

## Diabologic: 2008 Kavli Prizes

by Frank Dolinar

I suspect that nearly everyone who follows the news of the world knows about the Nobel Prizes, established in [Alfred Nobel's](#) will in 1895. These prizes are generally regarded as the most prestigious awards in their respective fields.

The prizes in [Peace](#), [Literature](#), [Chemistry](#), [Physiology or Medicine](#), and [Physics](#) were first awarded in 1901. An associated prize, which was not specified in Nobel's will is the [Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel](#). This prize was instituted by [Sweden's central bank](#) in 1968 and first awarded in 1969.

These awards, with the exception of the Nobel Peace Prize and the Prize in Economics are presented annually at the ceremony in Stockholm, Sweden on December 10, the anniversary of Nobel's death.

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Considerably fewer people have yet heard of the Kavli Prizes, which will be awarded for the first time this year, and for which the first winners were announced on May 28, 2008.

### ***About the Kavli Foundation***



The Kavli Prizes can't be appreciated in isolation from Fred Kavli (the man who made them possible), his motivation, and the foundation he endowed, which, with the Norwegian government, administers the process and awards the prizes.

According to the [Kavli Foundation](#), "Fred Kavli is a Norwegian-born physicist, entrepreneur, business leader, innovator and philanthropist who is dedicated to supporting research and education that has a positive, long-term impact on the human condition."

The Kavli Foundation, established in December 2000, has two major goals:

- advancing science for the benefit of humanity; and
- promoting increased public understanding and support for scientists and their work.

The Foundation implements its mission through an international program of research institutes, professorships, and symposia in the fields of astrophysics, nanoscience, neuroscience, and theoretical physics as well as prizes in the fields of astrophysics, nanoscience, and neuroscience. As of July 2008, the foundation has established 15 research institutes at leading academic and research institutions worldwide – three in Europe, two in China, and ten in the United States – at estimated startup cost (based on published materials) of \$7.5 million (USD) for each institute. It has also endowed six professorships.

Kavli Institutes:

- **Astrophysics:** Peking University, Beijing, China; MIT; the University of Chicago; the University of Cambridge; Stanford University; University of California, Santa Barbara; and the Chinese Academy of Sciences
- **Neuroscience:** Columbia University; the University of California, San Diego; Yale University; the Norwegian University of Science and Technology
- **Nanoscience:** Cornell University; Harvard University; Delft University of Technology in the Netherlands; CalTech

*"My goal in establishing these institutes is to support research at the frontiers of science. I feel that it is especially important to pursue the most far-reaching opportunities and challenges and to seek answers to the most fundamental questions. The Kavli Institutes will pursue science at astronomical scales - the universe; at the most infinitesimal scales - atoms and molecules; and in the most complex of all things - the human brain. I have selected these three areas of emphasis because I believe they provide the greatest opportunity for major scientific breakthroughs and will have long range benefits for humanity."*

- Fred Kavli, Founder, The Kavli Foundation  
(from the Kavli Foundation website)

**About the Kavli Prizes**

The Kavli Foundation has created and funded international awards to recognize seminal advances in science in the fields of nanoscience, neuroscience and astrophysics, which are being awarded for the first time in 2008. These three prizes consist of a scroll and a medal for each winner. Each prize also has a cash award of \$1 million (USD) that will be shared by the winners of that prize.

*"The Kavli Prizes recognize three scientific areas we believe are exceptionally exciting in the 21st Century and at the brink of remarkable discoveries – astrophysics, nanoscience and neuroscience. Created to honor, support and recognize scientists whose work have had a profound impact in these areas, through these Prizes we also hope to raise people's awareness of the benefits of basic science in their own lives."*

— Fred Kavli, founder of The Kavli Foundation

The prizes are awarded by the Norwegian Academy of Science and Letters, in cooperation with the Kavli Foundation and the Norwegian Ministry of Education and Research. The first such prizes are being awarded this year (2008) and thereafter at a ceremony in Oslo every two years.

The winners are selected for extraordinary, groundbreaking work. The committee for each prize is populated with scientists whose work is known worldwide and they're not picked at random. The committee members are recommended by scientific academies including the Royal Society, the Max Planck Society (Germany), the National Academy of Sciences (US), the French Academy of Science, the Chinese Academy of Science, and the Norwegian Academy of Science and Letters. Four of this year's fifteen committee members are Nobel Laureates.

