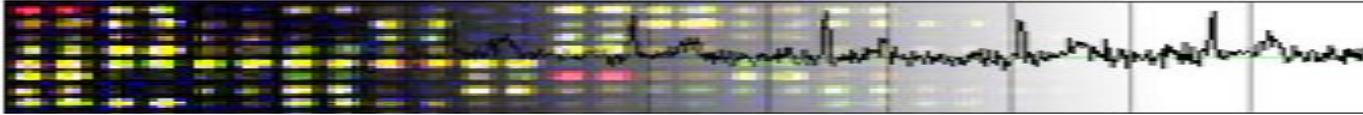


# Biomedical Information Technology

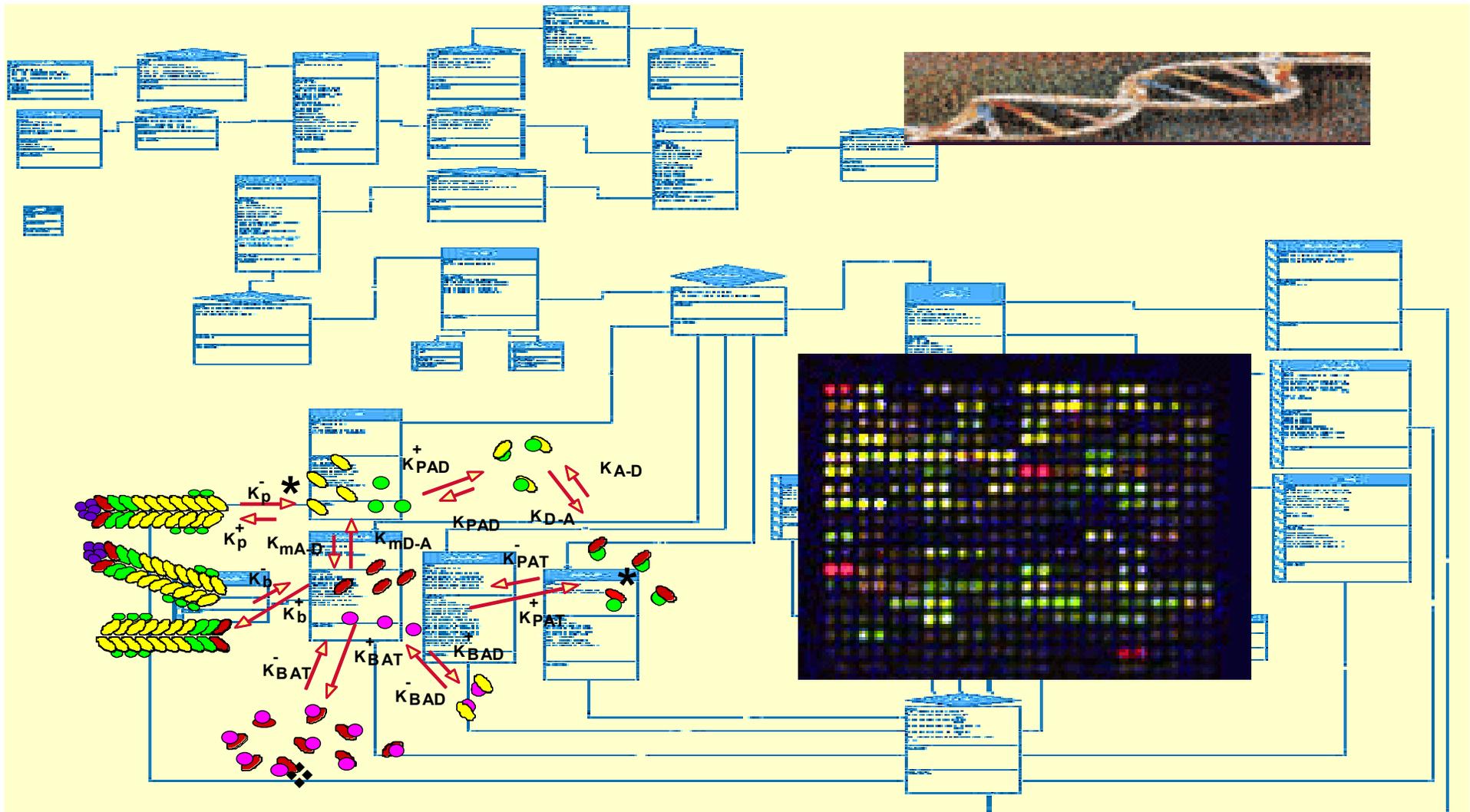
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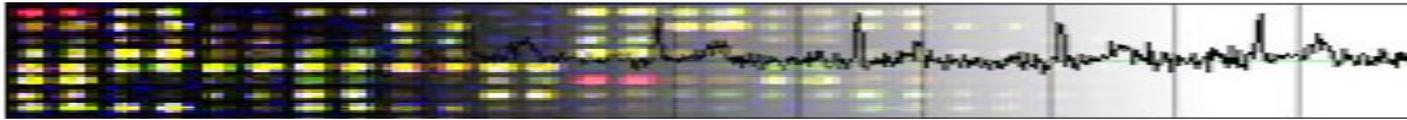
Lecture 3 February 2005

