

EUROMECH

EUROPEAN MECHANICS SOCIETY

Final Report

Date: 25 June 1996

Please send this report to the Secretary-General of EUROMECH, Professor Bengt Lundberg, School of Engineering, Uppsala University, Box 534, S-751 21 Uppsala, Sweden, within one month after the Colloquium.

General

EUROMECH Colloquium No: 344

Dates: 10-13 April 1996

Title: Fluid-structure interactions in biomechanics

Co-Chairman: Prof. C. G. Caro

Place and country: London, England

Is there need of another colloquium on the same subject? Which year? Yes. 1998/9.

Finance

Conference fee: £65.00

The fee included: see separate report

Funding: £4750.00 sponsorship for bursaries

Accommodation (type and cost): } Student study-bedrooms at Imperial College.

Meals: } £130

Participation

Number of participants from each country:

Austria	<u>4</u>	Germany	<u>6</u>	Rumania	<u>2</u>
Belgium	<u>4</u>	Great Britain	<u>39</u>	Russia	<u>2</u>
Bielorussia	—	Greece	<u>1</u>	Slovakia	—
Bosnia	—	Hungary	—	Slovenia	—
Bulgaria	<u>1</u>	Ireland	—	Spain	—
Croatia	—	Italy	<u>1</u>	Sweden	—
Czech Republic	<u>2</u>	Latvia	—	Switzerland	—
Denmark	—	Lithuania	—	Ukraine	<u>2</u>
Estonia	—	Netherlands	<u>8</u>	Yugoslavia	—
Finland	—	Norway	—	Others	<u>25</u>
France	<u>9</u>	Poland	<u>1</u>	Total	<u>107</u>
Georgia	—	Portugal	—		

Please turn

Scientific Report

Please see separate report.

T.S. Redley

EUROMECH 344

FLUID-STRUCTURE INTERACTIONS IN BIOMECHANICS

Chairman's Report

The Colloquium was held at Imperial College, London, on 10-13 April, 1996. There were 107 registered participants from 19 different countries; 62 were members of Euromech.

Scientific

The Colloquium was intended as part of the series concerned with physiological fluid mechanics which started with no. 12 in Poland in 1969 (the others were 32, 67, 92, 118, 167, 186, 259, 286, 311; nos. 68, 137, 158, 170, 179, 290 also had biological connections). The scientific emphasis was on dynamic interactions between fluid loading and wall geometry in which neither could be prescribed in advance. It was hoped that papers would be offered not only on passive interactions (elastic boundaries) but also on active ones, both short-term, when muscle contractions determine the boundary deformation but are themselves determined by the hydrodynamic load (e.g. peristaltic pumping), and long-term, involving biological remodelling in response to mechanical stresses. Submissions on pure fluid mechanics - blood flow in arteries of fixed or prescribed geometry - were not encouraged. In the event very little was offered concerning flow-muscle interaction, but there was a lot of very interesting material on the passive interactions and on remodelling.

Highlights of the meeting were the three invited general lectures:

Peter F. Davies (U. of Chicago): Mechanisms of shear stress induction of endothelial responses;

Thomas L. Daniel (U. of Washington): Integrating internal and external mechanisms in locomotion in fluids;

Philip G. de Groot (U. of Utrecht): The influence of flow on platelet-vessel wall interactions.

All these emphasised the important message that, in such a field, the mechanics must be subservient to the biology. Dr. Davies gave a stimulating account of the structure of individual arterial endothelial cells, in vivo or in culture, and how they respond, biologically, to haemodynamic shear stress on a variety of time-scales (involving second messengers, gene expression, protein synthesis, etc.). His sub-micron scale imaging is truly remarkable. Dr. Daniel gave a zoologist's view of flow-structure interaction, a salutary (and inspiring) reminder to medics and bioengineers that both external and internal mechanics exert important constraints on an animal's locomotion and hence evolution. His "simple" example (jellyfish locomotion) brought out very clearly the intimate coupling between muscle contraction and the resulting flow. Dr. de Groot is a biochemist, and revealed some of the richness of this (for many of us) alien world which exerts vital control on the mechanical processes of blood clotting and thrombus formation.

