Biological Networks Across Scales: Course Overview

Héctor Corrada Bravo

University of Maryland, College Park, USA

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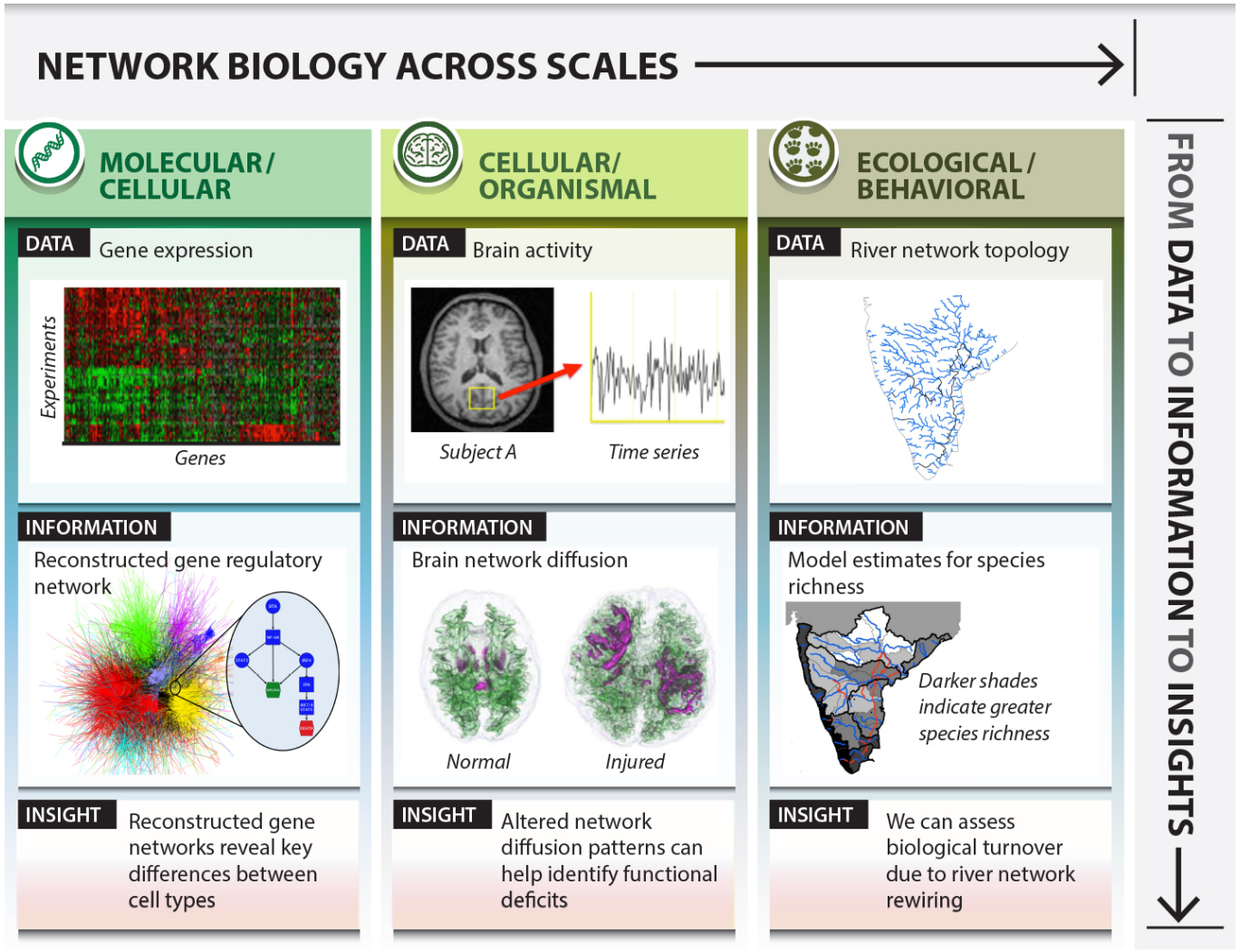
Course Information

