

TIME TABLE

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	July 6	July 7	July 8	July 9	July 10
9.00 - 9.45	Registration	Vogel	Fuchs	Ryan	Kojic
9.45 - 10.30	Ferrari	Vogel	Fuchs	Ryan	Kojic
11.00 - 11.45	Ferrari	Vogel	Fuchs	Ryan	Kojic
11.45 - 12.30	Fuchs	Ferrari	Decuzzi	Kojic	Ferrari
14.30 - 15.15	Fuchs	Ryan	Vogel	Kojic	
15.15 - 16.00	Fuchs	Ryan	Vogel	Kojic	
16.30 - 17.15	Decuzzi	Ryan	Vogel	Decuzzi	
17.15 - 18.00	Decuzzi	Ferrari	Decuzzi	Decuzzi	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: <http://www.cism.it> or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The registration fee is 600,00 Euro.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by **May 6, 2009** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

The Deutscher Akademischer Austausch Dienst (DAAD) and the Deutsche Forschungsgemeinschaft (DFG) offer support to German students. Please contact:

DAAD, Kennedyallee 50, 53175 Bonn
tel. +49 (228) 882-0
e-mail: postmaster@daad.de
web site: <http://www.daad.de/de/kontakt.html>

DFG, Kennedyallee 40, 53175 Bonn
tel. +49 (228) 885 2655
e-mail: ing4@dfg.de
web site: <http://www.dfg.de>

Information about travel and accommodation is available on our web site, or can be mailed upon request.

For further information please contact:

CISM
Palazzo del Torso - Piazza Garibaldi 18
33100 Udine (Italy)
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fax +39 0432 248550
e-mail: cism@cism.it

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences



ACADEMIC YEAR 2009
The Broglio Session

BIOMECHANICAL DESIGN OF NANOTECHNOLOGICAL DEVICES FOR HEALTH CARE

*Advanced School
coordinated by*

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The University of Texas
Health Science Center at Houston, TX
USA

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Università "Magna Graecia" di Catanzaro
Italy
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Health Science Center at Houston, TX
USA

Udine, July 6 - 10, 2009

BIOMECHANICAL DESIGN OF NANOTECHNOLOGICAL DEVICES FOR HEALTH CARE

The integration of Nanotechnology with biomedical research and practice has already shown profound effects on the diagnosis, treatment and prevention of diseases as such cancer and cardiovascular, generating a new scientific field known as Nanomedicine. Drug formulations based on injectable particulate systems are already used in the clinic; multifunctional nanoparticles incorporating both therapeutic and contrast agents for disease treatment and imaging are currently in clinical trials; sophisticated micro- and nano-fluidic devices for the in-vivo long term (several months) release of biomolecules; for rapid and inexpensive ex-vivo blood processing and analysis are under development in several laboratories; nanostructured and nanoporous surfaces for

the selective trapping of blood molecules have been integrated in biochips for the ex-vivo early detection of diseases; nano- and micro-probes are used routinely to test and measure the biomechanical properties of single molecules and cells in-vitro; biological entities, from single molecules to DNA strands, have been coupled together with artificial man-made objects to generate molecular-based motors. Nanomedicine is the field where knowledge pertaining to chemistry, physics, mathematics and engineering sciences are fused with biological and biomedical notions to solve truly multidisciplinary and complex problems with the guiding aim of being of true benefit to the human-kind. Consequently, the course will provide an overview of the

main nanotechnological devices so far developed and under development for health care; a comprehensive description of the physico-chemical processes and laws governing the behavior and performances of such devices and engineering criteria for their design and testing. The proposed course will have a short introduction into the topic, emphasizing current technological and scientific challenges together with regulatory rules. The development and design of devices for health care is indeed strictly regulated by agencies, as the Food and Drug Administration. The course will be followed by an overview on the fabrication, development and use of nanotechnological devices as micro- and nano-particles for the systemic administration of

therapeutic and imaging agents; nanofilters for the controlled release of biomolecules; nanoporous chips for the early detection of diseases; cantilever based scanning probes for biomechanical testing and measurements. Lectures describing the nanotechnological devices will be alternated with lectures elucidating the biophysical and biochemical mechanisms governing the behavior and performances of each device presenting in particular the mathematical and engineering tools required for their analysis and optimal design. The course will be addressed to PhD students and post doctoral fellows as well as researchers and engineers in the industry, and will be tailored to be suitable for technical as well as a biomedical backgrounds.

