

TIME TABLE

TIME	Monday July 19	Tuesday July 20	Wednesday July 21	Thursday July 22	Friday July 23
9.00 - 9.45	Registration	Goodship	Marotti	El Haj	Currey
9.45 - 10.30	Cowin	Marotti	El Haj	Doblaré	El Haj
11.00 - 11.45	Goodship	El Haj	Doblaré	Currey	Doblaré
11.45 - 12.30	Marotti	Doblaré	Currey	Cowin	Cowin Q&A
14.30 - 15.15	El Haj	Currey	Cowin	Goodship	
15.15 - 16.00	Doblaré	Cowin	Goodship	El Haj	
16.30 - 17.15	Currey Q&A	Goodship	Currey	Goodship	
17.15 - 18.00	Cowin Intro	El Haj Q&A	Goodship Q&A	Doblaré Q&A	

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 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

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 19, 2010** 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:

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33100 Udine (Italy)
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e-mail: cism@cism.it

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences



ACADEMIC YEAR 2010
The Lippmann Session

BONE CELL AND TISSUE MECHANICS

*Advanced School
coordinated by*

Stephen C. Cowin
The City University of New York
NY, USA

Udine, July 19 - 23, 2010

BONE CELL AND TISSUE MECHANICS

Bone mechanics is considered here to include the mechanical behavior of whole bones as structural elements, the mechanical behavior of bone tissue as a material, the response of bone cells to mechanical and electrokinetic stimuli and the physiological significance of the mechanical behavior. Specialists in anatomy, orthopaedics, dentistry, biochemistry and molecular and cellular biology, as well as biomechanics, are involved in the bone cell and tissue mechanics. This topic has only formalized into a distinct discipline in the last thirty years. During this period the important mechanical properties of bone have been determined, but the salient

mechanical properties of bone cells are only now being studied.

Bone remodeling is the primary research area in bone mechanics. We use the term "remodeling" to describe the renewal and redevelopment of bone tissue as it adapts to altered load bearing. That is to say, in the course of time bone changes its shape, its apparent density, and its stiffness to adapt to the environmental load it experiences. Bone is sometimes viewed as an optimum composite and the skeletal system is an optimal structure. The cellular mechanisms that constitute the mechanosensory system in bone tissue and drive the

adaptive remodeling are unknown at the present time, but there are several promising candidates for the mechanosensory system.

The subject of bone mechanics is basic to the understanding of musculoskeletal disease, the principles underlying orthopaedic and dental surgery and the design of orthopaedic implanted prostheses such as artificial hips, knees, finger joints, etc. The engineering design of these orthopaedic appliances is about fifty years old and is still in a state of evolution, particularly in the area of orthobiologics. It is a major manufacturing industry.

The goal of this course will be to review the entire area of bone cell and tissue mechanics, with an emphasis on bone remodeling. Besides being informative, it is hoped that the course will function as a forum for the exchange of data, philosophy, and ideas across disciplinary divides and so provide further stimulus for a comprehensive approach to the problems of bone mechanics. We expect an audience as diverse in background as the lecturers, that is to say spanning the across the professional spectrum from material scientists to biologists, to orthopaedic and dental surgeons, to veterinarians and to structural and biomedical engineers.

LECTURES

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

INVITED LECTURERS

Stephen C. Cowin - City University of New York, USA

1. Bone structure and microstructure
2. Introduction of participants & lecturers
3. The mechanosensory system in bone
4. Russian doll poroelasticity
5. Diagnostic bone ultrasound
6. Friday Q&A

John D. Currey - University of York, UK

1. Form-mechanical property relationships in whole bones.
2. Composition-mechanical property relationships in bone tissue.
3. Histology-mechanical property relationships in bone tissue.
4. The role of microdamage in bone mechanics.
5. Recent developments in testing bone tissue and whole bone mechanical behaviour
6. Monday Q&A

Manuel Doblaré - University of Zaragoza, Spain

1. Introduction to the macroscopic mechanical behavior of bone tissue; computational models for the prediction of bone fracture
2. Damage-based phenomenological models of bone remodeling
3. Mechanistic models of bone remodeling
4. Computational simulation of bone fracture healing
5. Computational simulation of bone osseointegration
6. Thursday, Q&A

Alicia J. El Haj - Keele University, UK

1. Bone cell biology
2. Differentiation of bone cells and the bone cell lineage
3. Bone development and remodelling
4. Mechanotransduction and bone cell signalling
5. Controlling bone cells by physical forces/Applied cell biomechanics
6. Bone cell apoptosis and cell turnover
7. Tuesday Q&A

Allen Goodship - Royal Veterinary College and Institute of Orthopaedics, University College, London, UK

1. Bone modeling and remodeling
2. Functional adaptation in bone - part one
3. Functional adaptation in bone - part two
4. Fracture repair in bone
5. Mechanically related modulation of bone repair
6. Mechanogenetics of bone - potential implications for mechanical competence, repair and replacement of the skeleton.
7. Wednesday Q&A

Gastone Marotti - Università di Modena e Reggio Emilia, Italy

1. Quantitative data on bone formation rate throughout the skeletal system
2. The structure of bone tissues
3. The mechanism of transduction of mechanical strains into biological signals at the bone cellular level.

PRELIMINARY SUGGESTED READINGS

Cowin, S.C. (editor), Bone Mechanics Handbook, CRC Press, Boca Raton, FL, 2001.

Cowin, S.C. and Doty, S.B., Tissue Mechanics, Springer, 2007.

Currey, J.D., Bones, Princeton University Press, 2002.

**BONE CELL
AND TISSUE MECHANICS**

Udine, July 19 - 23, 2010
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 _____