Monte Carlo Simulations of the Eukaryotic Cell Cycle

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Research Summary

BBSI 2006

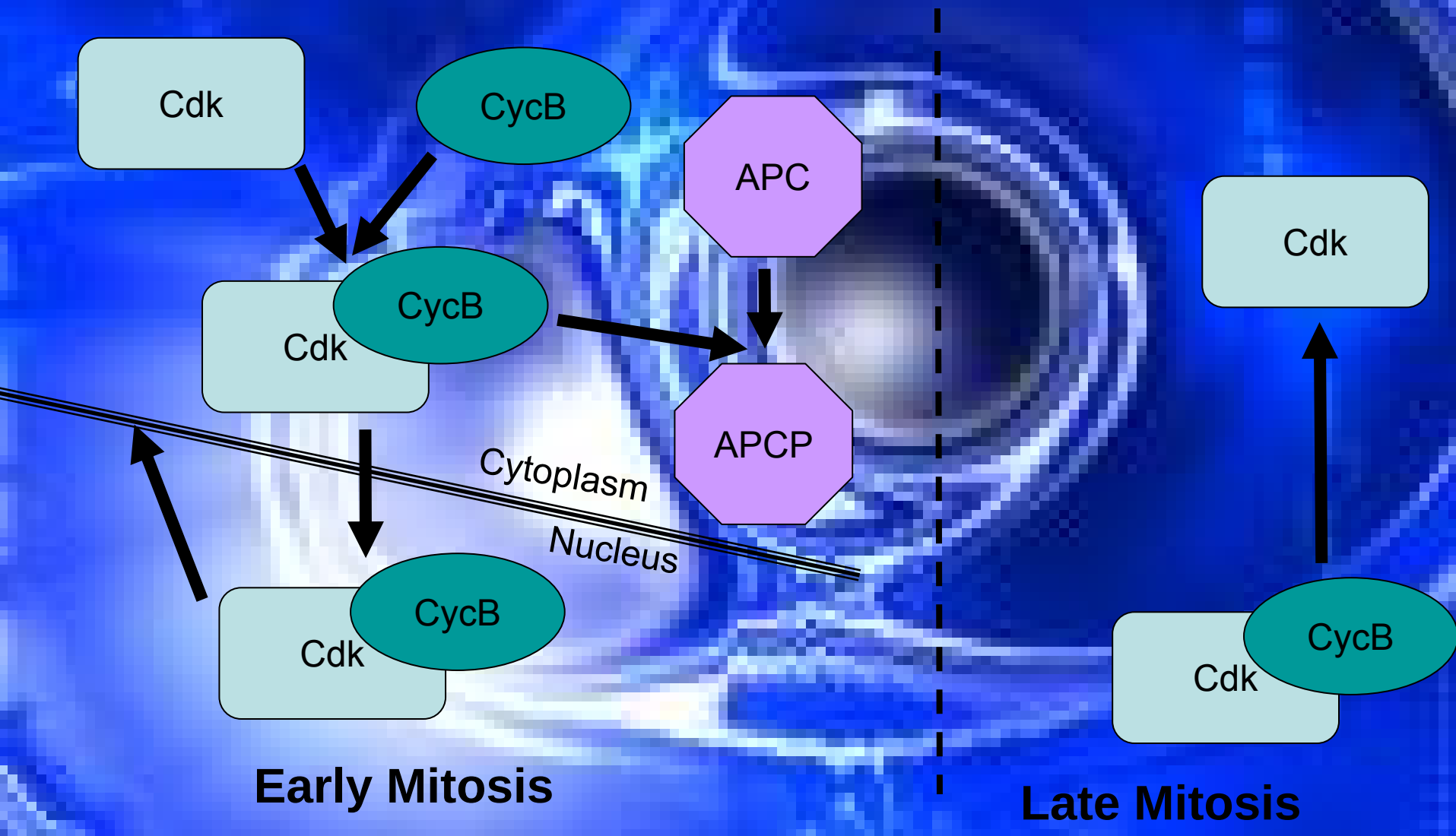
A Cell Divided

- What causes cell division?
- How do we fix/control it?
  - How they divide
  - When they divide
  - How big are they
  - Is it accurate
  - Where are the problems

Cell Modeling

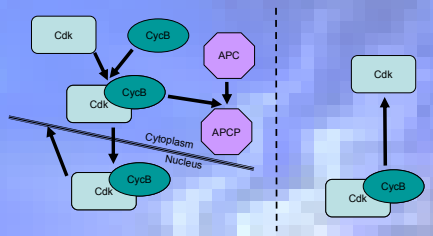
- Save time
- Mathematics (ODE)
  - Represent physical entities as parameters
  - Assumptions about ease of transport and molecular availablility
- Stochastic
  - Probability and physical interaction
  - Spatial realism

