

Systems biology: Principles and applications

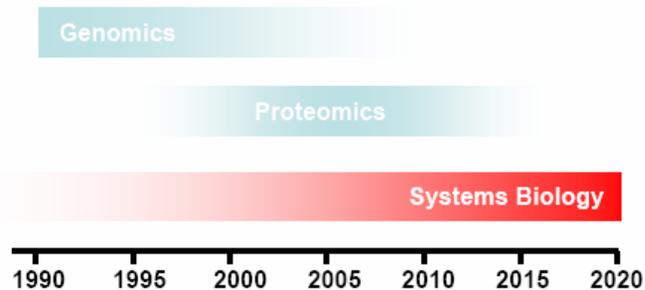
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Systems biology: Principle and applications

Genomics, Proteomics & Systems Biology

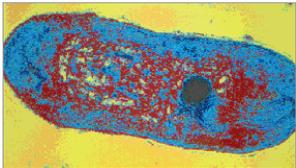


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Systems biology: Principle and applications

What is systems biology?

It's a combined wet-dry approach



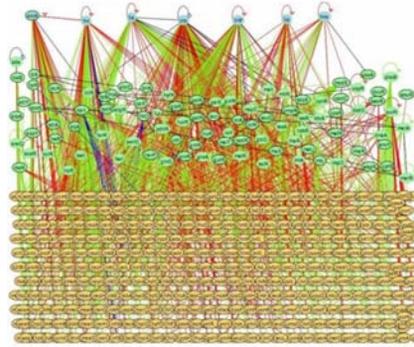
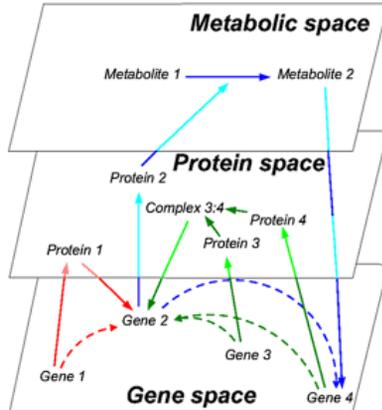
Experiments



$$\begin{array}{c}
 \begin{matrix} v1 & v2 & v3 & \dots \end{matrix} \\
 \mathbf{S} = \begin{pmatrix} -1 & 0 & 0 \\ 1 & -1 & 0 \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{pmatrix} \begin{matrix} \text{Glu} \\ \text{G6P} \\ \dots \\ \text{ETH} \end{matrix} \\
 \text{Matrix Form} \\
 \mathbf{S} \cdot \mathbf{v} = 0
 \end{array}$$

Calculations

It's an integrative Approach

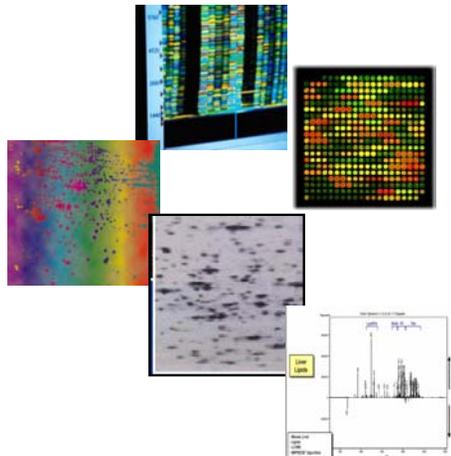


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It's about all level of -omics studies

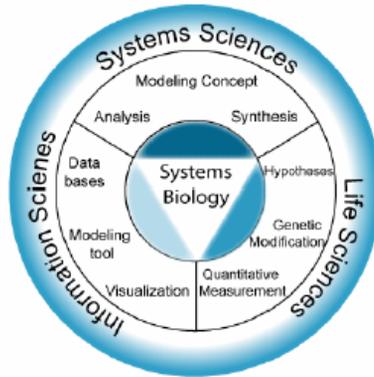
- Genomics
- Transcriptomics
- Proteomics
- Metabolomics
- Fluxomics
- Phyonomics
- Interactomics
- omics



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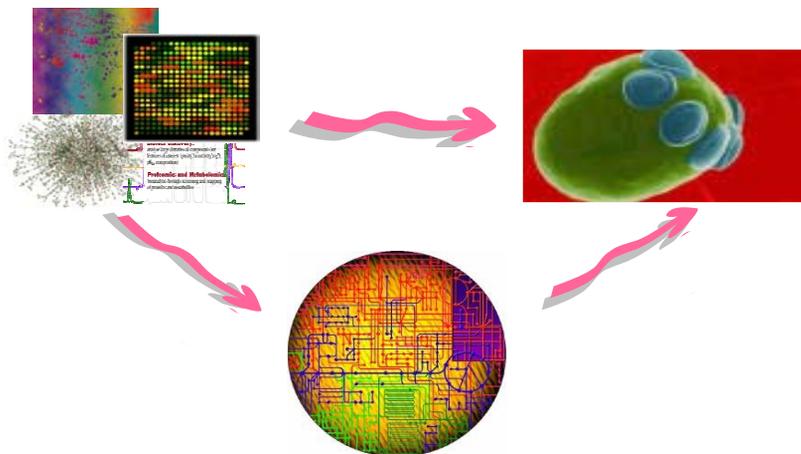
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It's multidisciplinary approach



