

Introduction to Systems Biology

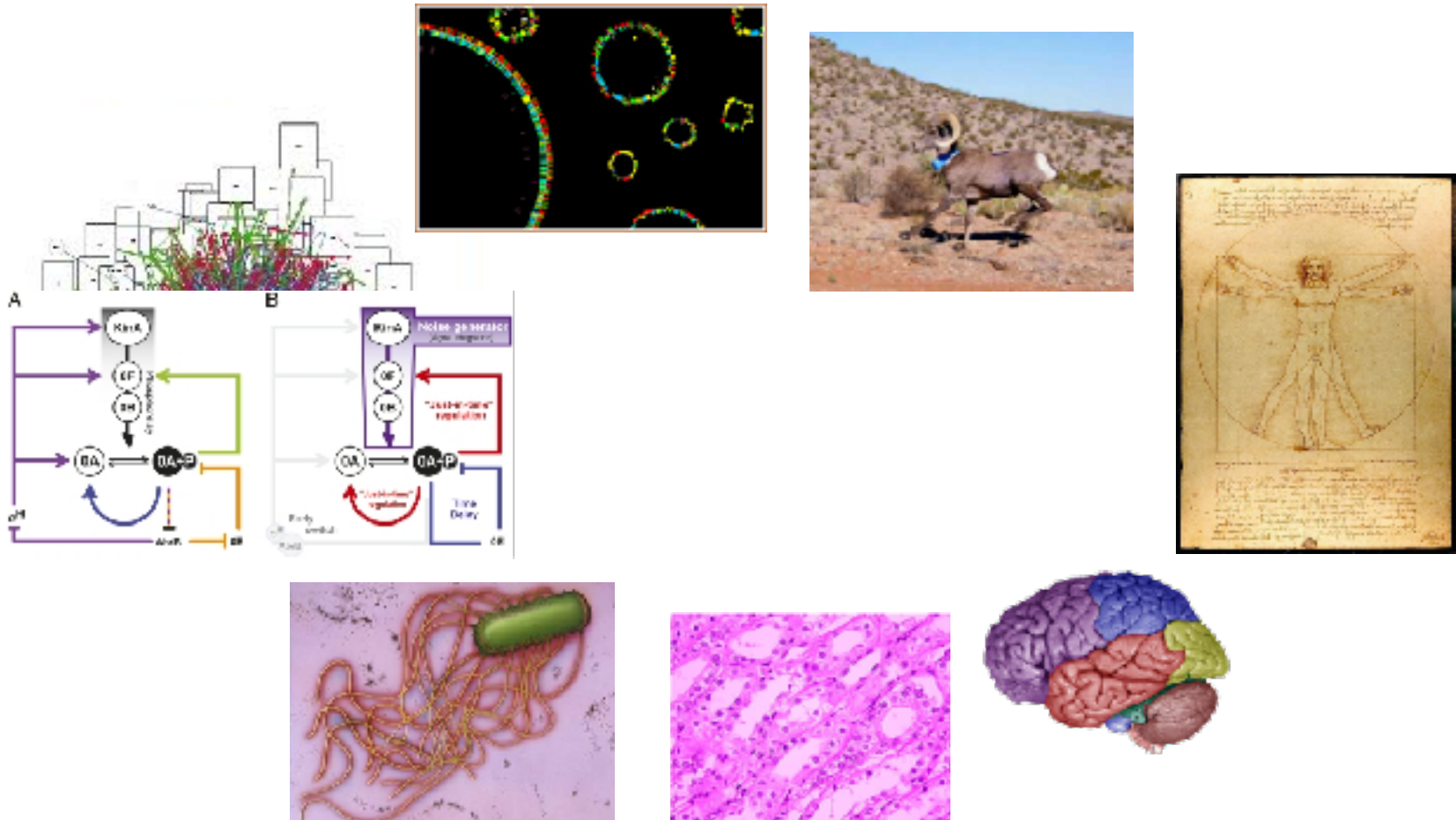
Bio311 – Spring 2017
Lecture 1

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TA: Yuantong Ding

Overview

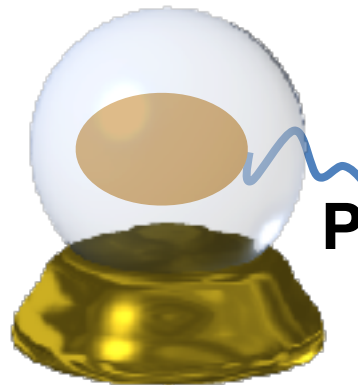
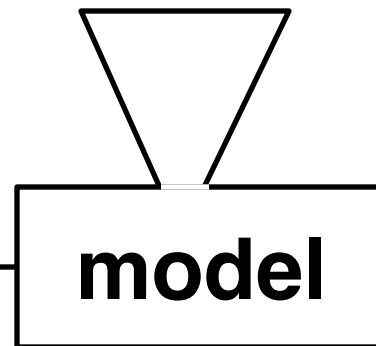
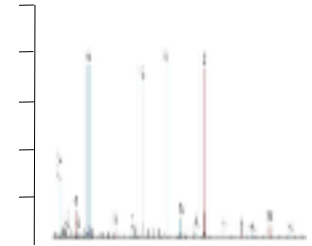
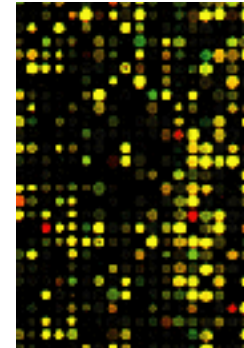
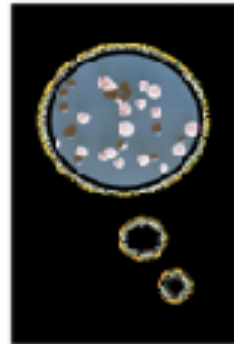