The Foundation



The Building Begins

- Translation: MDL

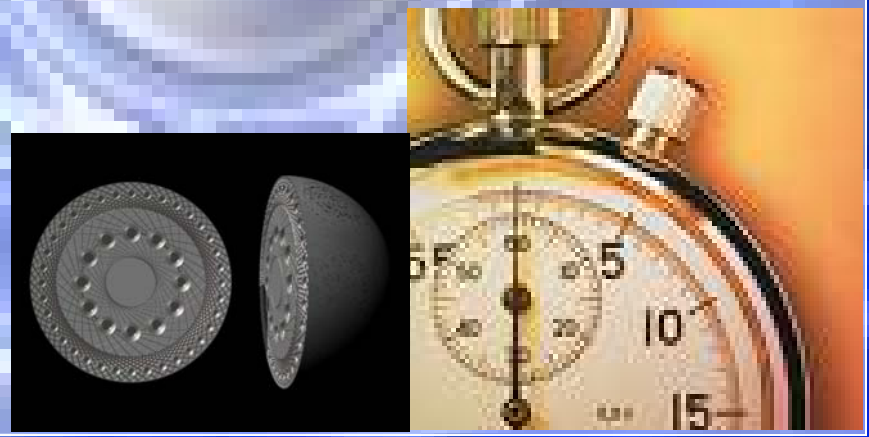


CycB + Cdk -> CycBCdk [1e9]: Activate_Cdk

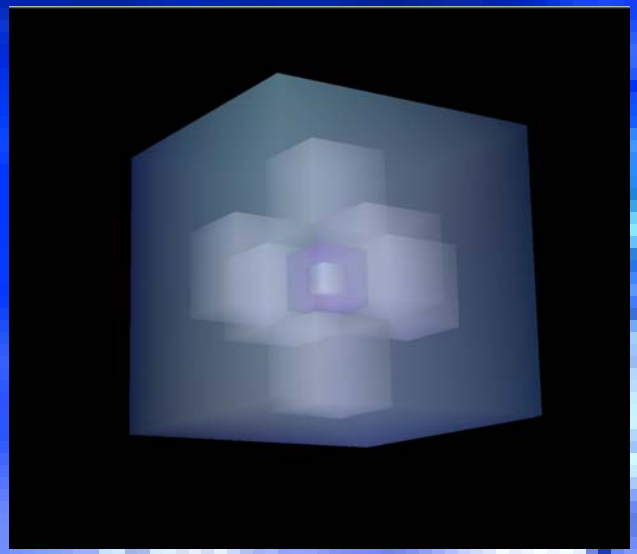
CycBCdk' + nuc_surf' -> nuc_surf' + CycBCdk, [1e9]: Transport_MPF

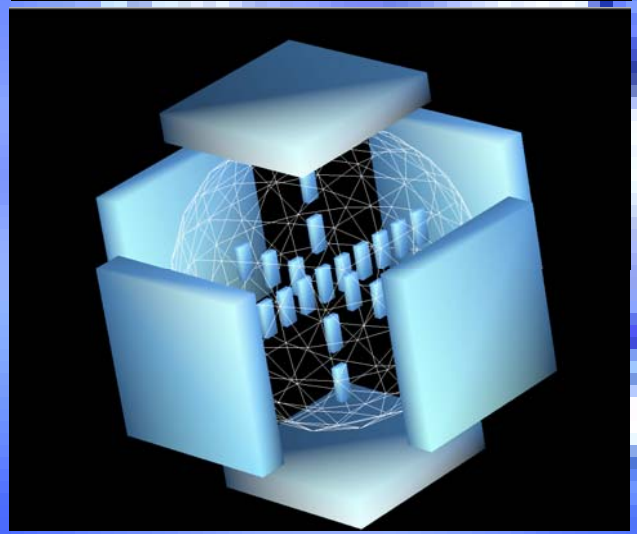
… ect.