Biology + Mathematics + Statistics + Engineering + Informatics + ... + ...
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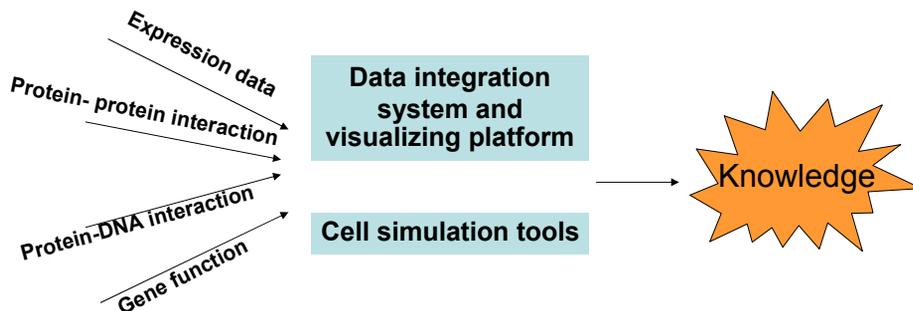
It is about predictive biology



What's systems biology?

- Systems biology is a process of predicting the phenotypic behaviors of a living organism from the genomic information being generated for that organism and the environmental conditions that influence the expression of that genome.

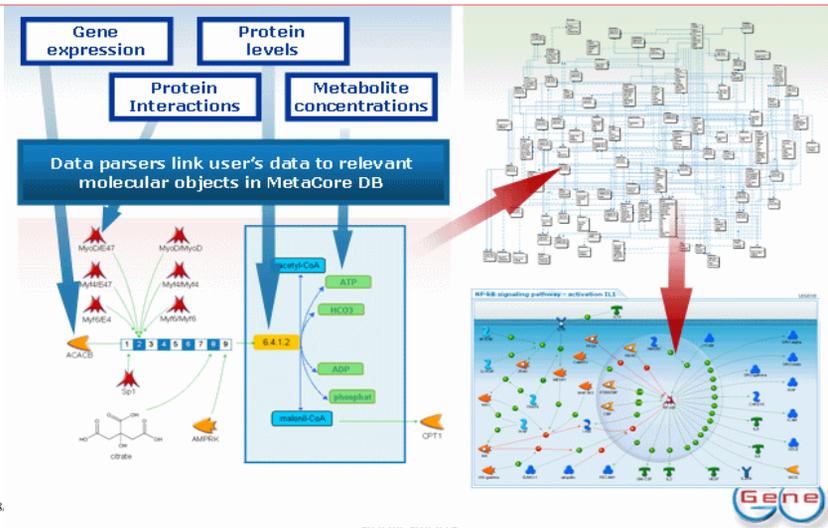
Recent Research in Systems Biology

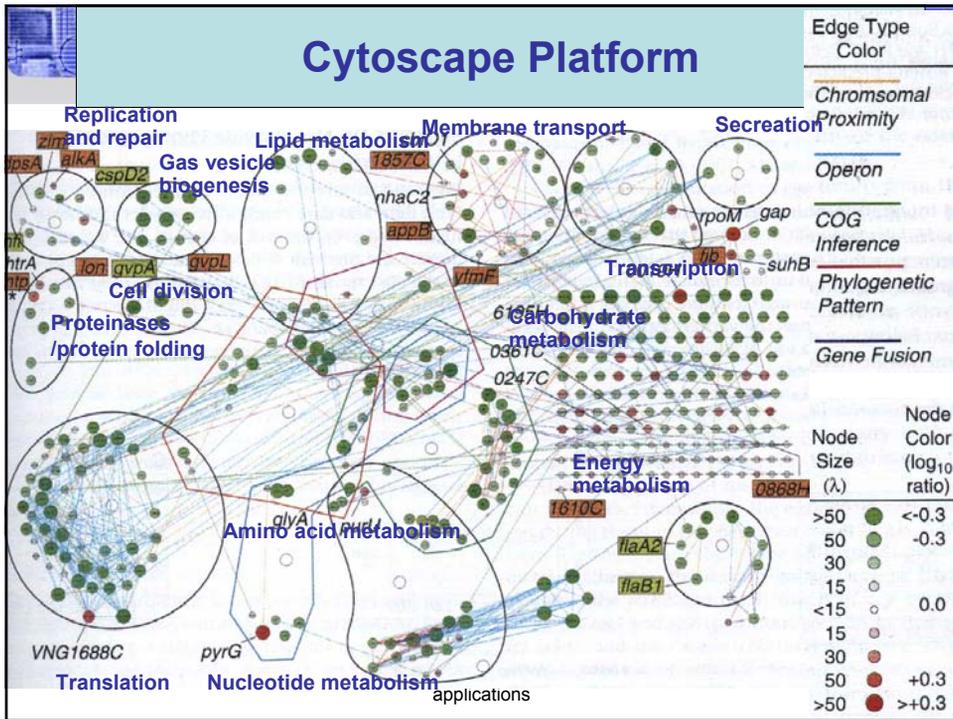


Data Integration Platform and Visualization Tools

- Pajek
 - Graphlet
 - daVinci
 - Osprey
 - PIMrider
 - GeneGo
 - Cytoscape
 - Etc
- } Organize and display the data as 2D network
- } Display and link the network to molecular interaction and functional database
- } Intergrate both molecular interaction and state measurement