Course webpage

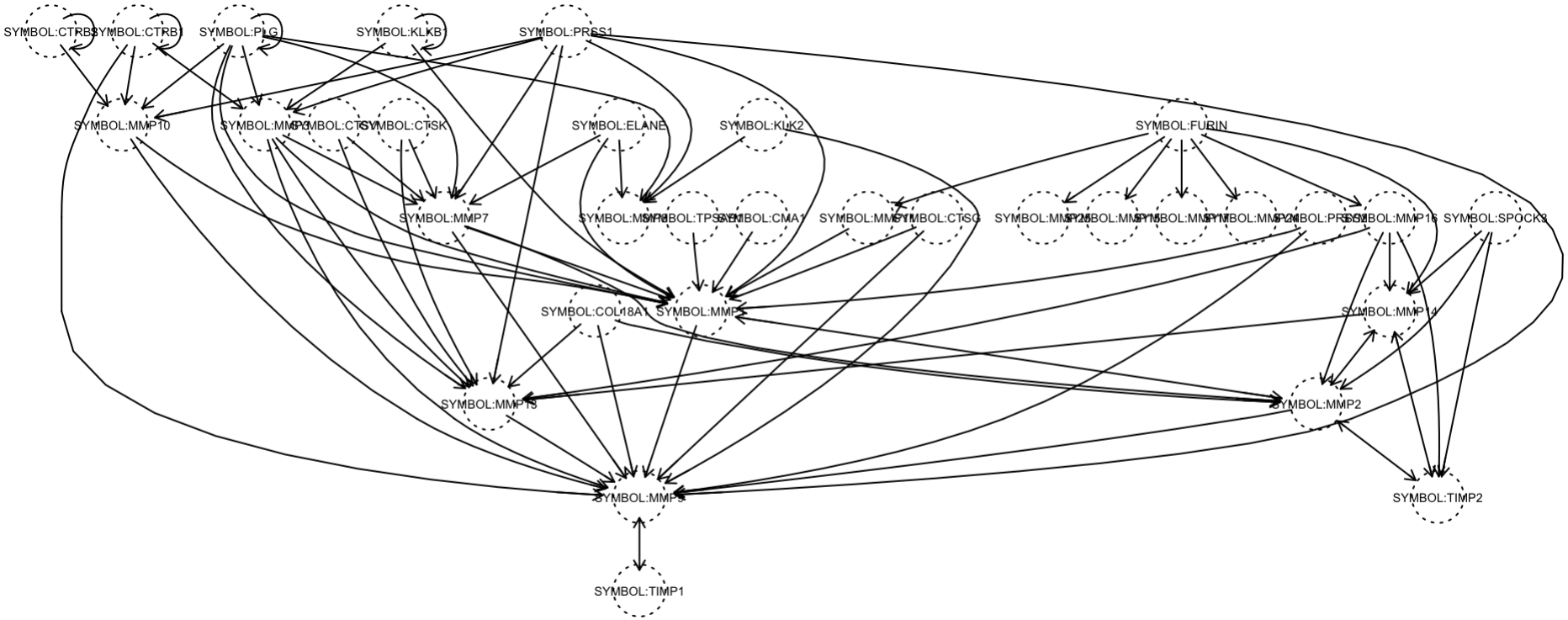
- http://www.hcbravo.org/networks-across-scales/
- Shortened: http://bit.ly/hcb-nas

Other sites

- **ELMS**: Grades, assignments, readings, etc.
- **Piazza**: Discussion and any other communication
- Links in course webpage


NETWORK BIOLOGY ACROSS SCALES
MOLECULAR / CELLULAR
DATA
Gene expression
Experiments
Genes
INFORMATION
Reconstructed gene regulatory network
INSIGHT
Reconstructed gene networks reveal key differences between cell types
CELLULAR/ ORGANISMAL
DATA
Brain activity
Subject A
Time series
INFORMATION
Brain network diffusion
Normal
Injured
INSIGHT
Altered network diffusion patterns can help identify functional deficits
ECOLOGICAL / BEHAVIORAL
DATA
River network topology
INFORMATION
Model estimates for species richness
Darker shades indicate greater species richness
INSIGHT
We can assess biological turnover due to river network rewiring
FROM DATA TO INFORMATION TO INSIGHTS

