

Annex B: The Molecular Frontiers Foundation

Molecular Frontiers is a global effort to promote the understanding and appreciation of molecular science in society.

Beyond the Horizon

Molecular Frontiers, a world-wide virtual institute, seeks to strengthen the position of science in society—among the public, in education and among politicians—as a primary approach to describing and analyzing reality. The institute provides a forum for exchange and analysis of scientific advances and their implications, and employs various strategies to engage the public in an open dialogue. The institute's activities promote scientific knowledge in general with special emphasis on the molecular perspective. As knowledge may be considered a right to all, global open access is a guiding principle.

The scientific advisory board, a group of prominent scientists representing a wide range of molecular science disciplines, assemble regularly to identify and analyze key scientific developments—what has just appeared on the horizon, what we can expect to see next and what is missing—and guide the organization's scientific activities.

The Molecular Frontiers Foundation held the 1st Molecular Frontiers Symposium, known as the Catalytic Forum, at The Royal Swedish Academy of Sciences in Stockholm on February 2-3, 2007.

Focus on Youth

Molecular Frontiers makes strong efforts to engage the young generation in its pursuit. Through Internet activities on MoleClues www.moleclues.org, an interactive portal for the young, Molecular Frontiers illustrates how molecular events govern much of the world we live in to inspire young people to scientific curiosity.

Molecular Frontiers has launched a global competition, the Molecular Frontiers Inquiry Prize for the young to submit questions about anything that may fall within the molecular realm, broadly defined. The competition aims to stimulate an interest in science in the young though encouraging them to ask profound scientific questions. They are then guided towards better scientific understanding in a safe online environment by research scientist mentors.

Scientific Advisory Board Members

The Scientific Advisory Board constitutes the core of an international think tank of experts from a broad range of disciplines addressing issues vital to achieving critical outcomes in research. Comprised of leading scientists and Chaired by Nobel Laureate Ahmed Zewail, the Scientific Advisory Board www.molecularfrontiers2008.com

recommends topics for Catalytic Forum workshops and also provides policy advice for the organization.

[Ahmed Zewail, Ph.D., Chairman](#), California Institute of Technology, United States

[Francis Allotey, Ph.D.](#), Institute of Mathematical Sciences, Ghana

[Piero Baglioni, Ph.D.](#), University of Florence, Italy

[Chunli Bai, Ph.D.](#), The Chinese Academy of Sciences, P.R. China

[Maria Arménia Carrondo, Ph.D.](#), New University of Lisbon, Portugal

[Paul Crutzen, Ph.D.](#), Max Planck Institute for Chemistry, Germany

[Sture Forsén, Ph.D.](#), Lund University, Sweden

[Roald Hoffmann, Ph.D.](#), Cornell University, United States

[Sir Aaron Klug, Ph.D.](#), United Kingdom

[Gerard van Koten, Ph.D.](#), Utrecht University, The Netherlands

[Sir Harold Kroto, Ph.D.](#), Florida State University, United States

[Reiko Kuroda, Ph.D.](#), University of Tokyo, Japan

[Jean-Marie Lehn, Ph.D.](#), Institute of Science and Supramolecular Engineering, France

[Susan Lindquist, Ph.D.](#), Whitehead Institute for Biomedical Research, MIT, United States

[Sara Linse, Ph.D.](#), Lund University, Sweden

[Benoit Mandelbrot, Ph.D.](#), Pacific Northwest National Laboratory, United States

[Achim Mueller, Ph.D.](#), University of Bielefeld, Germany

[Ryoji Noyori, Ph.D.](#), Nagoya University, Japan

[C.N.R. Rao, Ph.D.](#), Jawaharlal Nehru Centre for Advanced Scientific Research, India

[Richard Schrock, Ph.D.](#), Massachusetts Institute of Technology, United States

[Bengt Stenlund, Ph.D.](#), Åbo Akademi University and The Swedish Academy of Engineering Sciences, Finland

[Jürgen Troe, Ph.D.](#), Max Planck Institute for Biophysical Chemistry, Germany

[Craig Venter, Ph.D.](#), J. Craig Venter Institute, United States

[George Whitesides, Ph.D.](#), Harvard University, United States

[Jackie Ying, Ph.D.](#), Institute of Bioengineering and Nanotechnology, Singapore