INVITED LECTURERS

Paolo Decuzzi - The Univ. of Magna Graecia Catanzaro, Italy and The University of Texas Health Science Center at Houston, USA
6 lectures on: modeling the dynamics of micro/nano-cantilever beams; modeling the transport, adhesive and endocytosis dynamics of particulate-based systems for the systemic delivery of drugs and bio-imaging contrast agents.

Mauro Ferrari - The University of Texas Health Science Center at Houston, USA
5 lectures on: the growing field of Nanomedicine; and the theoretical design and experimental development of micro-chips for biological analysis and nanochannel-based filters for the systemic delivery of drugs from implants.

Harald Fuchs - University of Münster, Germany
6 lectures on: the use of micro- and nano-cantilevers for sensing forces at the molecular scale; for the inspection of soft nanostructures consisting of organic or biological molecules, Dip Pen Lithography, self organized organic layers and templates.

Milos Kojic - Harvard School of Public Health, Boston, MA, USA
6 lectures on: computational methods in solid and fluid mechanics with emphasis on modeling blood flow in microvessels and particle transport, including finite element (FE) method, element free Galerkin (EFG) method, smoothed particle hydrodynamics (SPH) and dissipative particle dynamics (DPD) mesoscale method.

John Ryan - Oxford University, UK
6 lectures on: biomolecular systems and machines, from the single molecule level up to complex molecular machines, integrating "top-down" nanoscale lithography with "bottom-up" biomolecular assembly.

Viola Vogel - ETH Zurich, CH
6 lectures on: how cells can sense and transduce a broad range of mechanical forces into distinct sets of biochemical signals that ultimately regulate cellular processes, including adhesion, proliferation, differentiation, and apoptosis.

PRELIMINARY SUGGESTED READINGS

Ferrari M. Cancer nanotechnology: opportunities and challenges. *Nat Rev Cancer* 2005; 5:161-71. Review.

Tasciotti E, Liu X, Bhavane R, Plant K, Leonard AD, Price BK, Cheng MM, Decuzzi P, Tour JM, Robertson F, Ferrari M. Mesoporous silicon particles as a multistage delivery system for imaging and therapeutic applications. *Nat Nanotechnol* 2008;3:151-7.

Decuzzi P, Pasqualini R, Arap W, Ferrari M. Intravascular Delivery of Particulate Systems: Does Geometry Really Matter? *Pharmaceutical Research* 2008.

Milos Kojic, Nenad Filipovic, Boban Stojanovic, Nikola Kojic: *Computer Modeling in Bioengineering – Theoretical Background, Examples and Software*, J. Wiley and Sons, 2008.

D Ebeling, H Hölscher, H Fuchs, B Anczykowski and U D Schwarz, *Imaging of biomaterials in liquids: a comparison between conventional and Q-controlled amplitude modulation ('tapping mode') atomic force microscopy*, *Nanotechnology* 2006;17:S221-S226.

Goel A, Vogel V. Harnessing biological motors to engineer systems for nanoscale transport and assembly. *Nature Nanotechnology* 2008; 3: 465-475.

Thomas WE, Vogel V, Sokurenko E. Biophysics of catch bonds. *Annual Review of Biophysics* 2008; 37: 399-416.

Voitchofsky K, Contera SA, Kamihira M, Watts A, Ryan JF. Differential stiffness and lipid mobility in the leaflets of purple membranes. *Biophysical Journal* 2006; 90: 2075-2085.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.

**BIOMECHANICAL DESIGN OF NANOTECHNOLOGICAL DEVICES
FOR HEALTH CARE**

Udine, July 6 - 10, 2009

Application Form

(Please print or type)

Surname _____

Name _____

Affiliation _____

Address _____

E-mail _____

Phone _____ Fax _____

Method of payment upon receipt of confirmation (Please check the box)

The fee of Euro 600,00 includes IVA/VAT tax and excludes bank charges

I shall send a check of Euro _____

Payment will be made to CISM - Bank Account N° 094570210900,
VENETO BANCA - Udine (CAB 12300 - ABI 05418 - SWIFT AMBPIT2M -
IBAN CODE IT83Z 05418 12300 09457 0210900).
Copy of the receipt should be sent to the secretariat

I shall pay at the registration counter with check, cash or VISA
Credit Card (Mastercard/Eurocard, Visa, CartaSi)

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____
Address _____

C.F.* _____
VAT/IVA* No _____
(*) Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies

I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.

Complete information on CISM's privacy policy is available at www.cism.it.

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____ Signature _____