## The Life Cycle of Scientific Data



# The information-driven scientific method

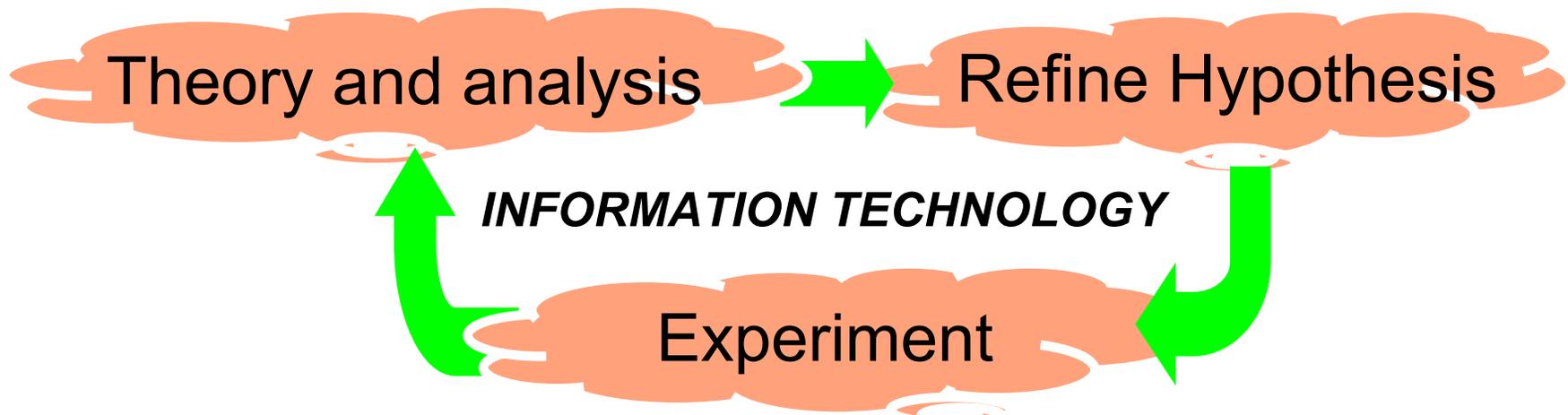


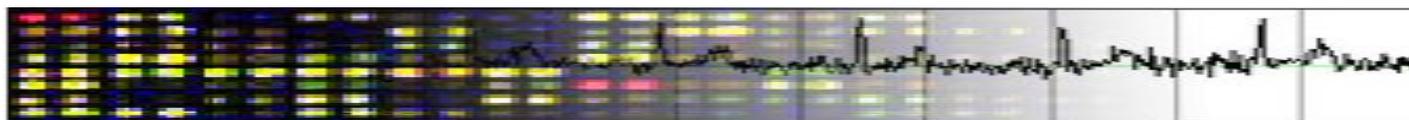


## The new data architecture

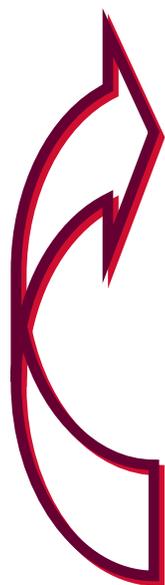
- ❖ The data architecture enables the research.
- ❖ Data storage and retrieval are key elements in the entire enterprise.