[Richard Zare, Ph.D., President](#), Stanford University, United States

For more information see www.molecularfrontiers.org

Annex C: Institute of Bioengineering and Nanotechnology

1. The **Institute of Bioengineering and Nanotechnology (IBN)** is a member of the Agency for Science, Technology and Research (A*STAR). Established in March 2003, IBN is headed by its Executive Director, Professor Jackie Y. Ying, who was recruited from MIT.
 - Born in Taipei and raised in Singapore and New York, Prof Ying has been on MIT's Chemical Engineering faculty since 1992, and was promoted to Professor in 2001. She is among the youngest to be promoted to this rank at MIT.
 - She was named in the centennial issue of MIT's Technology Review magazine as one of the world's 100 young people likely to lead 21st Century innovators. In 2005, she was appointed to be among 237 leaders in the World Economic Forum's panel of Young Global Leaders, and was also elected as a member of the German Academy of Natural Scientists, Leopoldina.
 - Prof. Ying serves on the Advisory Board of the Society for Biological Engineering. In 2006, she was appointed by the U.S. National Academy of Engineering to serve on the blue-ribbon committee that identifies the grand challenges and opportunities for engineering. She was also recently appointed to the Scientific Advisory Board of Molecular Frontiers.

2. The Institute's mission is to establish a broad knowledge base and conduct innovative research at the interface of bioengineering and nanotechnology. Positioned at the frontiers of engineering, IBN is focused on creating knowledge and cultivating talent to develop technology platforms that will spur the growth of new industries. IBN also fosters an exciting, multidisciplinary research environment for the training of students and young researchers to spearhead biomedical advancement.

3. IBN has carved a niche for itself by converging multiple disciplines across engineering, science and medicine to develop novel approaches and technological breakthroughs in the following six areas:
 - Delivery of Drugs, Proteins and Genes, where the controlled release of various therapeutics involves the use of nanoparticles with functionalized moieties for targeting diseased cells and organs, or for responding to specific biological stimuli.
 - Cell and Tissue Engineering, where sophisticated materials architecture is employed to design and fabricate living replacement devices for surgical reconstruction and transplantation.

- Artificial Organs and Implants, where multi-functional systems and devices are engineered as biomimetic structures, for use as organ replacement.
 - Pharmaceuticals Synthesis and Nanobiotechnology, which encompasses the efficient catalytic synthesis and separation of chiral pharmaceuticals and specialty chemicals.
 - Medical and Biological Devices, which involve nanotechnology and microfabricated systems for the detection and treatment of diseases.
 - Bioimaging and Biosensing, which comprises the imaging of cells, tissues, small animals, and biomaterials using advanced techniques and novel imaging tags, as well as the sensing and detection of biologics and biomolecules using nanostructured materials.
4. IBN's interdisciplinary research is carried out by scientists who have been recruited from top institutions from around the world. The Institute has an active recruitment drive, and has received over 8,000 applications for research positions since March 2003.
- Current staff strength: 197
 - 19 Principal Investigators, 65 Research Staff
 - 58 Technical Staff, 22 Administrative Staff
 - 31 PhD and 2 MSc Students
 - IBN's researchers are recruited globally from: MIT, Harvard, Princeton, Stanford, Caltech, Berkeley, Duke, Johns Hopkins, Cornell, Wisconsin, Cambridge, Imperial, Heidelberg, Berlin, Cologne, Bonn, Ulm, Zürich, Amsterdam, Montpellier, Lausanne, Gothenburg, Kyoto, JAIST, Tsinghua, Fudan, Chinese Academy, National Taiwan, Seoul, KAIST, IIT, IIS, New South Wales, etc.
 - They have multidisciplinary backgrounds in biological, chemical, electrical and mechanical engineering; biology; chemistry; physics; materials science; computer science; pharmacy; and medicine.
5. IBN has made excellent progress towards achieving its mission of advancing bioengineering and nanotechnology. Its innovative research has created intellectual properties at the interface of these two emerging fields.
- To-date, the Institute has published 360 papers in top scientific journals, and filed 424 patent applications for its inventions.
6. In 2003, IBN launched the Youth Research Program (YRP) to expose young people and their educators to state-of-the-art scientific research, in an effort to promote an active research culture among Singaporean youth.