A Molecular Pathway



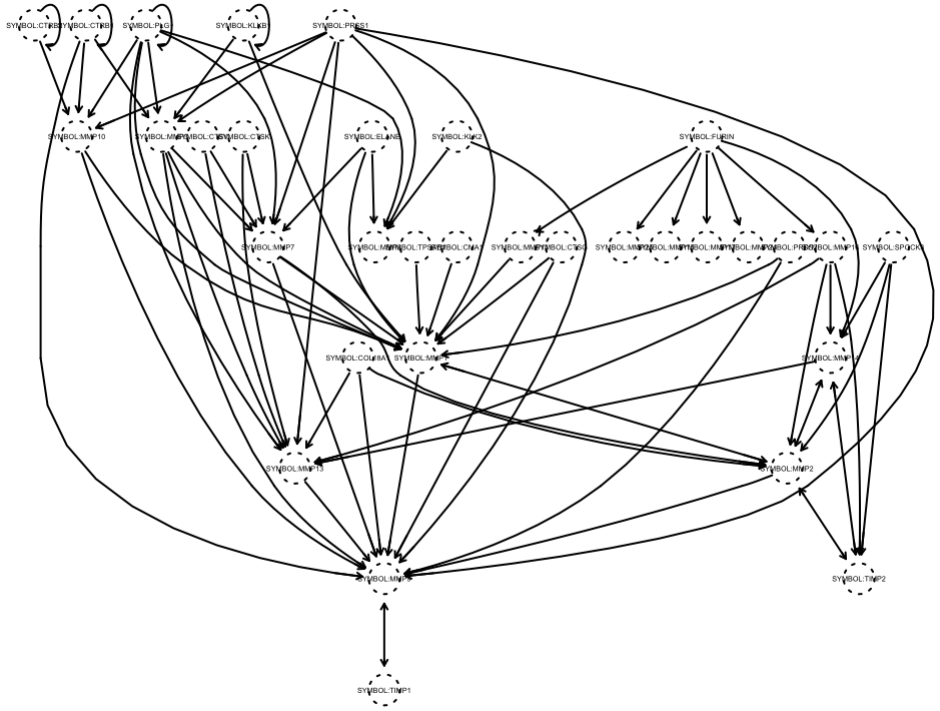
Activation of Matrix Metalloproteinases

Course Components

- Network Analysis Methods
- Biological Networks
- Data Projects

Networks Analysis Methods

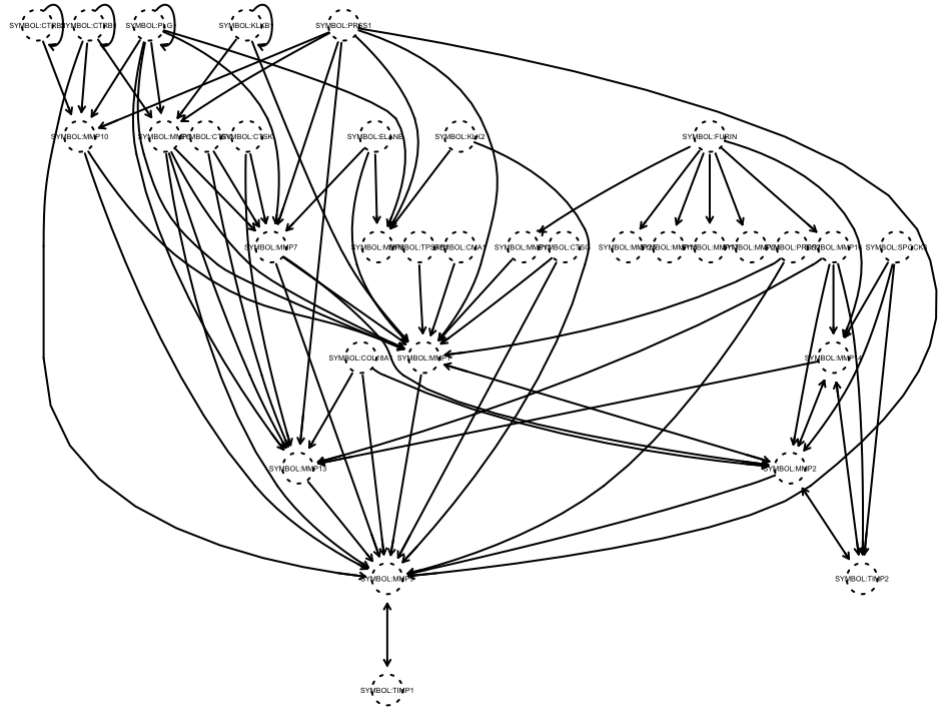
Module 1: Network Properties and Characteristics