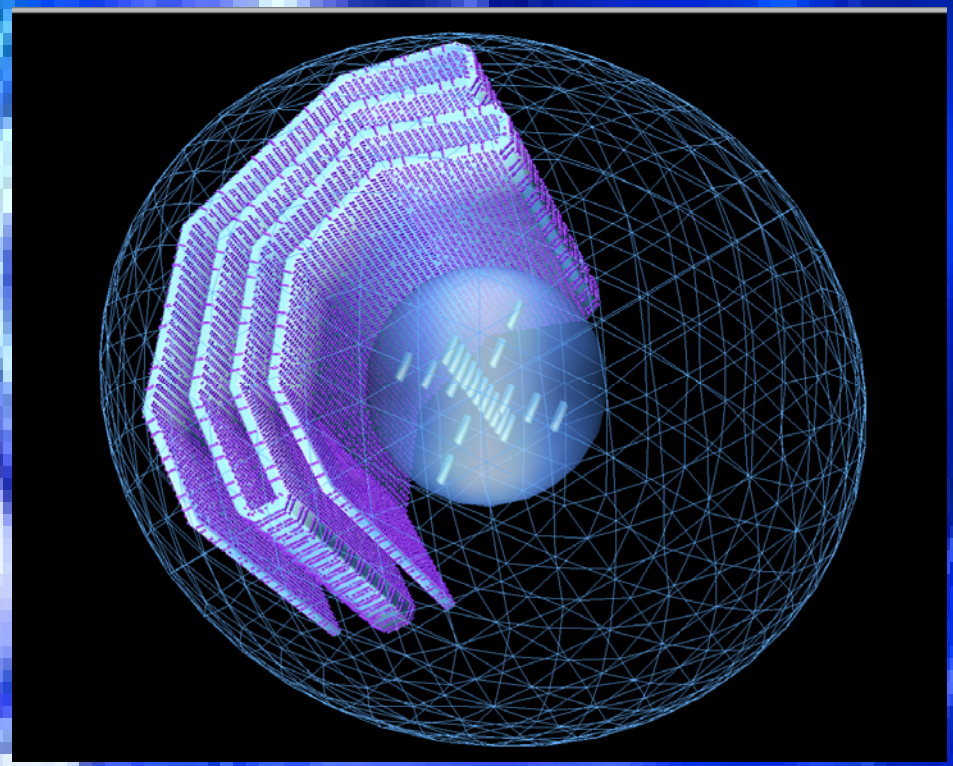
- Scripts
  - Checkpoint
  - Concentration
- Scale It Down