- The YRP has since reached out to more than 20,700 students and teachers from 178 schools through activities such as Open Houses, school talks, career fairs, workshops and research attachments.
- More than 770 students and teachers have also been attached to IBN for a minimum period of four weeks, during which they received hands-on experience in scientific research under guidance from an IBN researcher.
- The YRP's latest initiative, Nano-Bio Kits, which were launched in 2007, are educational tools to help teachers introduce practical applications of bioengineering and nanotechnology to their students through interactive sessions using basic laboratory equipment commonly available in schools. Each kit contains materials for teachers and students to conduct a series of experiments that demonstrate various scientific concepts and techniques used in research. The first three kits in the series are the Biological Fuel Cell Kit, the Thermo-Responsive Hydrogel Kit and the Dielectrophoresis Chip Kit.
 - 15 schools have since incorporated the kits into their science curriculum.
 - The Kits are also featured in exhibitions at the Miraikan Museum in Tokyo, Japan, and the Museum of Modern Art in New York, USA.

7. For more information, visit www.ibn.a-star.edu.sg.

Annex D: The Royal Swedish Academy of Sciences

The Royal Swedish Academy of Sciences, founded 1739, was modeled on the pattern of the Royal Society of London and of l'Academie Royale des Sciences in Paris.

The academies of sciences are all very special bodies representing a cultural heritage which dates back to the Renaissance. Their origins, background and history differ and they fulfill their duties in different ways although they all promote science and defend the freedom of science.

The Swedish Academy of Sciences was created as, and still is, an independent, non-governmental scientific society. It began on a modest basis and achieved distinction through the quality of its leadership as well as its determination to promote natural science. Sweden in the first half of the 18th century presented an unusually distinguished array of scientists.

Among the founders were the world-famous naturalist Carl Linnaeus (knighted von Linné), the mercantilist Jonas Alströmer and the mechanical engineer Mårten Triewald as well as the politician Anders Johan von Höpken, who became the Academy's first Permanent Secretary.

The Academy, in its early days, with its eminent membership, was in a position to establish fruitful scientific relationship with the academies of the main European countries - a step towards the internationalization of research. With its regularly published "Handlingar" (Transactions) and the bulletins then published in its Almanac, the Academy transmitted research findings both within the scientific community and to the Swedish general public - two different levels of research information.

During its first heyday, The Academy was above all concerned with promoting everyday applications of scientific discoveries, e.g. in agriculture, ship building and mining. The eminent chemist J. Berzelius was appointed Permanent Secretary in the beginning of the 19th century. His first care was to reorganize the Academy and to turn it into a society with purely scientific aims. This organization is still prevailing.

The Royal Swedish Academy of Sciences is an independent organization whose overall objective is to promote the sciences and strengthen their influence in society. The Academy seeks chiefly:

- to be a forum where researchers can meet across subject borders
- to offer unique research environments
- to support young researchers
- to reward prominent contributions to research
- to arrange international scientific contacts
- to act as a voice of science and influence research policy priorities

- to stimulate interest in mathematics and the natural sciences in schools
- To disseminate scientific and popular-scientific information in various forms.

Activities

The Academy administers a researcher exchange with academies in other countries and publishes six scientific journals. Every year the Academy awards the Nobel Prizes in Physics and Chemistry, the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel, the Crafoord Prize and a number of other large prizes.

Academy work is very much based upon the Academy's ten classes

- Mathematics
- Astronomy and Space Science
- Physics
- Chemistry
- Geosciences
- Biosciences
- Medical Sciences
- Engineering Sciences
- Social Sciences
- Humanities and for outstanding services to science

The academy's research institutes offer excellent facilities for its own research teams and for guest researchers. The institutes were founded to develop subject areas considered important, and were often funded by donations.

Numerous research institutions have been founded by the Academy over the years but many have been transferred to the state. These include the National Museum of Natural History in Stockholm and the Swedish Institute of Space Physics in Kiruna. Nowadays the Academy runs the following institutes:

Institut Mittag-Leffler

Area of research: mathematics

The Abisko Scientific Research Station

Area of research: ecological, geological, geomorphological and meteorological research in the Arctic area

The Beijer Institute of Ecological Economics

Area of research: ecological economics

The Bergius Foundation

Area of research: botany

The Center for History of Science

Area of research: history of science

The Institute for Solar Physics of the Royal Swedish Academy of Sciences

Area of research: solar research

The Kristineberg Marine Research Station

Area of research: marine ecology and the biology of marine organisms

Committees, such as the Environmental Committee and the Polar Research Committee work with issues requiring a broad scientific competence.

For further information see http://www.kva.se/KVA_Root/index_eng.asp