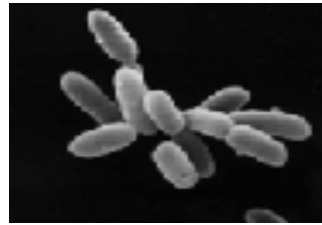
1. Introduce instructors and TA
2. Introduce yourself
3. Go over syllabus.
4. What is systems biology?
5. Research vignettes on applications of systems biology.

Definition of a “system” at many levels of complexity

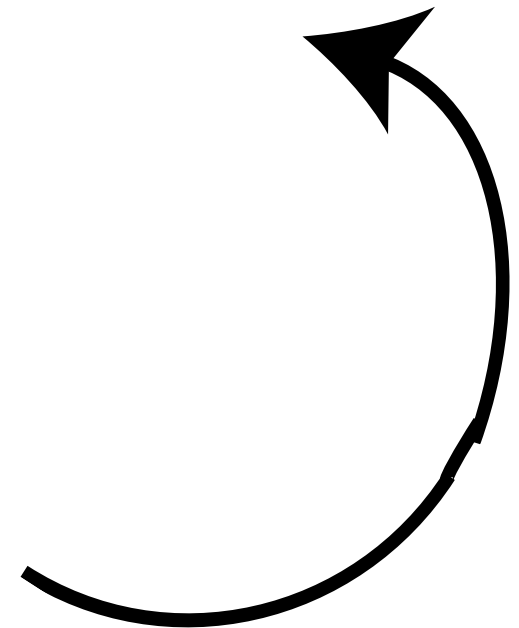


What is systems biology?

 Environment

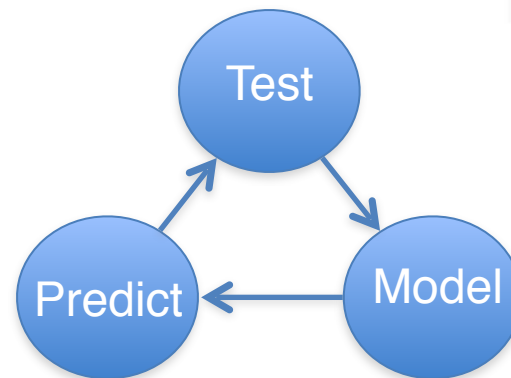
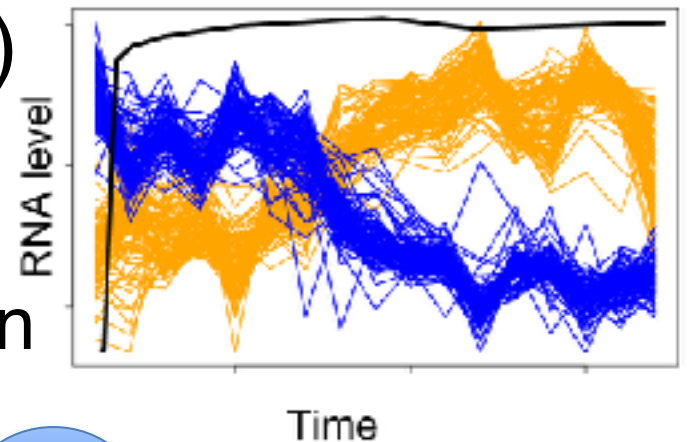


