
Multi-level modelling of type 2 diabetes and its co-morbidities

why do we need sessions on this?

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Overview

- Backstory
- Is this really a good idea?
- The workshop

Welcome to Linköping!

- Linköping is the fifth biggest city in Sweden
- Almost equal distances from Stockholm, Gothenburg and Lund/Malmö
- 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

2011-12-06

The theory and systems biology part



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First workshop

- In the EU-network BioSim there was one Workpackage devoted to fat cells, beta cells, muscle, and whole-body glucose homeostasis
- Why didn't they talk to each other?
- I arranged a meeting with them, and some object-oriented modellers from engineering applications
- This was in January 2006

Amsterdam meeting



November 2006

More applications and meetings

- Malmö, January 10-11, 2008
- STREP application HIMOD, 2008
- DEEPINSIGHT, 2009
- The latest attempt was in 2010, M-INS...

M-INS

- Muscle: Riel, Zierath, Kiens/Richter
- Adipose: Cedersund, Strålfors, Arner
- Liver: Riel, Timmer, Bartholome, Holzhütter
- Whole-body: Cobelli, Adiels/Borén
- Omics: Cascante, Gunther, Kratchmarova
- Scientific advisory board: AstraZeneca, Novartis, Pfizer, NovoNordisk, Entelos

Let's focus on getting things done as well!

Overview

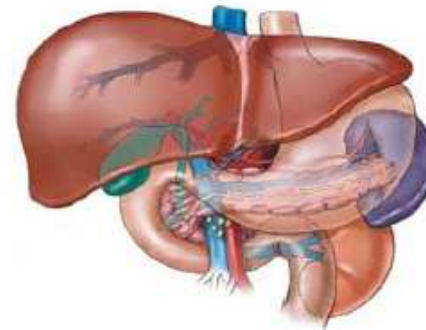
- Practicalities
- Backstory
- **Is this really a good idea?**
- The workshop

What is the idea?

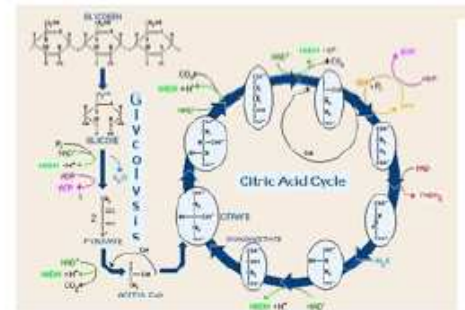
Whole-body level



Organ modules



Detailed level



Can we then ever say anything more than this?

It could be like that

or.....