Networks Analysis Methods

Module 2: Network Models

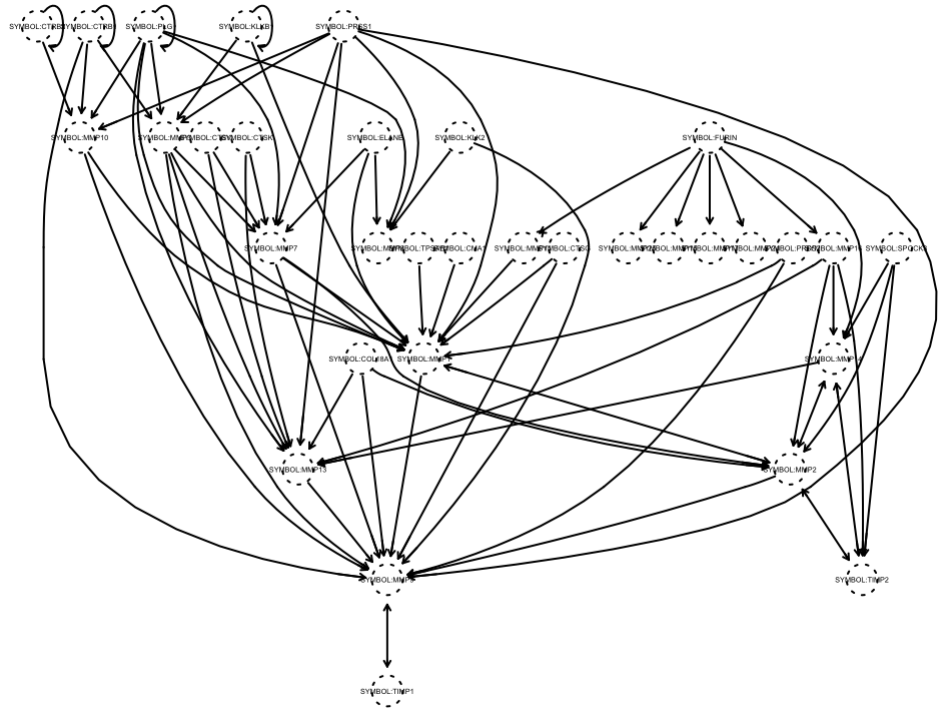
Networks as representation of systems



Networks Analysis Methods

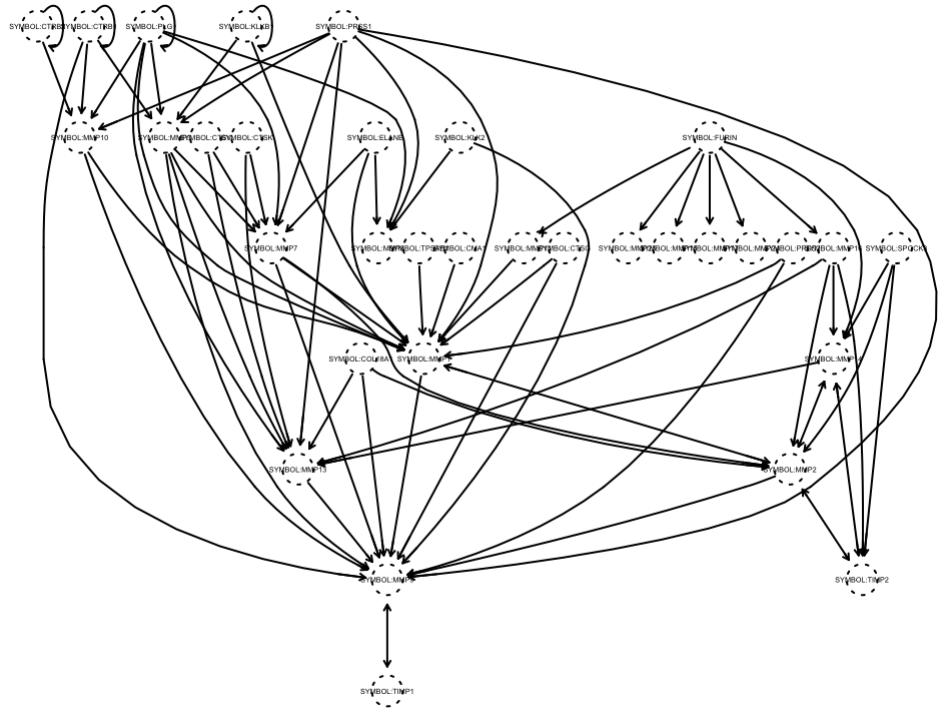
Module 3: Statistical Analysis of Networked Data

