Radiation Oncology & Radiobiology Subcommittee for the Scientific Program of the Radiological Society of North America. He is currently on the Government Relations, History, and Education Committees for the American Society of Therapeutic Radiology & Oncology (ASTRO) as well as the Committee on Education/Commission on Radiation Oncology for the American College of Radiology. He has held the position of medical subspecialty representative on the Wisconsin Genetics Advisory Council of the Wisconsin Division of Public Health. Dr. Welsh presently serves the United States Nuclear Regulatory Commission as a member of the Advisory Committee on the Medical Use of Isotopes.

Dr. Welsh has authored numerous peer-reviewed articles and book chapters and has clinical research interests in image-guided intensity modulated radiation therapy, electronic brachytherapy, radioimmunotherapy, and particle (hadron) therapy. His basic science interests include radiobiology of dose-rate, immunological effects of ionizing radiation, biology of brain tumors, and the biological effects of terrestrial radiation over geological history as well as paleontological applications of megavoltage CT imaging.