MATH CURES
Improving Healthcare by Mathematics

3TU.AMI workshop, March 10, 2011
University of Twente

The formula of this workshop was unique. Different aspects of a problem were discussed by couples of speakers with different backgrounds:

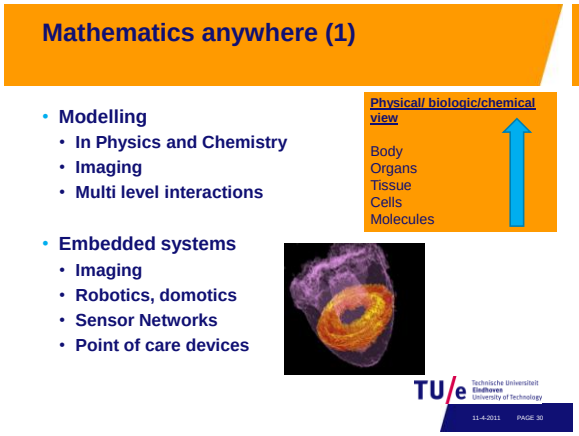
- A specialist from a specific medical practice;
- A mathematician from 3TU.AMI

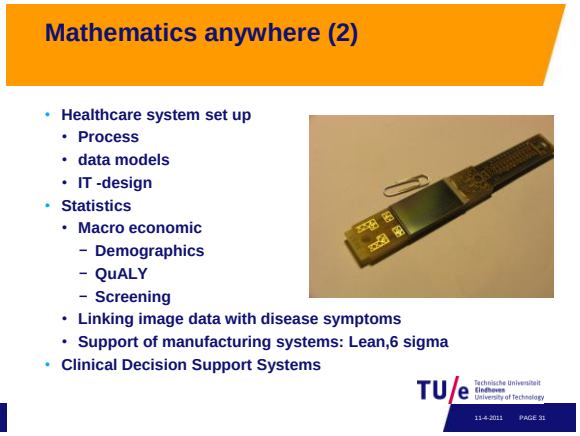
The problems discussed were:

- Rapid cancer diagnosis
- Biomedical imaging
- Wound healing
- Neuroscience

Copies of the presentations can be downloaded from the 3TU.AMI website.

Roel Fonville (Director of Strategic Area Health of the TU Eindhoven and former Vice President Philips Medical Systems) gave a lecture on the developments in biomedical technologies and mathematics. About the role of Mathematics, it became clear that Mathecatics is of vital importance to Healthcare, but Mathematics is “invisible”. Maybe because Mathematics is everywhere, you can’t see it.





At the end of the workshop, Christof Schütte gave an overview of the activities of MATHEON in the field of Health. Christof Schütte is Professor in Optimaztion and discrete mathematics & Numerical analysis and scientific computing at the Freie Universität Berlin. He is also Deputy Chair at MATHEON (which is a DFG Research Center of the Mathematics Departments of the three Berlin universities and the research institutes WIAS and ZIB.

At MATHEON, there are specific areas where mathematics has begun to take on an active role.

In medicine, the already traditional role of mathematics in medical imaging (e.g., computer tomography) has been successfully extended. Mathematical progress has proved to directly influence medical progress towards the design of patient-specific therapies - e.g., in the cancer therapy hyperthermia. As another example, computer-assisted surgery planning allows the comparison of various operation options before the actual operation on the basis of a simulation of more and more realistic models describing soft tissue, bone, or typical human gaits such as stair climbing. Further mathematization of the field is expected to open entirely new perspectives for the optimal design of joint prostheses adapted to individual anatomy.

In biotechnology, the present situation is clearly dominated by the generation of huge datasets about biomolecular, genetic, metabolic or other bio-processes. Algorithms from discrete mathematics or computer science (e.g., in multiple alignment) already play a publicly visible role in the decoding of the human and other genomes. In contrast to that, the mathematical treatment of the dynamics of bio-processes is still rather limited - even though this aspect seems to be crucial for the detailed understanding of virus diseases or the design of narrow band drugs. Therefore, beyond the well-established core areas of bioinformatics, numerical biocomputing has recently become more and more accepted as one of the keys to data-based reliable prediction, control and design of real-life bio-processes: As it turns out, a significant increase in our ability in a reliable quantitative simulation of the dynamics of large biomolecules is essential for a detailed understanding of, e.g., the enzymatic mechanisms of prion diseases (like the mad cow disease or its human counterpart, the Creutzfeldt-Jacob syndrome).

At MATHEON, the research topics in this field of Health are:

- computer-assisted surgery
- patient-specific therapy planning

- protein data base analysis
- protein conformation dynamics
- systems biology
- pharmacokinetics

In the future 3TU.AMI and MATHEON will consult on further collaboration in the field of Health & Mathematics.

The number of participants was 60, of whom 17 came from medical practices (e.g. hospitals).

	Total	TUD	TUE	UT	Medical practice	Other universities
Participants	60	10	8	18	17	7

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