Lecture 3 February 2005

The Life Cycle of Scientific Data
The information-driven scientific method
The new data architecture

- The data architecture enables the research.
- Data storage and retrieval are key elements in the entire enterprise.

\[ \Sigma = \text{A paradigm shift in the scientific method} \]

Theory and analysis \rightleftharpoons \text{Refine Hypothesis} \rightleftharpoons \text{Experiment}
The life cycle of scientific data

Hypothesis to be tested

Data acquisition: design

Data acquisition: measurement and storage

Analysis and modeling

Accommodating the unknown – by design
An example:
actin polymerization

* Potential points of regulation


Informatics Program
Biological Pathways

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Hypothesis to be tested

“Actin polymerization in endothelial cells decreases dramatically when fluid shear forces above a threshold are first applied to the cells.”

- Study name and design
- Study Unique Identifier (UID)
- Experiment Unique Identifier (UID) (multiple)
- Design specification
- Comments on design
Data acquisition: design

“Actin polymerization in endothelial cells decreases dramatically when fluid shear forces above a threshold are first applied to the cells.”

- Study name and design
- Cell identification
- Experiment Unique Identifier (UID)
- Cell conditioning, fluorescent dyes, medium
- Apparatus
- Test parameters, e.g. shear stress, duration, instrument settings, light sources, optical train, size of exposed region
- Scale (fiduciary marks)
- Date and operator
- Comments on experiment
Data acquisition: measurement and storage

“Actin polymerization in endothelial cells decreases dramatically when fluid shear forces above a threshold are first applied to the cells.”

- Study name and design
- Cell identification
- Cell conditioning
- Apparatus
- Test parameters, e.g. shear stress, duration, instrument settings, light sources, optical train,
- Date and operator
- Raw data on all measurements
- Comments on experiment
“Actin polymerization in endothelial cells decreases dramatically when fluid shear forces above a threshold are first applied to the cells.”

- Study name and design
- Experiment UID
- Analysis UID
- Analysis parameters
- Results
- Date and operator
- Comments on analysis
Accomodating the unknown – by design

“Release of Ca++ from intracellular stores causes actin polymerization in endothelial cells to decrease dramatically when fluid shear forces above a threshold are first applied to the cells.”

- New measurement methods?
- New simultaneous measurements?
- Changes in flow history?
- Addition of inhibitor?
- ?
- ?