
Can systems biology aid personalized medication?

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Welcome to Linköping!

- Linköping is the fifth biggest city in Sweden
- Almost equal distances from Stockholm, Gothenburg and Lund/Copenhagen
- University was founded in 1970
- Known for System Identification, and a clinically close research
- We have now put up the Linköping Centre for Systems Biology, focusing on these two areas. It involves approx 15 groups from 7-8 departments.

The group: Diabetes and Integrated Systems Biology



www.isbgroup.eu

2011-12-05

The theory and systems biology part



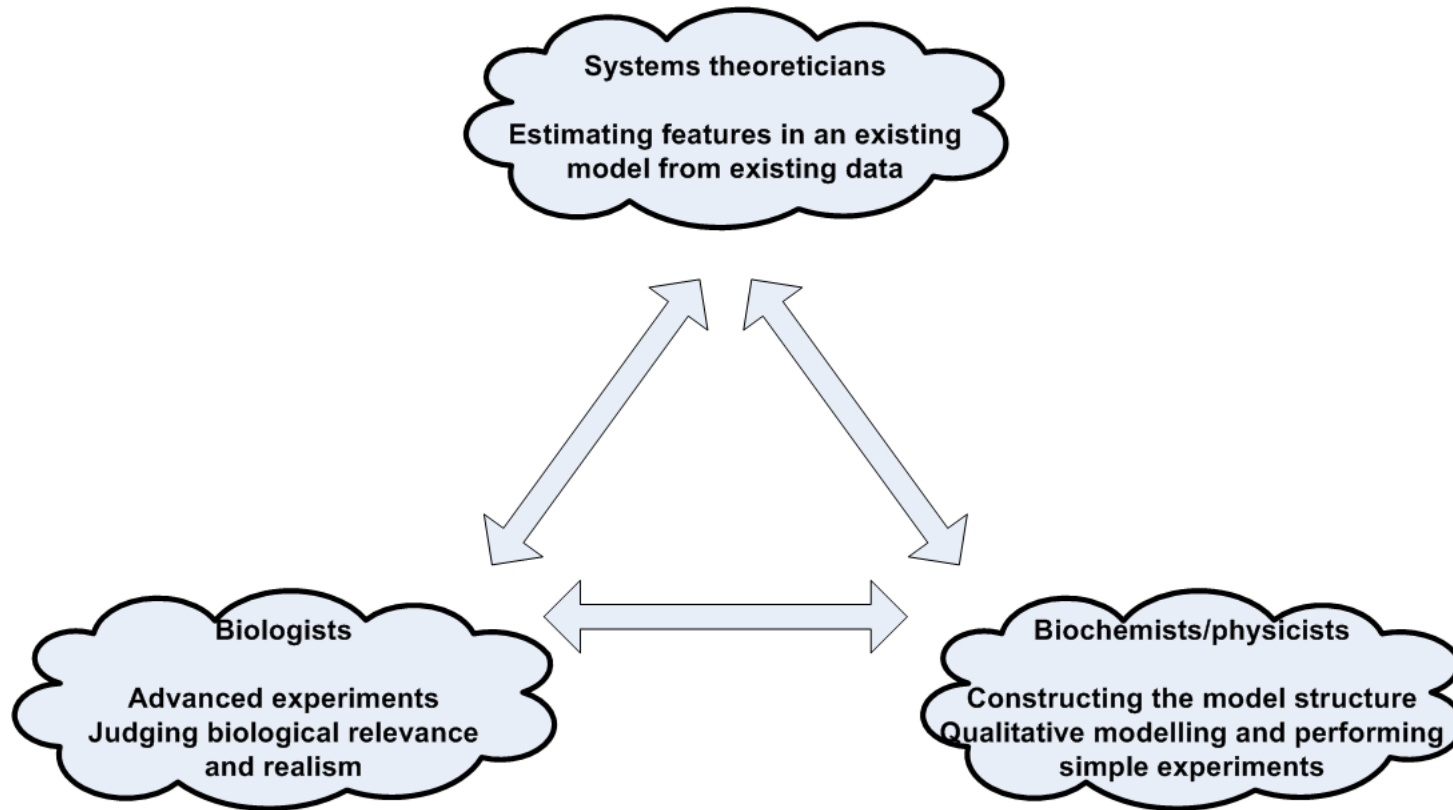
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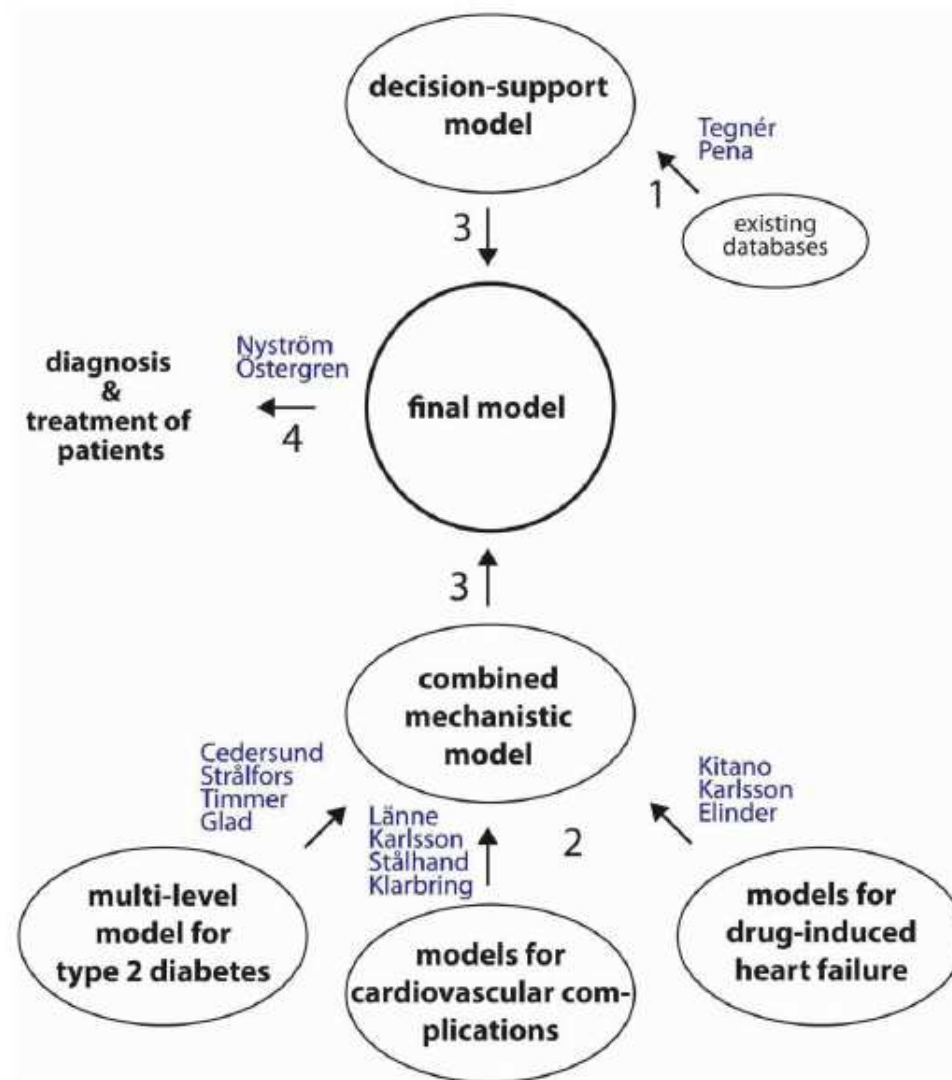
One page summary of systems biology

