ICN+T 2006: NCCR Nanoscale Science

ICN+T2006: NCCR Nanoscale Science. This year, an International Conference on Nanoscience and Technology (ICN+T2006) will take place at the Basel congress centre, Switzerland, from the 30 July through 4 August 2006 (www.icnt2006.ch). The scope of this conference is twofold: First to commemorate the invention and development of SPM (25 years of STM and 20 years of AFM) and their related techniques and their impact on the sciences. Second the expansion and reinforcement of Nanoscience in general and its potential to unleash future technologies.

The ICN+T2006 conference will be organised by members of the Swiss National Centre of Competence in Research (NCCR) Nanoscale Science, which is an interdisciplinary research effort focusing on nanoscale structures. The program provides new impact and ideas for the life sciences, for the sustainable use of resources, and for information and communication technologies. Today, the NCCR is recognised as a worldwide centre of excellence for nanoscale science. About 200 scientists work together in interdisciplinary groups of physicists, pharmacologists, biologists, chemists, physicians, computer scientists and engineers. The various research groups focus on the following five subject areas:

- Nanobiology and Nanomedicine
- Quantum Computing and Quantum Coherence
- Atomic and Molecular Nanosystems
- Molecular Electronics
- Functional Materials

These topics will also form the core of the programme of the ICN+T meeting. Last but not least, issues on industrial applications and safety and risk issues of nanoscale applications and products will be discussed. More than 120 worldwide leaders in these research fields of nanoscale science will present invited lectures upon their latest achievements.

New Industrial Revolution
At the beginning of the new millennium, three major scientific disciplines were considered to have an unprecedented potential for industrial applications.
These are the fields of information science and life sciences, which in turn are increasingly influenced by nanoscience.

The fundamental research in the overlapping areas requires an interdisciplinary approach and inevitably will lead to a new industrial revolution. The underlying science involves the basic building blocks and length scales of matter in biology, chemistry, physics and engineering.

Nature is the best example of a system that functions on the nanometre scale and where the materials, energy consumption and data handling processes are optimised. Integration of physics, chemistry and the life sciences into the field of nanoscience and nanotechnology is a novel concept that will generate new synergies in research and education.

This promises to create a new generation of scientists able to advance nanoscale science on a broader basis of knowledge and experience. Nanotechnology is expected to become a driving force of the world economies within the next 10–20 years.

To provide an overview on the individual research fields being discussed and presented at the meeting in Basel, some of the recent research highlights of the Swiss National Center of Competence in Research (NCCR) Nanoscale Science will be outlined in the following individual sections.

Nanobiology

Scientists within the nanobiology field study different native biomolecules, membranes and tissues with the Atomic Force Microscopy (AFM). A wide range of questions on the structure and function of the cytoskeleton, the nuclear envelope, the cell membrane and the respective individual building blocks are addressed.

Key questions concern the nanomechanical properties of the extracellular matrix (cartilage) and cytoskeletal fibers, nuclear transport, ligand and voltage induced channel gating, and the signal transduction by membrane embedded receptors.
Additionally, researchers examine the use of cantilever array sensors for genomics, proteomics and diagnostics, and the application of nanooptics for observing and manipulating molecular processes in living cells.

The Supramolecular Organisation of the G-protein Coupled Receptor Rhodopsin in the Native Membrane

Light is collected by rod and cone receptor cells in the eye’s retina to produce visual signals. Rods contain the receptor molecule rhodopsin, which triggers a chain reaction leading to a nerve impulse upon detection of light. A group of eye diseases named Retinitis Pigmentosa causes breakdown in the function of the rods and cones.

Until recently, it was believed that rhodopsin functions as a single molecule. Our work demonstrated for the first time that rhodopsin exists in rows of pairs in its native environment [1–3]. Based on our result, we showed that disruption of rhodopsin’s organisation in the eye by specific mutations in the gene coding for rhodopsin may cause certain forms of the Retinitis Pigmentosa disease.

Visualisation of rhodopsin was performed by electron microscopy and, particularly, by a new sophisticated microscopy technique called atomic force microscopy. This discovery on the organisation of rhodopsin led to a reconsideration of how the first steps in vision work.

In addition, potential factors leading to the onset of Retinitis Pigmentosa diseases were established based on our structural data. Importantly, rhodopsin is just one example of a receptor type of which more than a thousand exist in the human body. It now seems likely that most of these receptors also function as paired molecules, which has many implications for our health.

References

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