

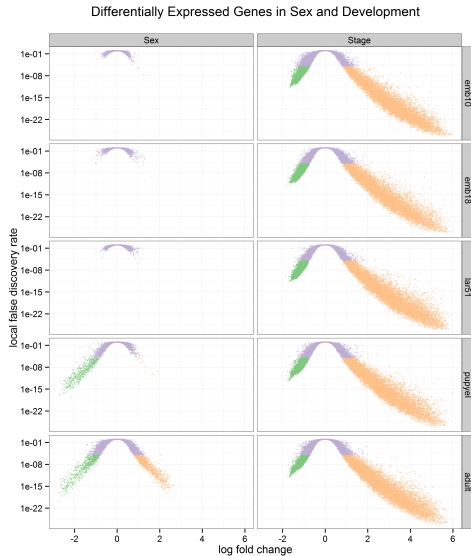
Modularity in Gene Expression Across Animal Development

Alfredo Rago¹, Jack Werren², John K. Colbourne¹

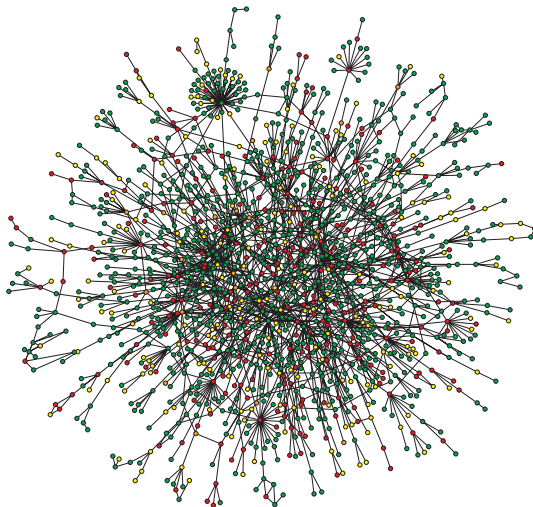
²Department of Biology, University of Rochester, Rochester, NY, USA

BEAR User Meeting, 15 December 2014

The Linear Modelling paradigm



The Network Biology paradigm



Barbasi et al., 2004

Is there a middle ground?

Linear Models: How does gene expression change in relation to the experimental treatment?

Network Biology: What are the reciprocal interactions between genes?

Systems Biology: How do interactions between genes change in relation to experimental treatments?

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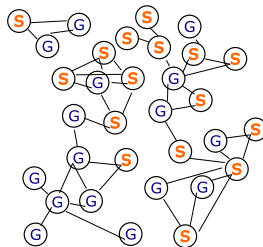
Systems Biology: How do interactions between genes change in relation to experimental treatments?

What Does My Module Do?

	samples			
transcripts	42	42	42	42
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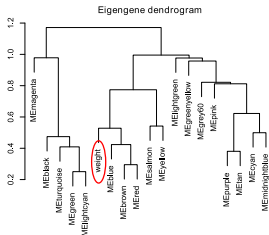
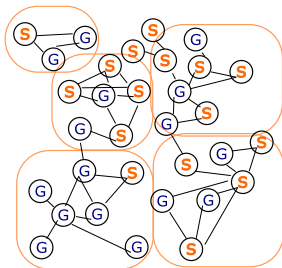
Rethinking
Gene
Expression

The Biology
of Modularity

Summary

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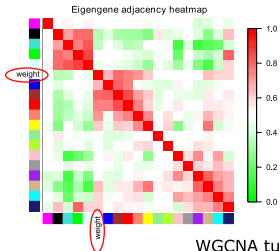
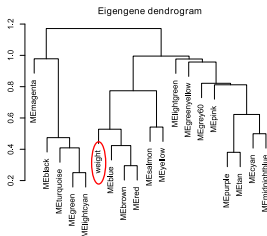
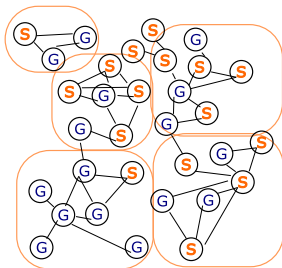
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WGCNA tutorial

What do We Want to Measure?

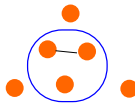
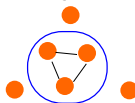
Density



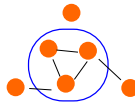
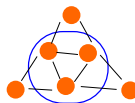
Centralization



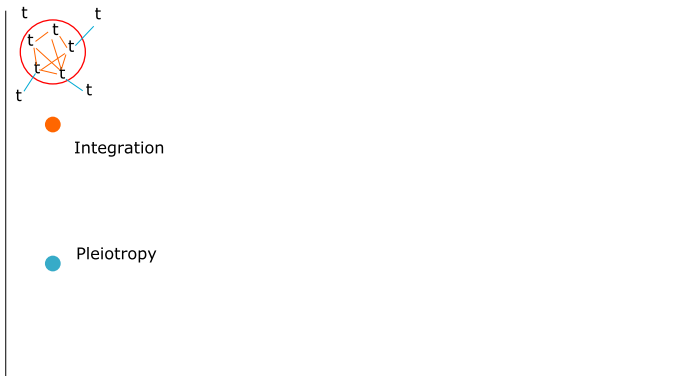
Integration



Parcellation

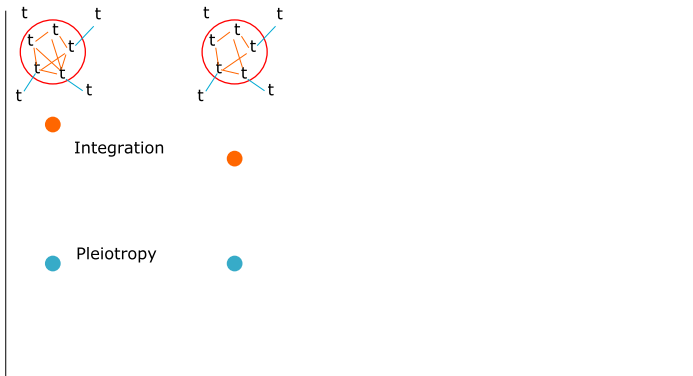


Permutation Testing of Modular Concepts



FFF

Permutation Testing of Modular Concepts

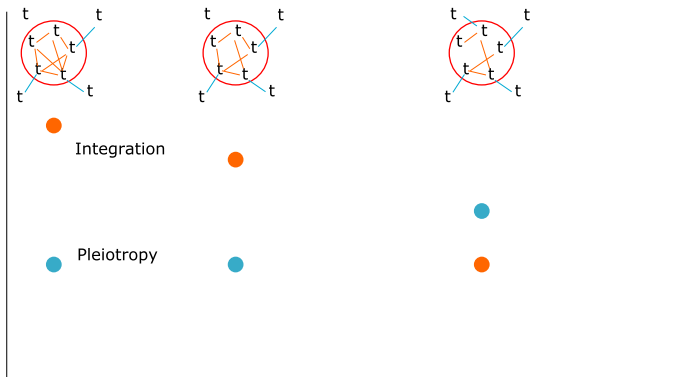


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Permutation Testing of Modular Concepts



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Summary

- Network biology is necessary to study functional architectures.
- A Modular perspective simplifies analyses and enables the study of network-based questions.
- Such as:
 - Are integration and parcellation separate processes?
 - Which regulatory mechanisms enforce module coexpression? Transcription Factors, Histone modification, chemical gradients.
 - Which environmental factors can disrupt module coregulation?

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