
WG 16: Cardiac and Cardiovascular Models

Coupling, Integration and Improvement



Fraunhofer

Institut
Techno- und
Wirtschaftsmathematik



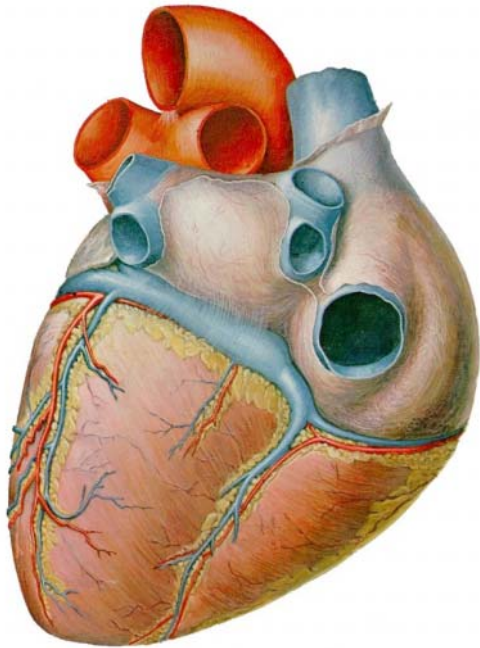
Speaker:

Hagen Knaf

Department:

Adaptive Systems

WG 16: Cardiac and Cardiovascular Models

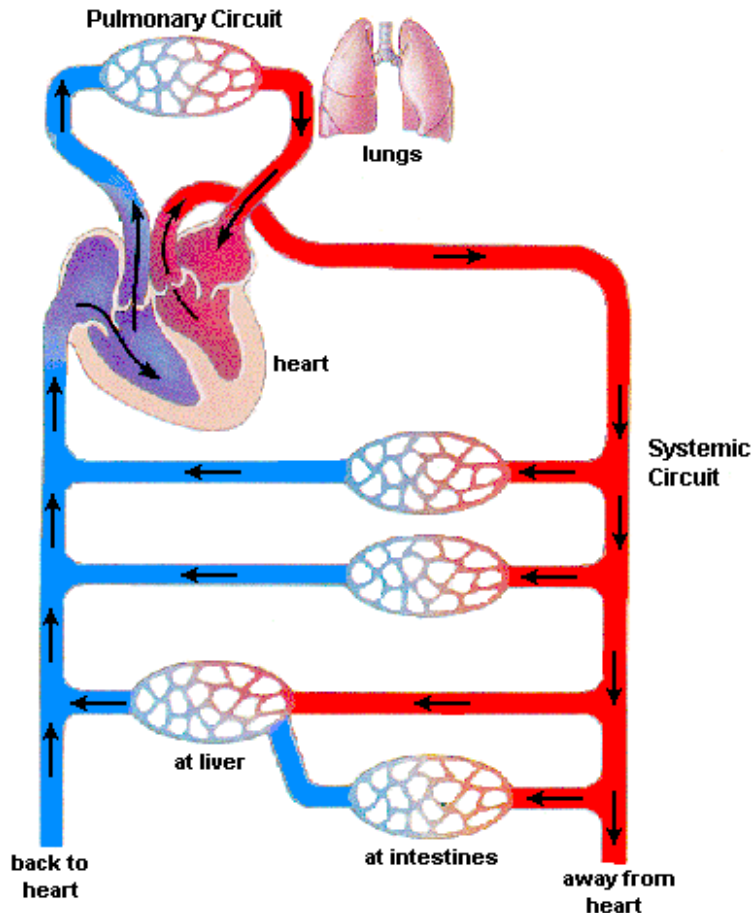


Overview

- Introduction
- Needs of the industry / of the medical sector
- Aims of the working group
- Participants
- Planned events



Introduction: What is it all about?