Virtually a Cell

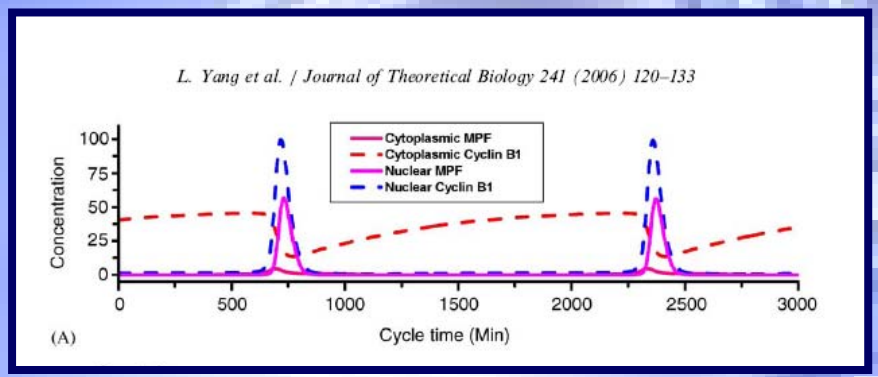


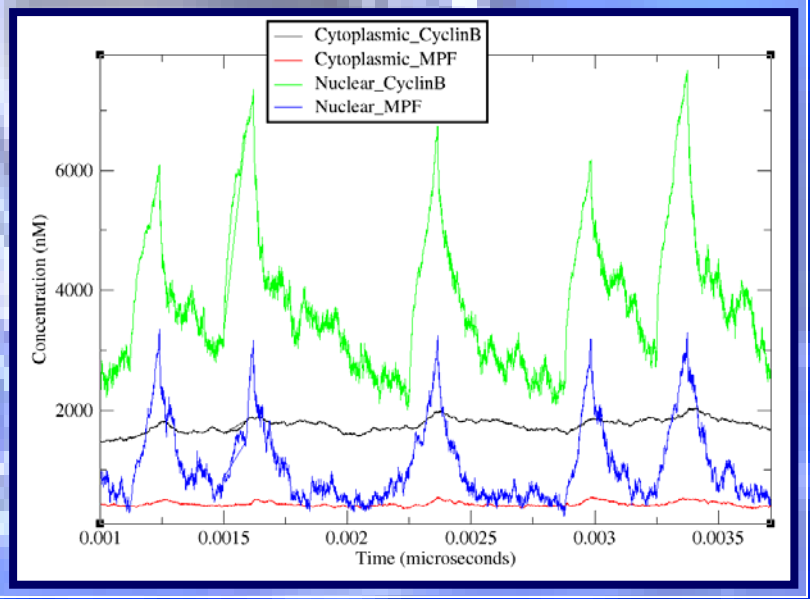




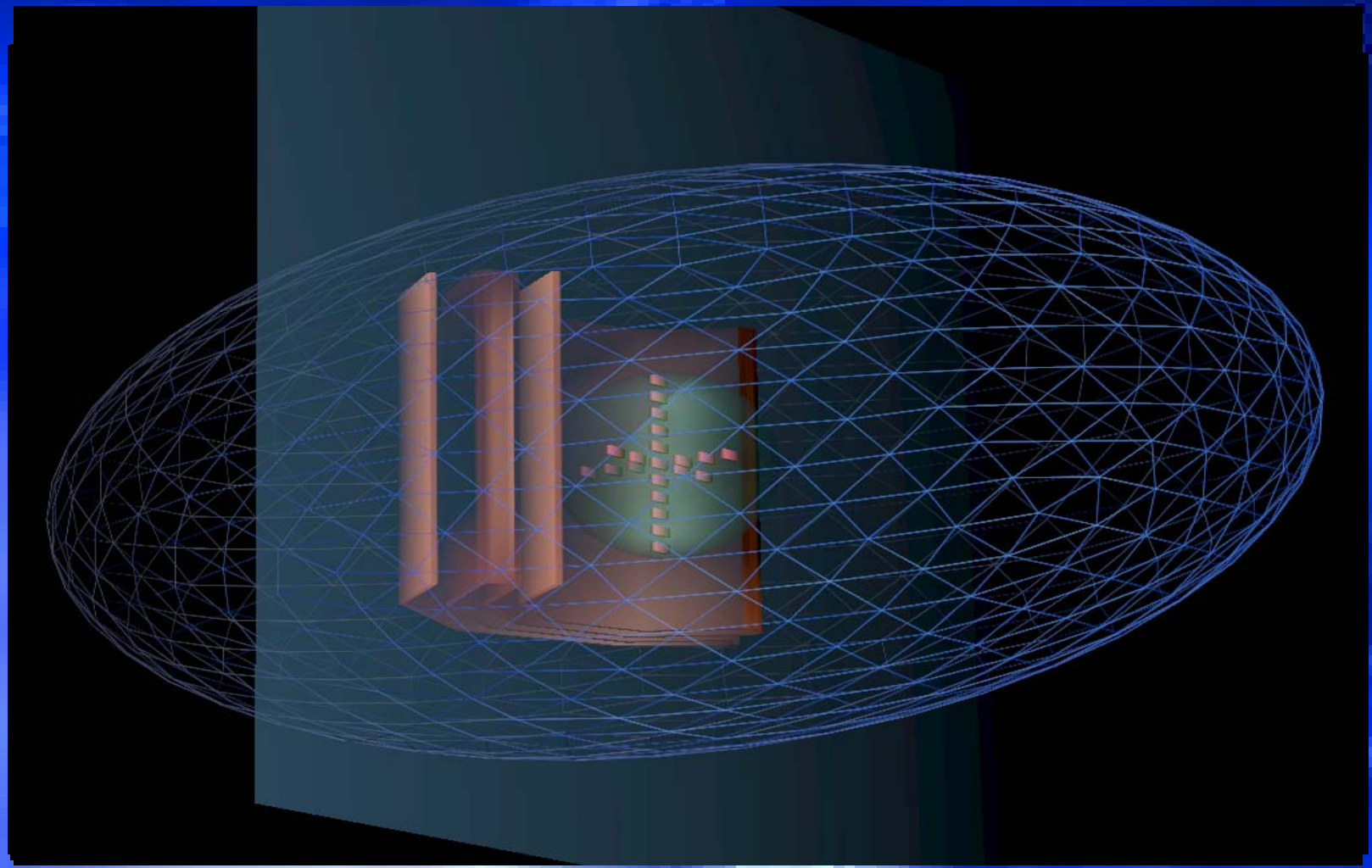
Putting It All Together

- Go faster!
- Oscillate!
  - Degradation based on MPF concentration
  - Similar and yet different





Current Progress



More work

- More networks
- Better Cell Architecture
- Reaction/Diffusion Rates
- Predict Experimental Results
- Different Cell Shapes/Types

References

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