***Inaugural Kavli Prizes 2008***

The [Norwegian Academy of Science and Letters](#) announced the winners of the first biennial Kavli Prizes on May 28, 2008. The laureates were selected for their groundbreaking research that has significantly advanced our understanding of the unusual properties of matter on an ultra-small scale, the basic circuitry of the brain, and the nature of quasars. HRH Crown Prince Haakon will present the prizes to the Kavli Laureates at an award ceremony in the Oslo Concert Hall on the 9<sup>th</sup> of September 2008.



**The Kavli Prize winners 2008**

The seven pioneering scientists who share these inaugural prizes are (from left to right):

- *Astrophysics*: Awarded jointly to **Maarten Schmidt**, of the California Institute of Technology, US, and **Donald Lynden-Bell**, of Cambridge University.
- *Nanoscience*: Shared by **Louis E. Brus**, of Columbia University, US, and **Sumio Iijima**, of Meijo University in Japan.
- *Neuroscience*: Awarded to **Pasko Rakic**, of the Yale University School of Medicine, US, **Thomas Jessell**, of Columbia University, US, and **Sten Grillner**, of the Karolinska Institute in Sweden.

You can view the 42 minute video of the actual announcement ceremony at

<http://media01.smartcom.no/Microsite/go.aspx?eventid=3116&urlback=null&bitrate=160057>

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***Astrophysics***

As it happens, I have had an interest in physics since that eye-opening course in high school. My first major in college was physics, and somewhere during that study I actually took a course in astrophysics, which today I remember only dimly.

*“The Kavli Prize in Astrophysics is awarded for outstanding achievement in advancing our knowledge and understanding of the origin, evolution and properties of the universe, and includes the fields of cosmology, astrophysics, astronomy, planetary science, solar physics, space science, astrobiology, astronomical and astrophysical instrumentation, and particle astrophysics.”*

— from the Kavli Foundation website



The astrophysics prize was awarded jointly to Maarten Schmidt, of the California Institute of Technology, US, and Donald Lynden-Bell, of Cambridge University.

Anyone who has ever gazed at the sky on a clear night looking at the stars, constellations, and the occasional planet, has an interest in astrophysics, however informal. What the ancients actually thought stars were is something we don't really know, even given the extant "scientific" works of our earliest recorded history. Today we know them as natural fusion furnaces, held together by gravity – for a while.

It's a constant balancing act, with the fusion process pushing outward and gravity pulling inward. A star will eventually burn up all its fuel and die. Depending on its size a star's death may be violent. But the most spectacular cataclysm is reserved for the largest stars, a supernova that results in an expanding halo of extremely hot gases, leaving behind a remnant of its former glory, collapsed by gravity into a black hole.

When black holes were first theorized, it was thought that nothing could escape from it once it was caught in the enormous gravity – not even light. But that's not entirely true. The energy imparted to matter as it dives into a black hole's extraordinarily deep gravity well is sometimes enough to generate escaping radiation, enough radiation to create the brightest lights in the universe – quasars.

The research of professors Schmidt and Lynden-Bell deals with quasars and the black holes that generate the quasar's extraordinary levels of energy output.

Schmidt and Lynden-Bell are honored for their contributions to understanding the nature of quasars. In making their award, the members of the Kavli Astrophysics Prize Committee said, "*Maarten Schmidt and Donald Lynden-Bell's seminal work dramatically expanded the scale of the observable universe and led to our present view of the violent universe in which massive black holes play a key role.*"

– from a CalTech news release

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### **Neuroscience**

This is an area of science for which I can claim almost no knowledge. That doesn't stop me from appreciating the results achieved by these researchers. When we think about how the human organism is organized and how it functions, I suspect that most of us rapidly get lost trying to grasp the complexity.

According to the Kavli Foundation website, the Norwegian Academy of Science and Letters has awarded the Kavli Prize in Neuroscience for 2008 "for discoveries on the developmental and functional logic of neuronal circuits."

*"The Kavli Prize in Neuroscience is awarded for outstanding achievement in advancing our knowledge and understanding of the brain and nervous system, including molecular neuroscience, cellular neuroscience, systems neuroscience, neurogenetics, developmental neuroscience, cognitive neuroscience, computational neuroscience and related facets of the brain and nervous system."*

– from the Kavli Foundation website



The neuroscience prize goes to three scientists: Pasko Rakic, of the Yale University School of Medicine, US, Thomas Jessell, of Columbia University, US, and Sten Grillner, of the Karolinska Institute in Sweden.

It seems to me that these scientists aren't just smiling for the camera, but are amused by a private joke – perhaps something like “I know how you're thinking”. If so, they've got a perfect right to be amused, because they do know. According to the Kavli Foundation:

**Pasco Rakic** deciphered how neurons in the embryonic brain arrange themselves during development into the highly ordered, densely interconnected, and immensely complex circuitry of the adult cerebral cortex.