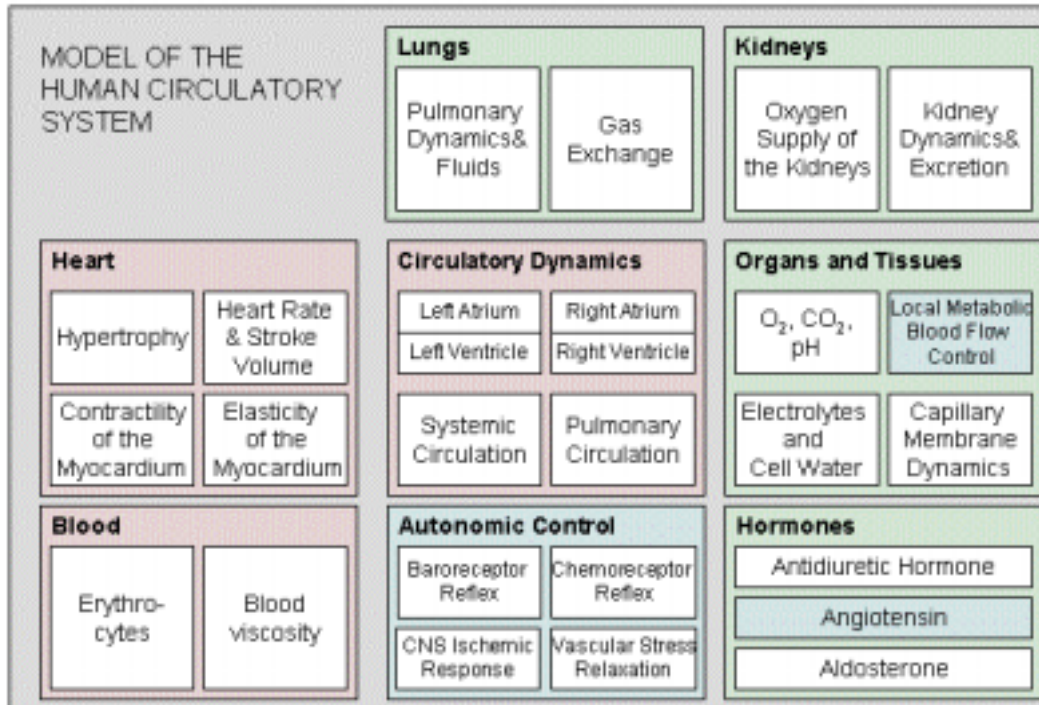
*Figure taken from Human Biology by Starr and McMillan

The cardiovascular system

- Consists of various structurally different components: myocard, valves, blood vessels, blood, hormones, nerves, ...
- Knowledge about the system is available and desirable at different levels: bio-chemical, electro-chemical, cellular, „local“, „compartmental“, ...
- Partial mathematical models based on rather different methods exist.

Seite 3

Introduction: What is it all about?



Circulatory dynamics: red, control mechanisms: blue, other physiologic subsystems: green

Selected mathematical methods

- Fluid Dynamics
- Cellular Automata
- Delay-Differential-Equations
- Nonlinear and Symbolic Dynamics
- Network Theory
- Control Theory

Needs of the industry / the medical sector

- Medical technics / devices
 - Pharmaceutical industry
 - Physicians, medical technicians ...
- Models for stents, artificial heart valves, ...
 - Simulation of new product properties
 - Models of the myocyte
 - simulation of drug effects
 - Computer models of (parts of) the cardiovascular systems
 - monitoring systems

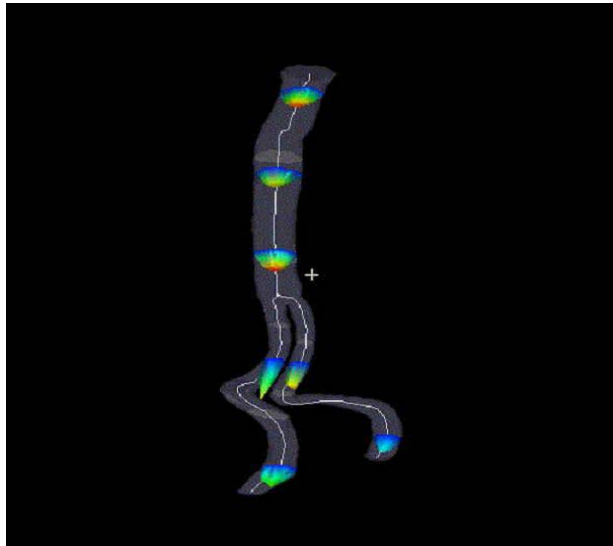
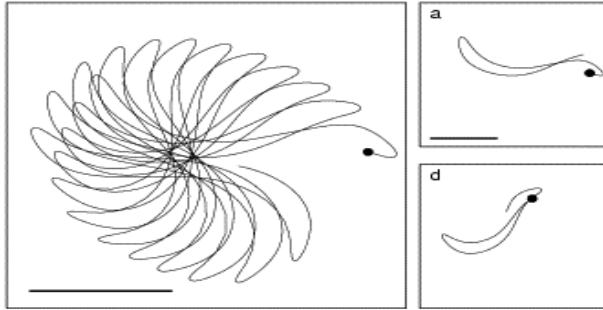
Needs of the industry / the medical sector