$\Sigma$  = *A paradigm shift in the scientific method*





## The life cycle of scientific data



Hypothesis to be tested

Data acquisition: design

Data acquisition: measurement and storage

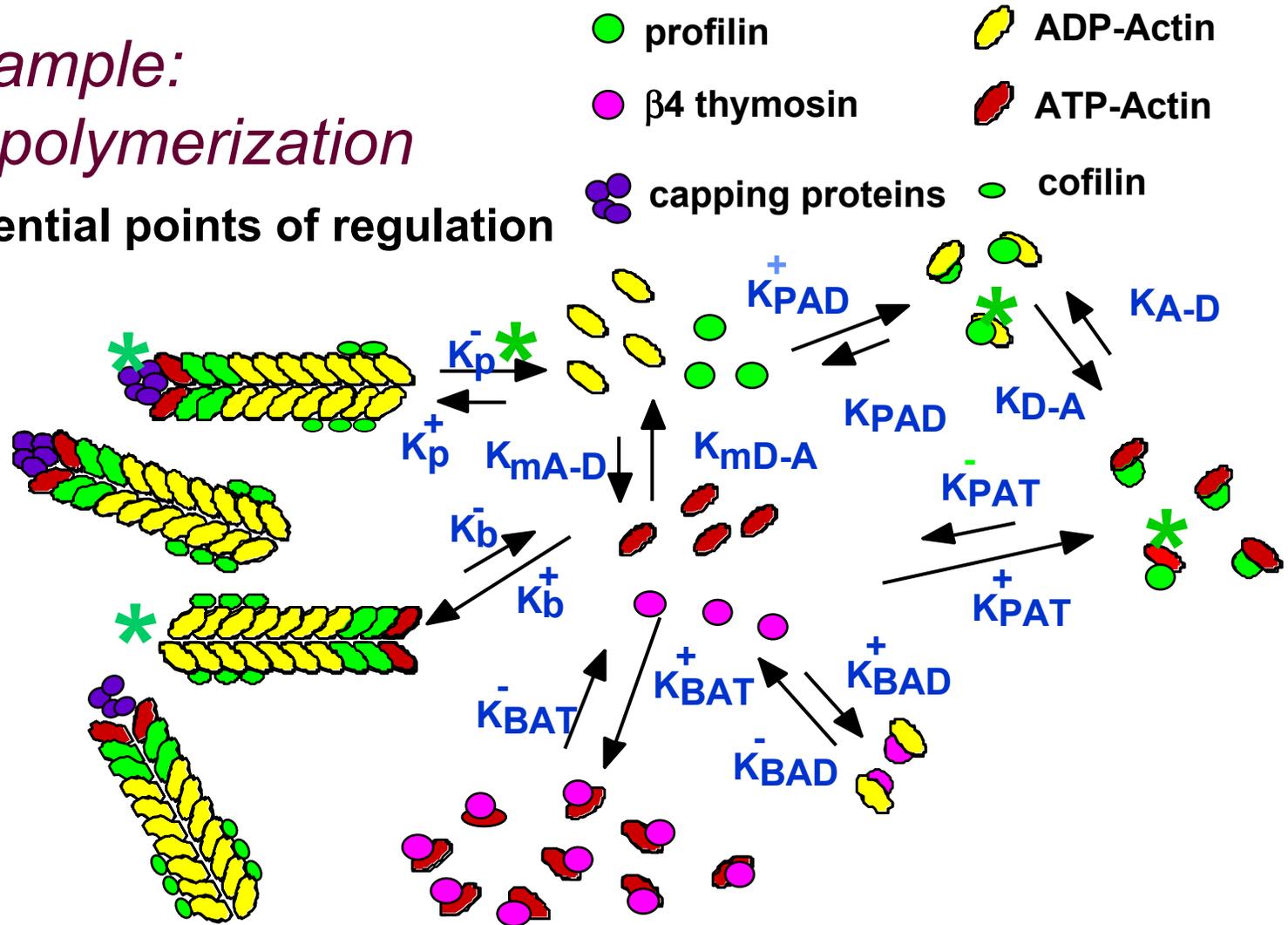
Analysis and modeling

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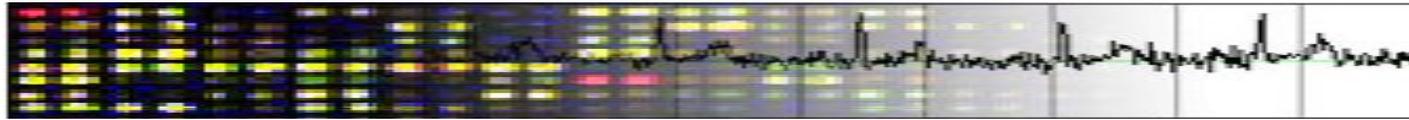
Accommodating the unknown – by design

