Centrum voor Wiskunde en Informatica

The Silicon Cell

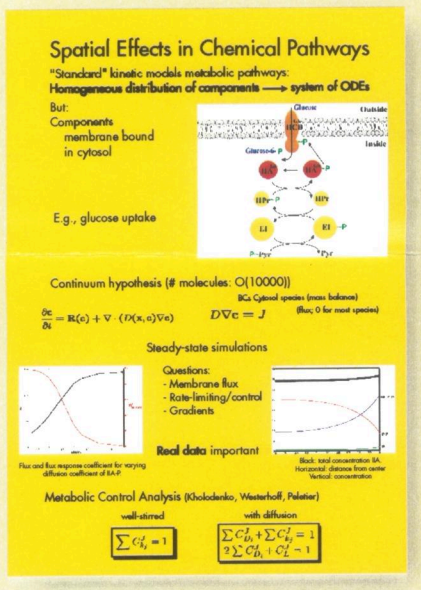
Mathematical / computational challenges

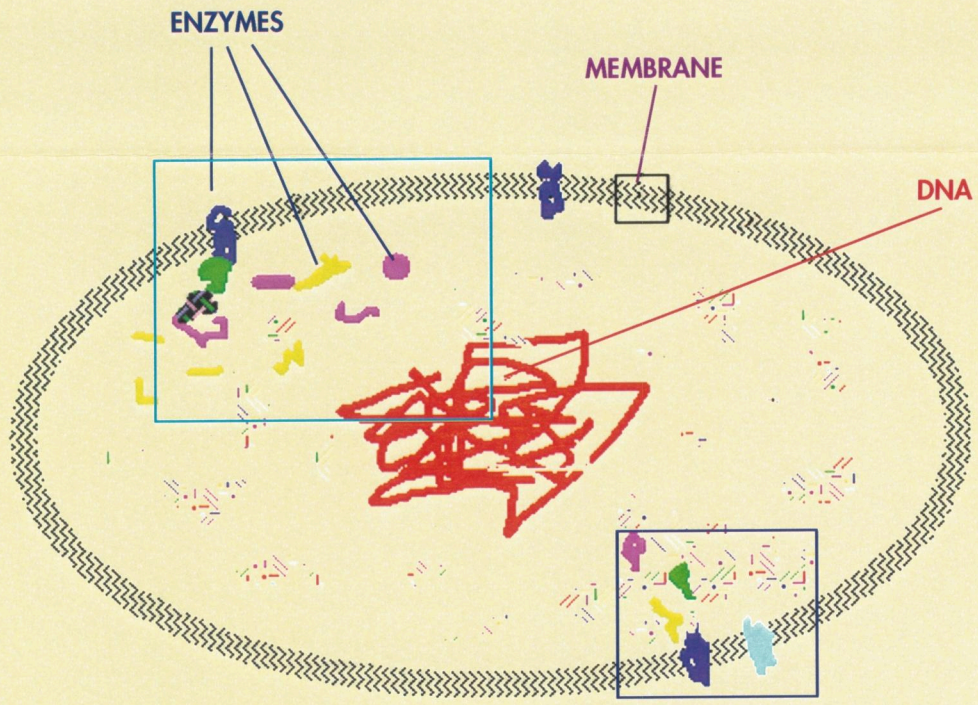
Modelling / Analysis

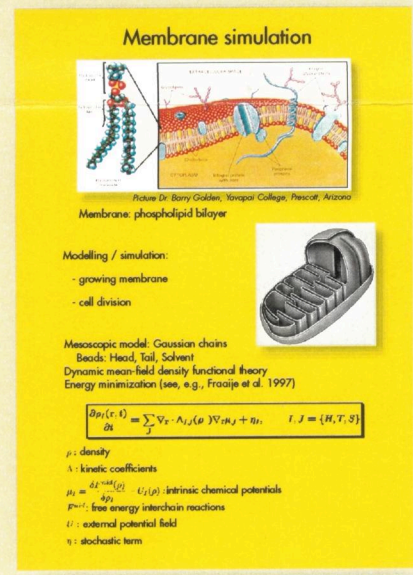
- control analysis (networks, cell cycle models)
- model reduction into functional modules (modular control analysis, combinatorial optimization, choice of metric definition)
- modelling dynamic structures
  - DNA supercoiling
  - aggregates (protein, chromatin)
  - membranes (growing cell, cell division)

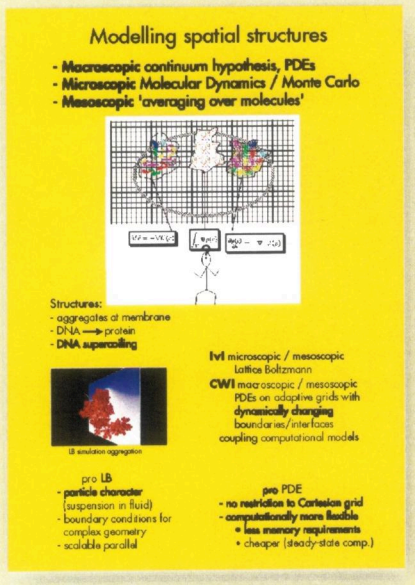
Numerics

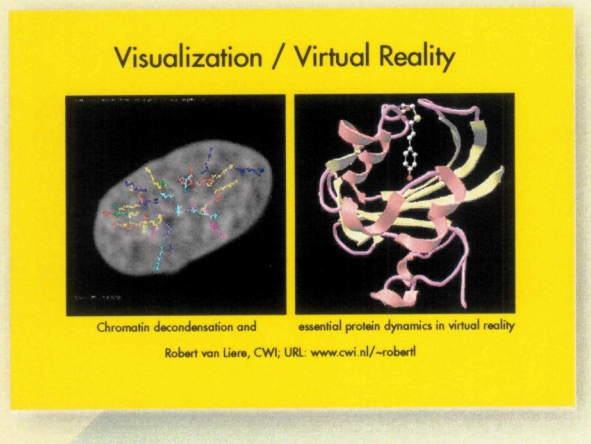
- time integration aspects
  - stiff ODE/DDE solvers
  - split-methods
- data sensitivity parameter estimation
- spatial aspects
  - (stochastic) PDEs on adaptive grids with dynamically changing boundaries/interfaces
  - particle-based methods
  - coupling of the above
- dynamical systems
- model reduction











Software

- large scale computations
- coupling PDE-based and particle-based codes
- systematic data access
- model validation / calibration
- reduction into functional modules (algorithmic + human steering)
- software management
- visualization / Virtual Reality
- HPCN / Grid computing

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