- It is a new sub-field of biology
- It attempts to understand *systems properties*
 - Hence *many things are measured in parallel* (-omics, bioinformatics)
 - Hence *mathematical modelling is necessary to make sense of the data*, and the complex assumptions
- This is hence a highly multi-disciplinary and conceptually ground-breaking research field

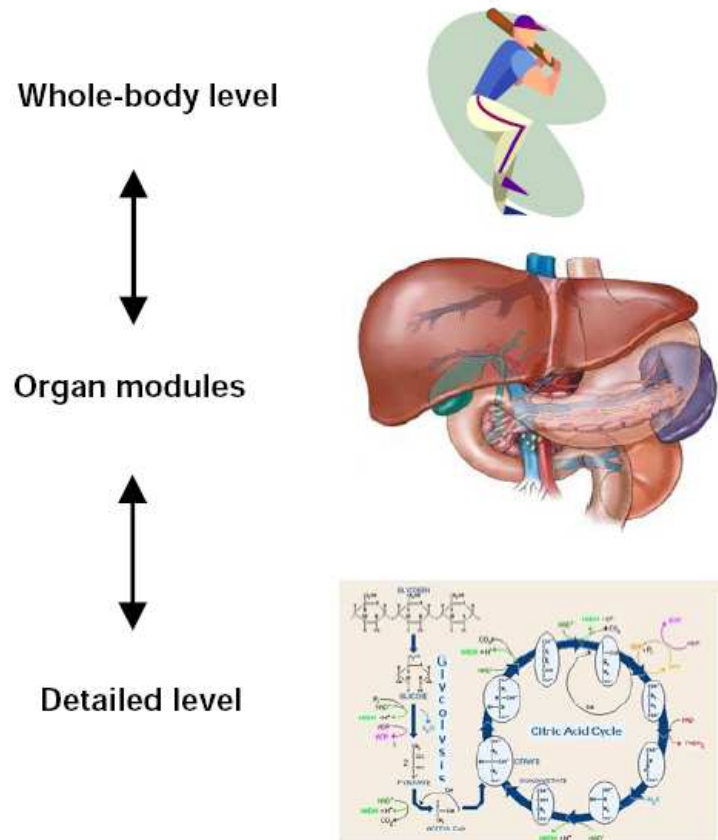
The essential competences in systems biology