An example:  
actin polymerization

\* Potential points of regulation



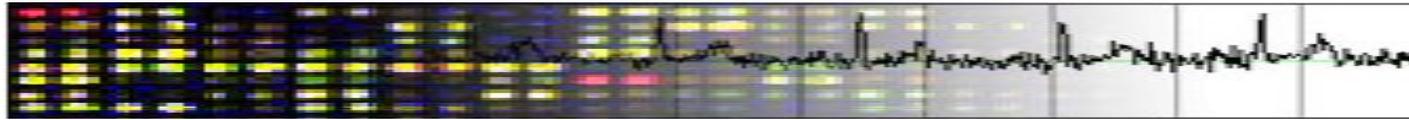
Refs: J. McGrath, Ph.D. Thesis, MIT (2001); Binschadler et al., Biophys. J. (2004)



## Hypothesis to be tested

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

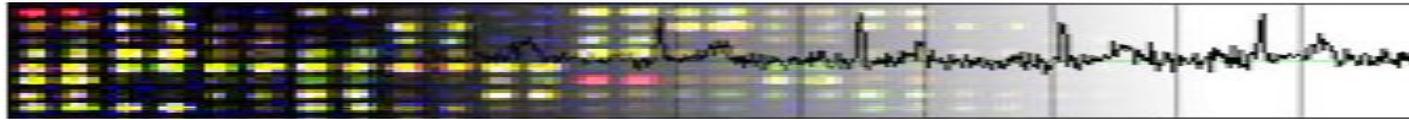
- ❖ Study name and design
- ❖ Study Unique Identifier (**UID**)
- ❖ Experiment Unique Identifier (**UID**) (multiple)
- ❖ Design specification
- ❖ Comments on design



## Data acquisition: design

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

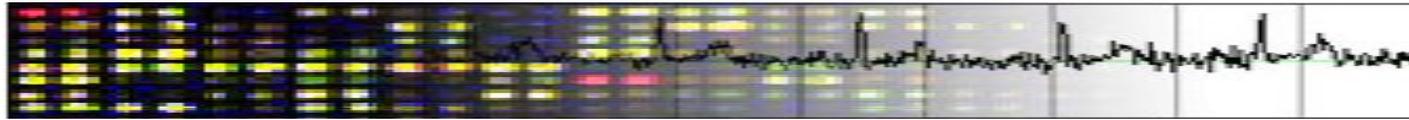
- ❖ Study name and design
- ❖ Cell identification
- ❖ Experiment Unique Identifier (**UID**)
- ❖ Cell conditioning, fluorescent dyes, medium
- ❖ Apparatus
- ❖ Test parameters, e.g. shear stress, duration, instrument settings, light sources, optical train, size of exposed region
- ❖ Scale (fiduciary marks)
- ❖ 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.”

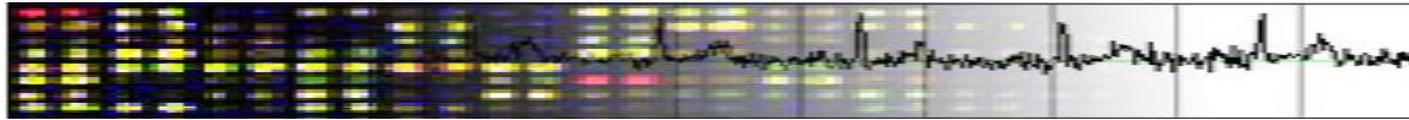
- ❖ Study name and design
- ❖ Cell identification
- ❖ Cell conditioning
- ❖ Apparatus
- ❖ Test parameters, e.g. shear stress, duration, instrument settings, light sources, optical train,
- ❖ Date and operator
- ❖ Raw data on all measurements
- ❖ Comments on experiment



## Analysis and modeling

“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



## Accommodating the unknown – by design

“Release of  $\text{Ca}^{++}$  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?
- ❖ ?
- ❖ ?