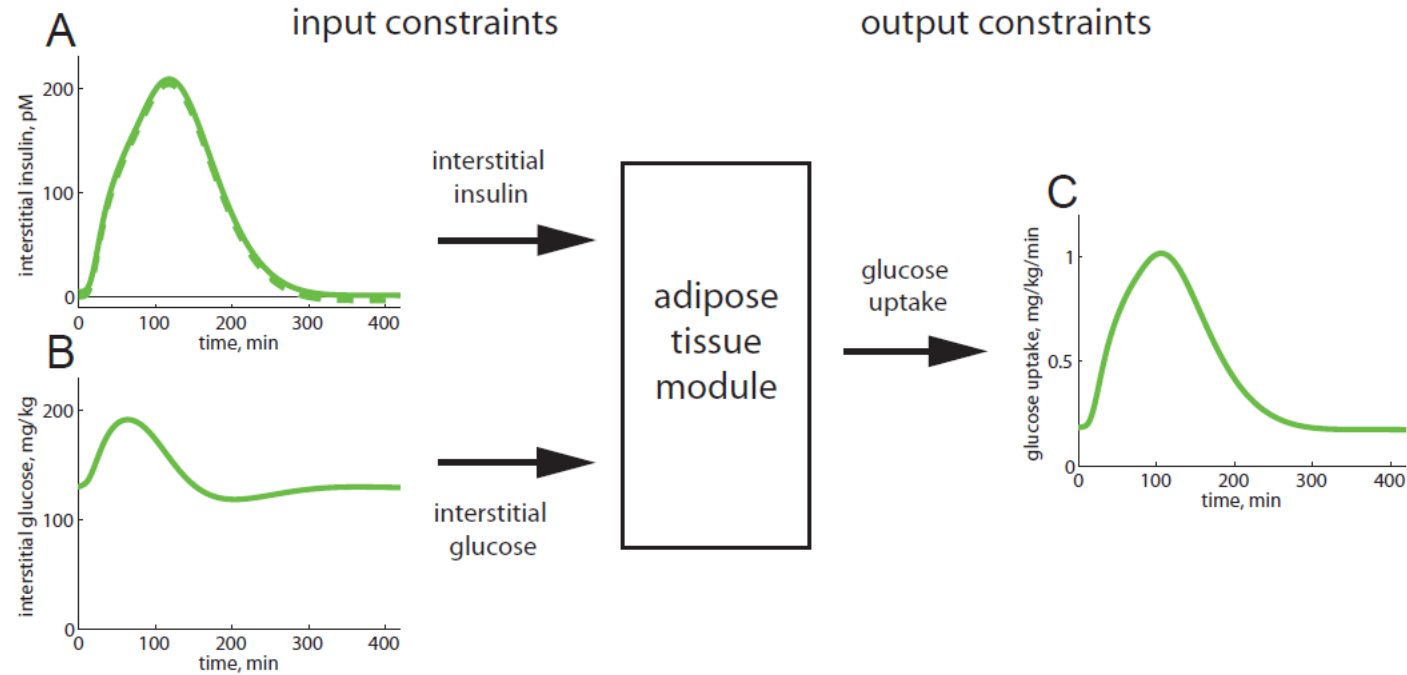
it could be in some other way

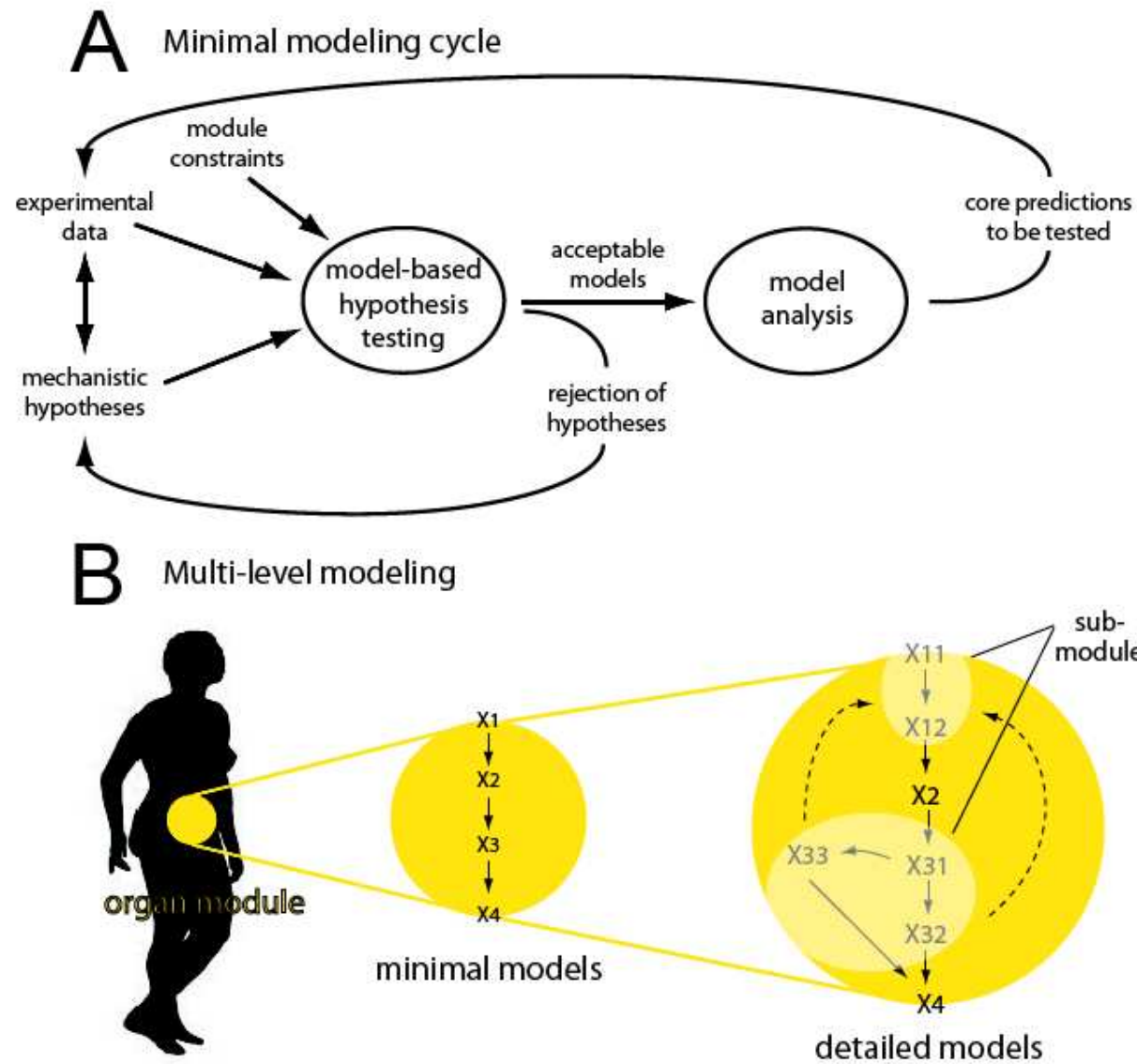


Actually we don't even have a beach statement yet

- There are lots of pieces to the puzzle
- However, the pieces don't match!
- And nobody bothers
- And type 2 diabetes remains an unresolved problem