Many people expressed the desire to present their work. We had only 31 slots available for oral presentation (20 minutes including discussion) and the committee drew up the programme with a view to giving each oral session a coherent theme, and to arranging natural groupings of posters for the poster sessions. The 6 oral sessions had the titles:

Mechanical effects of blood flow on vessel walls

Biological responses of vascular walls to applied stresses

Microvascular networks

Respiratory flow-structure interactions
Cardiac mechanics

Unsteady flows and compliant structures

In addition there were 45 posters. The poster sessions occupied all of one evening (17.00-21.00, with wine). The posters were divided into two batches, and presenters of posters were invited to describe their main point in a plenary session, with the help of at most one transparency, in at most one minute, rigidly enforced. This format proved to be both entertaining and popular, and was effective in letting the audience know (a) who the presenter was and (b) whether their poster would be worth detailed study. The posters were effectively grouped into topics of which the biggest was "Blood flow in complex geometries", containing all the offered papers in which fluid-structure *interaction* was absent.

The role of biomechanics within Euomech (or vice versa)

The Colloquium closed with a general discussion on this topic. Although the present meeting and its predecessors have had substantially more participants than Euomech colloquia usually do, there was a strong feeling in favour of keeping them going in a similar format, not as a Euomech Conference, for example. There are lots of big meetings in biomechanics (e.g. European Society of Biomechanics) and participants here very much liked the concentration on a single topic, the absence of parallel sessions, and the consequent genuine ability to interact with scientists from different backgrounds (biological, clinical, bioengineering). My own experience as chairman was shared by previous chairmen: despite the attempt to focus on a fairly narrow topic, it proved to be so interesting that everyone wanted to come!

The other matter that was raised by a number of participants was the following: Now that Euomech is a society, so we pay either a membership subscription or a levy for attending the Colloquium, what do we, i.e. the community served by this Colloquium, get in return? The value of the good name of Euomech, as umbrella organisation, was recognised, together with its list of contacts in many countries, but it was felt that some financial contribution, for example towards bursaries for younger participants or those from Eastern Europe, would be welcome.

Future Colloquia. Colleagues from Austria have indicated that they would like to host a meeting in this series, and colleagues from France expect to propose a Euomech Colloquium on Cell Mechanics, both within the next 3 or 4 years.

Financial Report

An outline of the accounts is attached. The registration fee was set at £65.00 (£93.00 for non-members of Euromech to cover the levy). This covered a buffet reception on the evening of 10 April, wine with posters (11th), tea, coffee, travel and accommodation for the three invited speakers, and secretarial and administration costs. Fortunately the Chemical Engineering Department at Imperial College permitted us to use their lecture theatre and display area free of charge, and we were most grateful. The only expense that was significantly over budget was the cost of administration/ secretarial time, which we had underestimated and which all had to be paid for; this could be covered only because the number of registered participants considerably exceeded the number (60) on which the budget was based. The accommodation fee of £130 covered all accommodation and meals at Imperial College, including the conference dinner (12th).

We were extremely fortunate to receive generous sponsorship for the Colloquium, from the British Heart Foundation (£2000), the Wellcome Trust (£2000) and the Physiological Society (£750). Almost all this money was put towards bursaries for young or East European participants; we gave 21 bursaries, the maximum value of which was £300 (local costs plus £105 cash towards travel expenses). The recipients and the organising committee are most grateful to our sponsors; without the sponsorship we would have had to impose a higher registration fee and offer too few bursaries.

Acknowledgements

I should like to express my warm thanks to Professor Christopher Edwards, Principal of the newly created Imperial College Medical School, who welcomed the Colloquium on behalf of the College; to the local members of the organising committee - Professor Colin Caro (co-chairman), Dr. John Lever, Dr. Christopher Phillips and Professor Robert Schroter - who had all the local organising to do; and to Mrs. Gill Cash who, with other secretarial assistants, kept everything running smoothly. All participants agreed that the Colloquium was stimulating and enjoyable, and we look forward to more in the future.

Professor Timothy J. Pedley
May 1996