GeneGO: Systems Biology for Drug Discovery

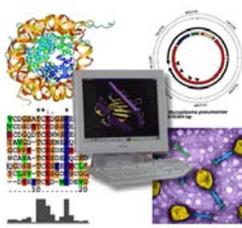
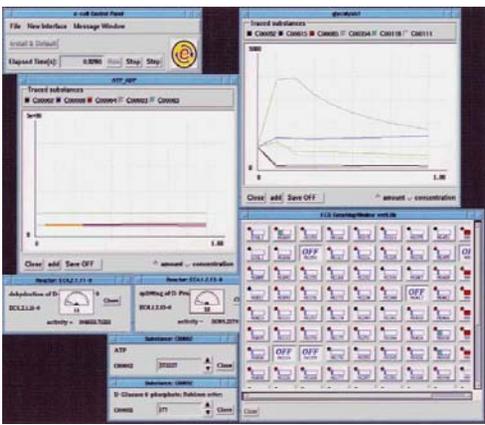




Systems Biology & Bioinformatics Research (SBI)
King Mongkut's University of Technology Thonburi

Cell Simulation Tools

- Software packages that allow us to model and simulate biological behavior of cells

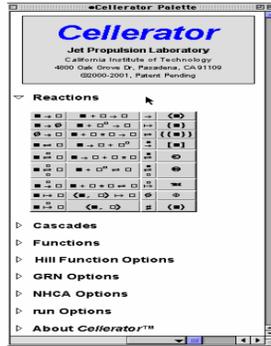
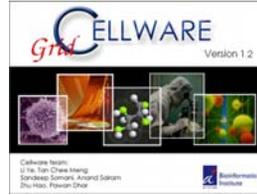
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Some Examples...

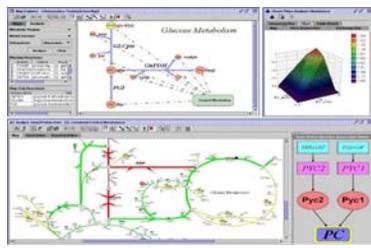
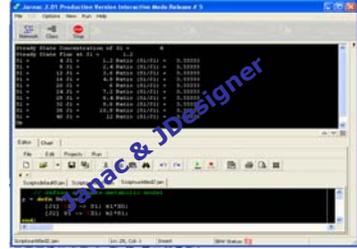


E-Cell System

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Some more....



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Applications

Medicine

Drug target identification
Diagnostic test development
- Tuberculosis
- Malaria



Agriculture

Starch granule control
for cosmetic
- drug
- plastic, film



Biotechnology

Essential oils production
Industrial lipid production
- health & medicine
- pharmaceuticals
- plastic, polymer, paint
lubricants



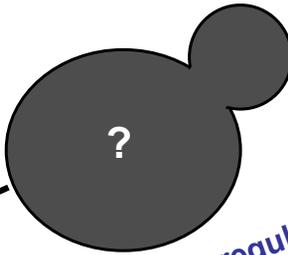
An example

Yeast Systems Biology for Lipid Metabolism Project

Yeast Systems Biology for Lipid Metabolism Project

Change in temperature

Change in lipid production



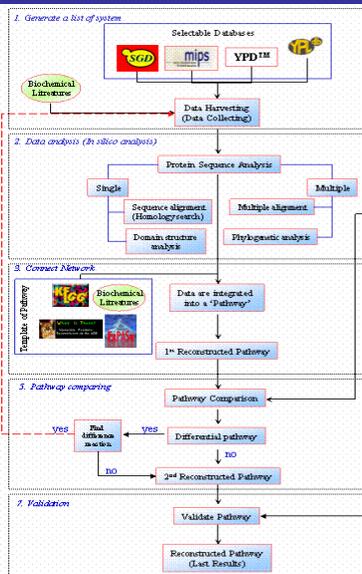
What are regulatory mechanisms?
How can we control them?

We hope to answer these questions by systems biology approach

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Reconstructing pathways by genome analysis



4. Generate pathway in other organisms
- Other Pathway from:
 - M. gen.*
 - E. coli*
 - B. subtilis*
 - S. cerevisiae*
 - D. melanogaster*
 - C. elegans*
 - etc.
 - 4. In experimental on Experimental I:
 - Frag. viciae*
 - Frag. viciae*