- Medical technics / devices
 - Pharmaceutical industry
 - Physicians, medical technicians ...
- Computer models of (parts of) the cardiovascular systems
 - better understanding hence better diagnosis and treatment of diseases
 - improvement of teaching / training
 - Expertsystems (in Cardiology)
 - objective knowledge databases through formalization
 - hypothesis testing
 - Tele medicine: Robust measuring methods / devices

Aims of the working group

- Coupling models
 - Integrating models on different scales
- Myocyte --> Heart --> {Heart,Lungs,Brain,Glands}
 - monitoring systems, anaesthesia
 - {Valves,Atria} --> Arteria --> Brain
 - heart infarction, stroke prevention
 - Purely data-based methods <--> Cardiovascular models
 - Tele medicine

Participants



Prof. Dr. L. Formaggia, MOX, Politecnico di Milano, Italy.

Dr. A. Frangi, Aragon Inst. of Engineering Research, Spain.

Fraunhofer ITWM, Kaiserslautern, Germany.

Prof. Dr. I.C. Hirsch, Uni. Brussel, Dept. Fluid Dynamics, Belgium.

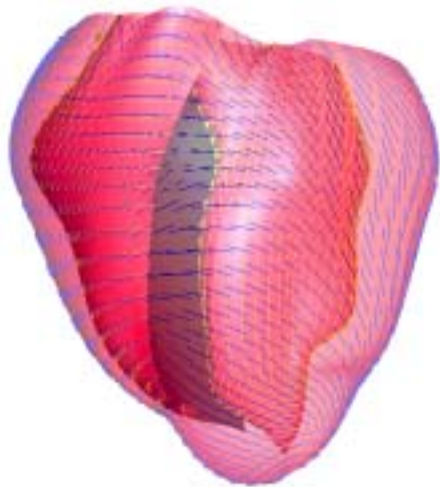
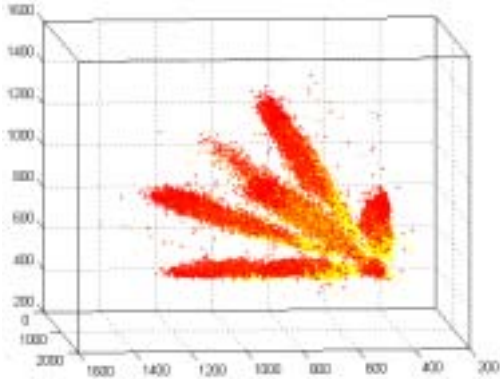
Prof. A. Holden, Comput. Biology Group, Uni. Leeds, UK.

Prof. Dr. F. Kappel, Inst. for Math., Uni. Graz, Austria.

Prof. Dr. L.F. Pavarino, Uni. Milano, Dept. of Math., Italy.

Philips Medical Systems, The Netherlands.

Participants



Dr. R. Reinhard, SynCare GmbH / Ganimed, Germany.

Dr. F. Sachse, Inst. für Biomed. Technik, TH Karlsruhe, Germany.

Prof. Dr. F. van de Vosse, Eindhoven Uni. of Technology, The Netherlands.

Potential Partner:

Geratherm Medical AG, Geschwenda, Germany.

Planned events



- Working group existent since Sept. 2002.
- early Spring 2003: Event with particular aim to attract/involve more industrial partners into the WG.
- June 2003: Event embedded into the workshop *Issues in Cardiovascular, Respiratory and Metabolic Control Modelling* in Graz.

End

