New Summer School:
Methods in micro – nano technology and nanobiotechnology.
Date: June 6th to June 10th 2005
Organizer: National Center for Scientific Research "Demokritos", Participating Institutes: Microelectronics, Radioisotopes and Radiodiagnostic Products, Physical Chemistry

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Rational: Modern Research and product development in Life Sciences, Chemistry, Pharmaceutics, Environmental and Agriculture/Food monitoring is taking advantage of the Micro and Nanotechnology developments. Merging areas of research such as Nanobiotechnology have been created, which demand highly interdisciplinary research skills. It is thus necessary that many researchers from Life Sciences, Chemistry, and Engineering (Chemical, Mechanical, Electrical, Material, Environmental) acquire basic principles and methods in Micro and Nanotechnologies in order to integrate better in modern research activities and/or product development.

Content: This 5 day intensive summer school will offer classroom and laboratory experience on the micro and nano-technology processes / materials / applications intended for the disciplines described above.

Who should attend: Graduate students with Engineering, Science or Life Science background, as well as group leaders involved in molecular biology or biotechnology, who wish to apply micro-technology in their research. This summer school will establish common language between the various disciplines and promote interdisciplinary research.
Maximum number of registrants 20 persons.

Synergies with other seminars:
Back to back dates for those desiring to attend the "Practical Course on Advanced Techniques in Molecular Biology", organized by FORTH/ICEHT, June 12-18, 2005
http://mb_school.iceht.forth.gr

Fees: The registration fee of 1000 Euro includes lectures, laboratory hands on experience in teams of 4-5 persons, notes, and lunches. A reduced fee is possible for those attending both summer courses at FORTH/ICEHT and Demokritos. The fees must be paid separately to each institution in order to avoid logistic confusion.

Detailed Syllabus:

1. **Lecture 1: Introduction to micro and nano-technology and nanobiotechnology** (Lecturer: to be announced, Institute of Microelectronics)
2. **Lecture 2: Patterning technologies (lithography and plasma etching) for Si, glass, and plastic substrates in the fabrication of analytical/bioanalytical microdevices** (Lecturers: Dr Evangelos Gogolides, Dr Angeliki Tserepi, Institute of Microelectronics)

3. **Laboratory 1. Fabrication of microfluidic devices on plastic substrates by novel lithographic techniques.** (Supervision of Dr Angeliki Tserepi: Short description: The laboratory will demonstrate the use of soft lithography for fabrication of a microfluidic device in PDMS. As a first step, fabrication of a polymer mold by lithography will be realised. Microfluidic devices will be fabricated by means of PDMS casting in the fabricated mold, thermal curing, and peeling off the mold.)
4. **Laboratory 2. Fabrication of plastic Capillary Electrophoresis Devices by Lithography and plasma etching techniques.** (Supervision of Dr Evangelos Gogolides, Short description: The laboratory will describe the use of plasma etching techniques for patterning of Si or hard plastic substrates. Patterned substrates of PMMA and PDMS will be processed in ICP plasmas for fabrication of a plastic capillary device used for electrophoretic separation.)
5. **Lecture 3: Principles of Integrated Biosensing Devices** (Lecturer Dr Constantinos Misiakos, Institute of Microelectronics). The lecture will cover: Optical sensing, Label free assays, interferometric sensing, Fluoro-bioassays, chromo-bioassays, metal nanoparticle labels, Electro-chemical sensing, ISFET bio-sensors, Enzyme based electrochemical devices, Impedance based biosensing, Other types of sensing, Surface acoustic wave devices, quartz microbalance devices, Lab-on-a-chip devices: Deposition of biomolecular probes, electrodes, microfluidic channels
6. **Laboratory 3: Operation of a lab-on-a-chip optical device using model assays and real time measurements** (Supervision of Dr Constantinos Misiakos)
7. **Lecture 4: Patterning of biomolecules and other biological substances** (2 hours, Lecturer: Dr Panagiotis Argitis, Institute of Microelectronics). The lecture will cover: New techniques introduced during the last years for the patterning of biomolecules, and biological substances in general, will be discussed. The presentation will cover microcontact printing methods, light guided DNA and protein synthesis, soft lithography-based approaches, photoresist-based processes, dip-pen lithography, and other emerging methodologies. Strong and weak points of the different techniques will be discussed, along with current and potential applications and technological challenges in the field.
8. **Laboratory 4a:Part A: Fabrication of protein microarrays using photoresist-based lithographic scheme under biocompatible conditions.** (Supervision of Dr Panagiotis Argitis). A new especially designed photoresist and standard lithography equipment will be used.)
9. **Laboratory 4b:Part B. Fluorescence detection of protein arrays.** (Supervision Dr Panagiota Petrou, Institute of Radioisotopes and Radiodiagnostic Products). Content: The protein arrays created on silicon by photolithography will be visualized through reaction with fluorescently labeled molecules that specifically bind to the immobilized proteins. Upon observation with the epifluorescence microscope, images of the arrays will be produced and processed in order to receive quantitative results.
10. **Lecture 5: Biomolecules as building blocks of molecular electronics** (Lecturer: N.Glezos, Institute of Microelectronics). Contents: General principles of molecular electronic devices, patterning methods, nanoelectrode preparation methods, the use of DNA as a template for conductive nanowires.

11. **Laboratory 5: Nano-patterning by electron beam lithography** (Supervision: N.Glezos). The laboratory will describe the use of electron beam lithography for bio-patterning and the fabrication of nanoelectrodes. Gold electrodes on Si substrates will be fabricated by a lift-off technique. Devices with molecular materials using these electrode setups will be demonstrated.
12. **Lecture 6: Protein and DNA arrays: fabrication, detection and applications.** (Lecturers: Dr Sotirios Kakabakos, Dr Panagiota Petrou, Institute of Radioisotopes and Radiodiagnostic Products). Content : Methods for protein and DNA immobilization onto solid-supports, immunoassay principles, detection schemes for protein chips, applications of protein chips, DNA hybridization and detection, applications of DNA chips.
13. **Laboratory 6: Demonstration of a capillary fluoroimmunosensor.** (Supervision Dr Sotirios Kakabakos). Content: The laboratory will include manual fabrication of protein arrays in the internal surface of plastic capillaries, immunoreaction with enzyme or fluorescently labeled binding protein and detection either through reaction with chromogenic enzyme substrate or by scanning the capillaries using a prototype device built for this purpose.)
14. **Lecture 7: Drug Delivery, Liposomes, Dendrimers, Cyclodextrins** (Lecturers: Constantinos Paleos, Irene M. Mavridis, Konstantina Yannakopoulou, Dimitris Tsiourvas, Institute of Physical Chemistry): Content: Multifunctional systems able to encapsulate drugs and at the same time be functionalised by appropriate groups in order to serve as biocompatible and targeted drug carrier systems. Liposomes versus Dendrimers, cyclodextrins and inclusion compounds, methods to characterise these drug carriers.
15. **Laboratory 7: Dynamic light scattering and Z-potential measurements, Video enhanced optical microscopy and Atomic Force Microscopy of Liposomes** (Supervision of Dr D. Tsiourvas)
16. **Laboratory 8: Drug inclusion monitoring in situ by NMR spectroscopy. X-ray diffraction characterisation of drug inclusion in Cyclodextrins and 3-D visualisation** (Supervision of Dr K. Yannakopoulou, and Dr I. M. Mavridis)