**Thomas Jessell** has defined key cellular and molecular mechanisms that control the development and functional organization of the spinal cord.

**Sten Grillner** has elucidated basic principles of neural circuit organization and function that control vertebrate locomotion ...

These men have grappled with the complex questions posed by the human nervous system. They have found answers that give us the ability to see the details without getting lost in the complexity, to understand a bit more of the how and the why it works, and to appreciate that we can know how the brain grows, is organized, and communicates with the rest of our bodies.

That's worth knowing and being satisfied with, even if the joke isn't “I know what you're thinking”.

### **Nanoscience**

I spend about one weekend a month introducing general audiences to the concepts and growing importance of nanotechnology in our lives. I know something about the topic. These scientists are **inventing** the disciplines of nanoscience and nanotechnology with their research. I'm awestruck by their vision.

*“The Kavli Prize in Nanoscience is awarded for outstanding achievement in the science and application of the unique physical, chemical and biological properties of atomic, molecular, macromolecular and cellular structures and systems manifested in the nanometer scale. This includes molecular self-assembly, nanomaterials, nanoscale instrumentation, nanobiotechnology, macromolecular synthesis, molecular mechanics and related topics.”*

☞ from the Kavli Foundation website



Louis E. Brus, of Columbia University, US, and Sumio Iijima, of Meijo University in Japan, share the nanoscience prize.

According to the Kavli Foundation website, the Norwegian Academy of Science and Letters has awarded the Kavli Prize in Nanoscience for 2008 “for their large impact in the development of the nanoscience field of the zero and one dimensional nanostructures in physics, chemistry and biology.”

About Professor Brus, the Kavli Foundation website says:

*“Louis Brus created the interdisciplinary field of colloidal semiconductor nanocrystals, through original discovery, theoretical modeling, chemical synthesis of purified samples, and by studying the spectroscopy of individual nanocrystals. ... The results of his studies have led to a surge of activities by many researchers in the field in the areas of synthesis and the application of these colloidal nanoparticles in many areas of chemistry, biology and medicine...”*

Sumio Iijima is the discoverer of the carbon nanotube. The Kavli Foundation website says:

*“Sumio Iijima prepared a new type of finite carbon structure consisting of needle-like tubes using an arc-discharge evaporation method. He also did careful electron microscopic analysis of the structure that revealed that each needle comprises coaxial tubes of graphitic sheets, ranging in number from 2 up to about 50. On each tube the carbon-atom hexagons are arranged in a helical fashion about the needle axis. The helical pitch varies from needle to needle and from tube to tube within a single needle. From this detailed structural analysis he has pointed out many future applications of these nanotubes.”*

For additional information, see:

- the [Brus Group](http://www.columbia.edu/cu/chemistry/groups/brus/) site at Columbia University <http://www.columbia.edu/cu/chemistry/groups/brus/>
- Professor Iijima’s site at NEC <http://www.nec.co.jp/rd/Eng/innovative/E1/top.html>

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### **Summary & Conclusion**

The vast majority of humans who populate this small blue marble called Earth desperately need to understand science in general, how scientists work in particular, and how science interacts with society. Despite complaints by students (far too many of them American) about the difficulties of learning science and mathematics, without such learning and the understanding that comes with it, too many people unwittingly find themselves living lives guided by the erratic compass of mythology and superstition.

Fred Kavli’s dedication to addressing this fundamental need and his willingness to commit his money to that end via his foundation, the various academic institutes, professorships, and ongoing seminars has made him well known in the world of science. It’s made him one of my heroes!

The Kavli Foundation is just getting started, but in the realm of science, education, and society, I believe it has already become a positive force – and one to be reckoned with.

Finally, I add my small congratulations to the seven winners of the Kavli Prizes for 2008. These seven scientists are only a handful of the thousands delving into the myriad aspects of astrophysics, nanoscience, and neuroscience. Each day the cumulative efforts of these researchers bring us perhaps

one step closer to a better understanding of ourselves and the large and small truths of the universe in which we live.

In the words of Martin Rees, President of the Royal Society:

*“The Kavli Foundation has chosen to focus its support on three key fields of science that offer special excitement and promise: Astrophysics, Nanoscience and Neuroscience. These sciences, collectively, span the grandest scale, the smallest of dimensions and the greatest complexity. The prizes that the Foundation is now announcing will surely be a further boost to these potentially transformational subjects. It is specially welcome that there is not an explicit limit to the number who can share a Kavli Prize. This is welcome recognition that the greatest scientific advances now often require a collaborative team effort.”*