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Multi-level modelling



Done already by Physiome, HD-physiology, Virtual physiological human, etc

The hierarchical session

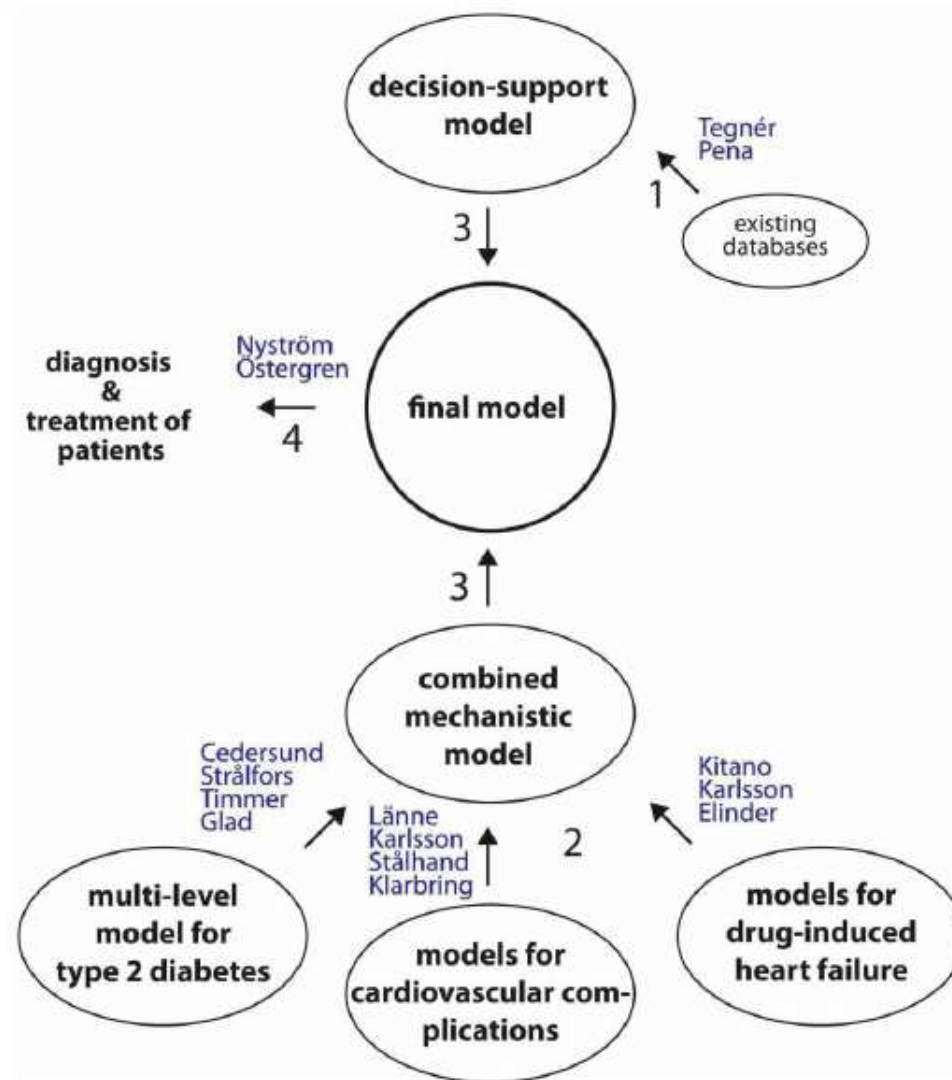
- Peter Fritzson, Elin Nyman - *multi-level modelling with Modelica, to simulate diabetes*
 - teaser for Tuesday morning session
- Matts Karlsson - *Hierarchical modelling of heart of and artheries*
 - teaser for Tuesday afternoon session
- Marek and Pavol - *HumMod - a large hierarchical model of integrative human physiology*
- Kitano - *Systems biology and its application to drug discovery*



Reasons for personalized medication

- Because different patients respond differently
- Because the same disease may actually be many different diseases
- What is the optimal treatment/procedure?
 - Maximize effect
 - Minimize risks
 - Maximize gained knowledge per measurement

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Methods for clinical decision support

In increasing level of mechanistic details...

- Databases/bioinformatics
- Bayesian models
- Network-based modelling
- Pharmacokinetic/pharmacodynamic models
- Mechanistic models
- Multi-level models

Decision-support and clinical practice

- Dirk Repsilber - *Screening for molecular signatures*
- Ljijana Majnaric - *Managing simple, clinical parameters*
- Peter Lucas - *Bayesian Network Modelling for Clinical Decision Making*
 - teaser for Wednesday session, on liver diseases
- Agnieszka Onisko - *Bayesian modelling for decision support in cancer*

Let's start the workshop by coming from the clinical need

Mikael Benson's introductory presentation

- He is one of our most recently recruited professors
 - Paediatrician and prof. in medical systems biology
 - The others are Hiroaki Kitano and Jens Timmer
- He is heading a cross-disciplinary group, and leading two EU-networks, with mutually complementing competences, focusing on personalized medication
- They will hence do the presentation as a group! :)