And by organ constraints, we can draw conclusions



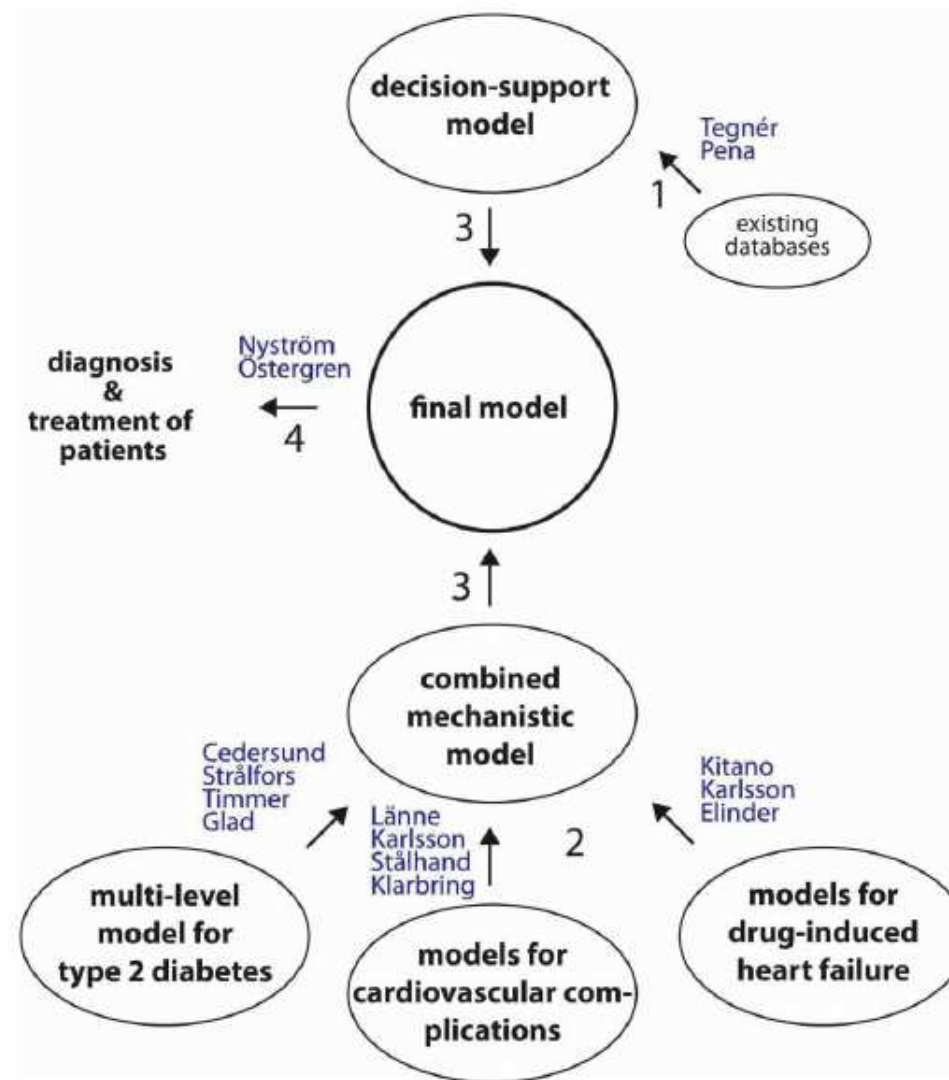


Classical arguments

- Understanding such a complex multi-level disease as diabetes requires multi-level modelling
- The acceptance of the Dalla Man model for replacement of test animals is an indication that models are improving
- However, the Dalla Man model cannot do drug-simulations
- And one group does not have all the necessary competences

Other ongoing and future plans

- Add fatty acid homeostasis (manuscript in prep)
- Model the brain better (see existing models)
- Model other states: diabetes and exercise
- Include more organs (brain, muscle, *beta cells*, *liver*)



This workshop

- Time to work!
- Disseminate knowledge
- Plan for the future, including clinical trials
- Raise new ideas
- Find generally interesting questions and approaches

This morning - multi-level modelling of diabetes

- Peter Strålfors, our adipocyte point-of-view
- Matthias König, a module for the liver
- Morten-Gram Pedersen, a module for the beta cells
- Maria Kjellsson, PKPD-perspective
- Folke Sjöberg, a clinicians perspective

After lunch - clinical trials towards cardiovascular disorders (CVD)

- Fredrik Nyström, Linköping, fastfood, cardiovascular
- Martin Adiels, Gothenburg, fatty acid measurements
- Ferdinand Stuckler, Munich, diabetes and fatty acid
- Discussion - future joint projects?

Final session today - linking up with heart and CVD

- Kitano and Hernandez - ongoing multi-level modelling of the heart in HD-physiology and VPH
- Elinder and Lundengård/Altimiras - ongoing intracellular modelling inside heart cells in Linköping
- Toste Länne - CVD modelling in Linköping
- Final discussion - overall project