PREDICT



Properties of systems biology

- Holistic: Measure levels of all system parts (macromolecules) and interactions between parts (networks)
 - Simultaneously
 - Over time
 - In response to perturbation
- Multidisciplinary
- Iterative

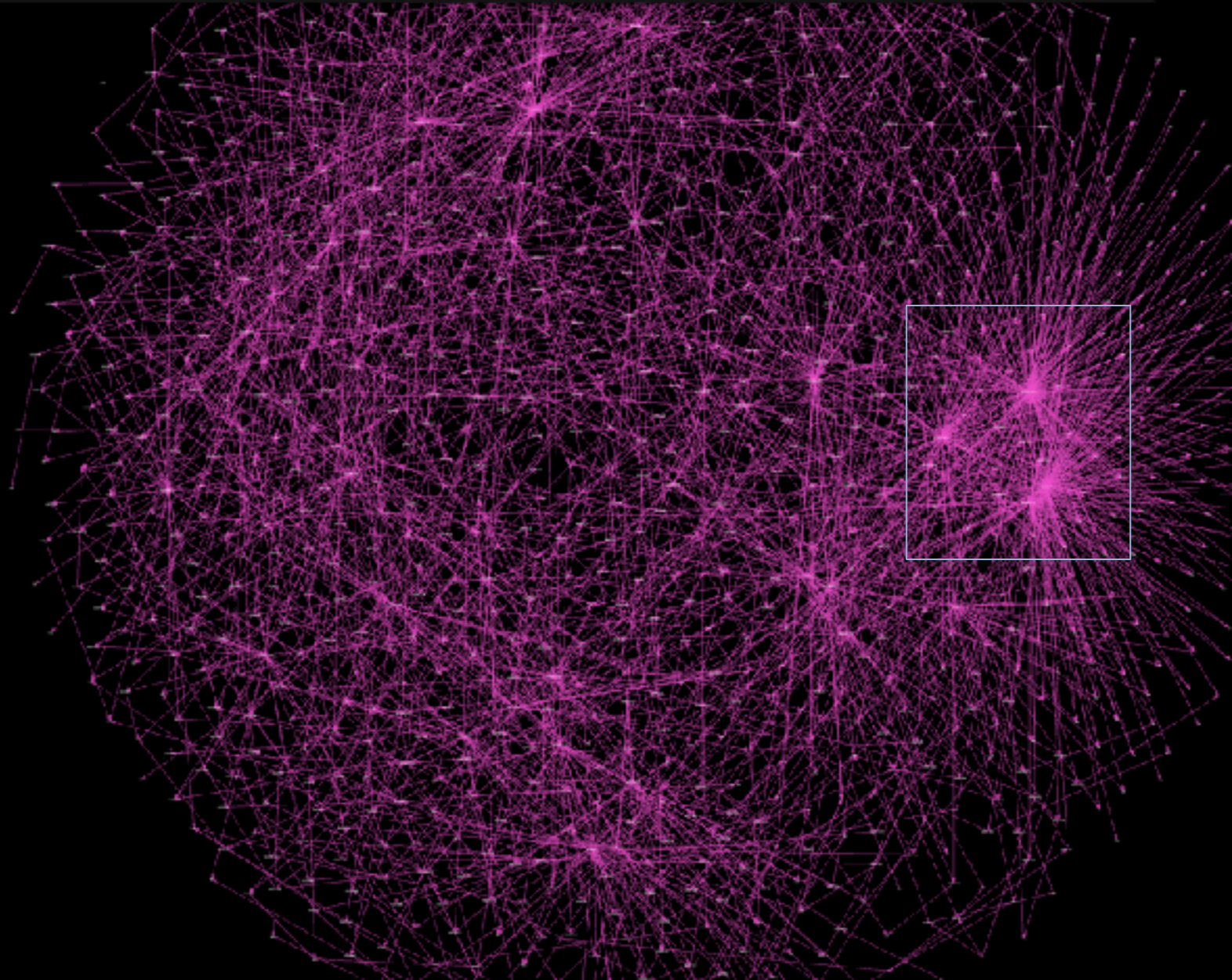


Networks on NOVA

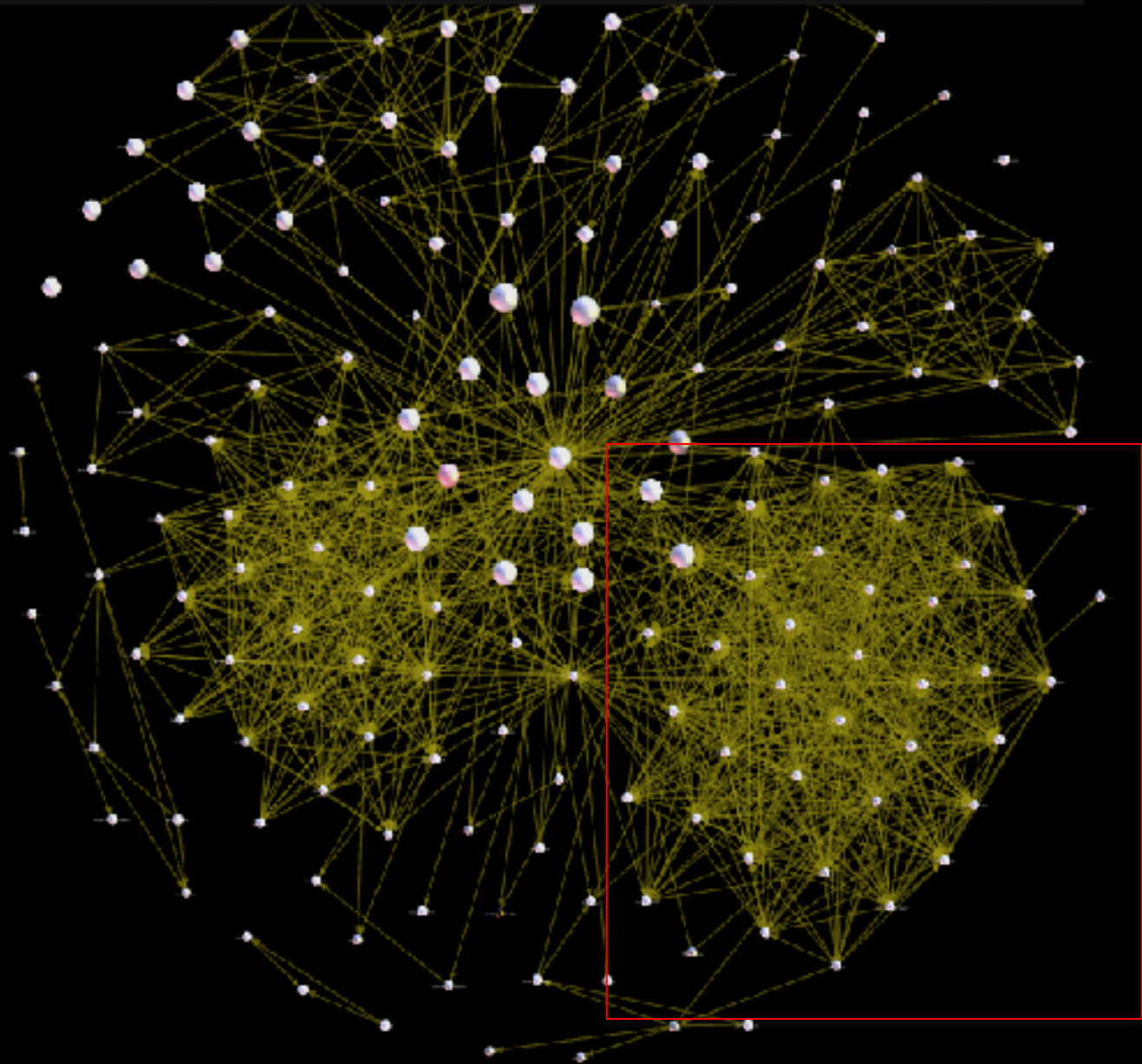
<http://www.pbs.org/wgbh/nova/physics/pattern-nature-network.html>

See also this article on the “diseasome” network for further reading:
<http://www.pbs.org/wgbh/nova/next/body/network-medicine/>

Example: Gene Regulatory Networks



Analogy: Friendship Networks



Emergent properties in large-scale networks

- Robustness
- Redundancy
- Modularity
- “Hub-and-spoke” -maximizing efficiency of information flow

Emergent properties in small-scale networks

- Hysteresis
- Noise filtering
- Buffering
- Feedback
- Criticality
- Pattern formation