Networks as representation of (in)-dependence



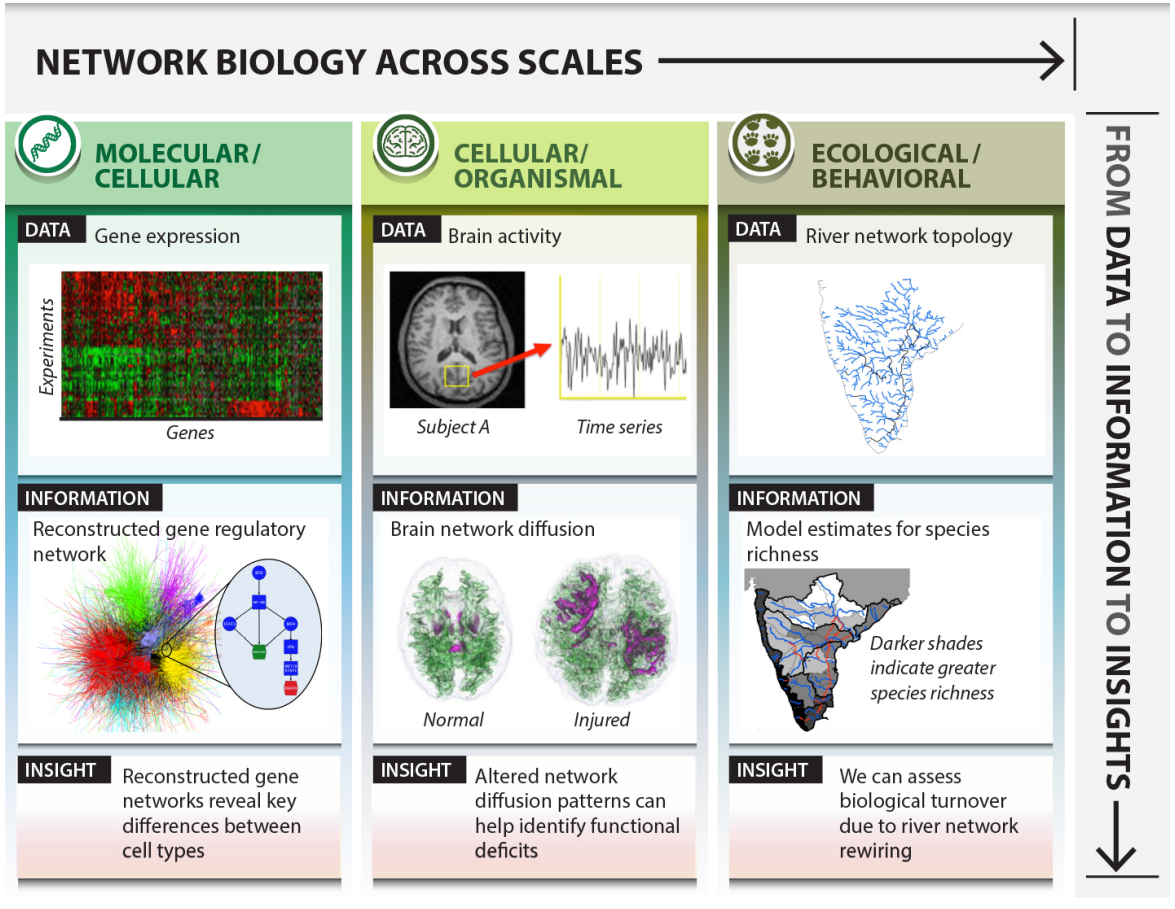
Networks Analysis Methods

Module 4: Network Visualization

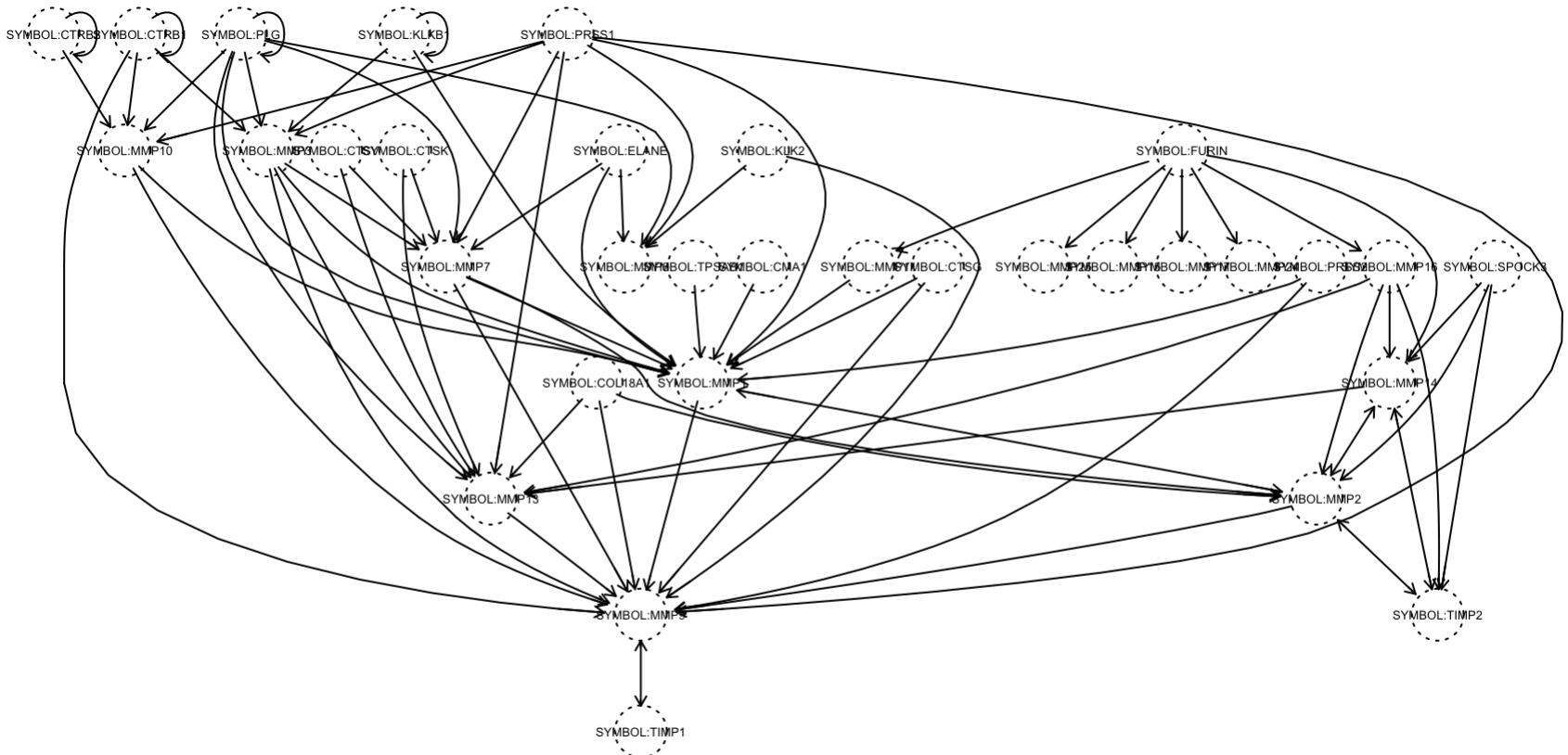


Biological Networks

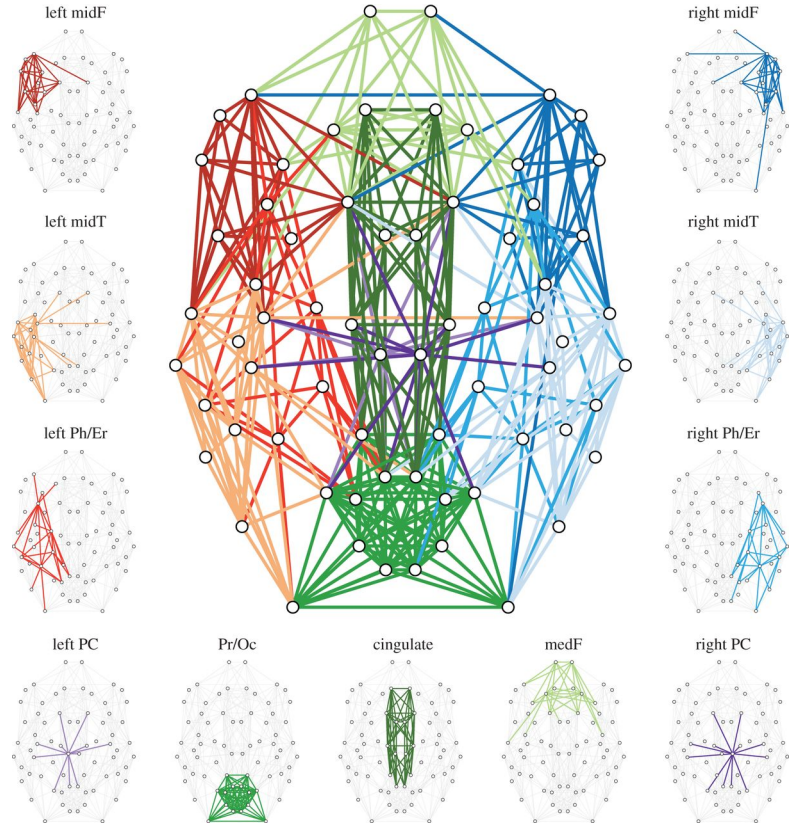
Student-led Presentations



Molecular Networks

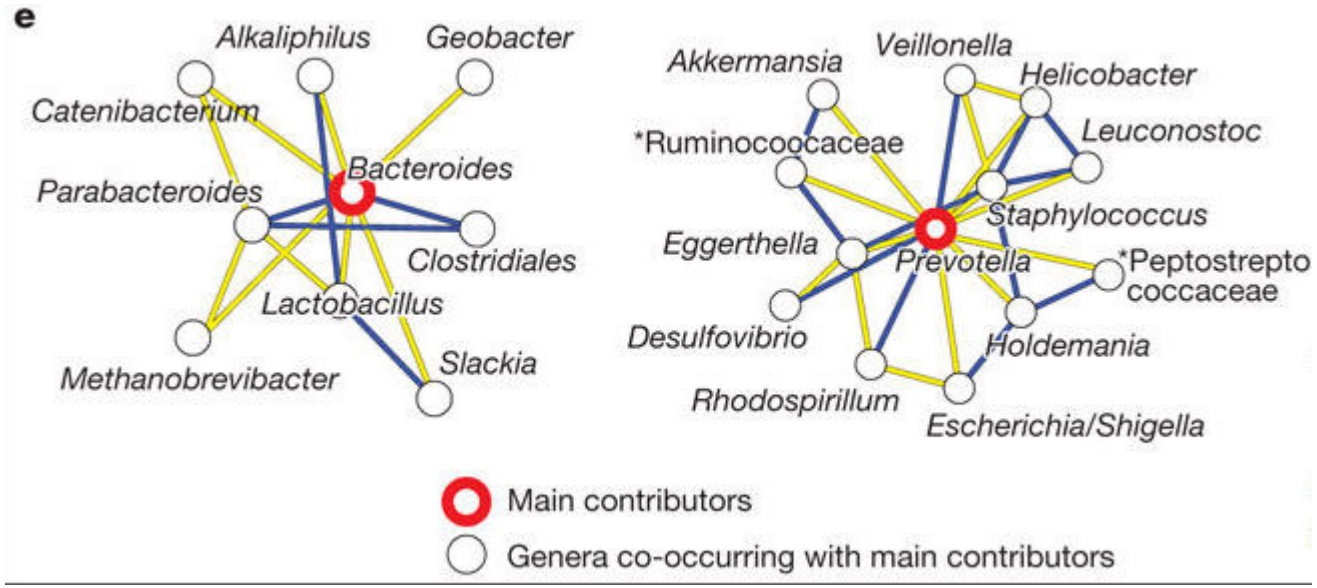


Cellular Networks



http://rstb.royalsocietypublishing.org/content/369/1653/20130527

Ecological Networks



https://doi.org/10.1038/nature09944

Data Projects

Semester-long projects

- Data from Biological Networks
- Apply Methodology as we go along
- Milestone presentations (and submissions)
- Submit final report

COMBINE Training Program

http://combine.umd.edu

- NSF funded training grant in biological networks
- Two courses: this one, course in research and science communication (Girvan/Serrano)
- Fellows from many research areas
- Training programs are **FANTASTIC**
  - Cohort
  - Focus