

# Network analysis and visualization with Cytoscape and STRING

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# Overview

## Introduction

- Network analysis in biology
- Types of biological networks
- Protein-protein interaction networks
- Building and analysing PPINs

## Practice

- Getting familiar with the STRING database

## Biocom

# Network analysis in biology

- Biological systems are often represented as networks which are complex sets of binary interactions or relations between different entities;
- Systems biology aims to understand biological entities at the systemic level, analysing them not only as individual components, but also as interacting systems and their emergent properties;
- Network biology which allows the representation and analysis of biological systems using tools derived from graph theory.

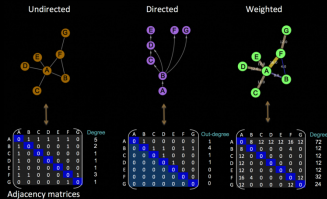


Figure: Example of molecular network types and its respective matrices.

# Types of biological networks

- Protein-protein interaction networks
- Metabolic networks
- Genetic interaction networks
- Gene / transcriptional regulatory networks
- Cell signalling networks

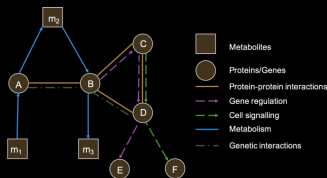


Figure: Example of molecular network[Dr. Nataša Pržulj].

Adapted from [Millan, 2011]

# Protein-protein interaction networks

Protein-protein interactions (PPIs) are essential to almost every process in a cell, so understanding PPIs is crucial for understanding cell physiology in normal and disease states. It is also essential in drug development, since drugs can affect PPIs. Protein-protein interaction networks (PPIN) are mathematical representations of the physical contacts between proteins in the cell. These contacts:

- are specific;
- occur between defined binding regions in the proteins;
- and have a particular biological meaning.

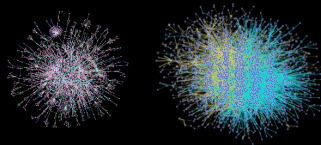


Figure: Yeast and human interactomes[Jeong et al., 2001][Rual et al., 2005].

Adapted from [Millan, 2011]

# Building and analysing PPINs

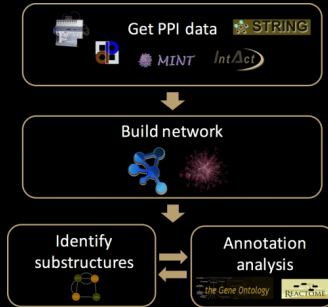


Figure: A potential workflow for building and analysing protein-protein interaction networks.

Adapted from [Millan, 2011]

# Getting familiar with the STRING database

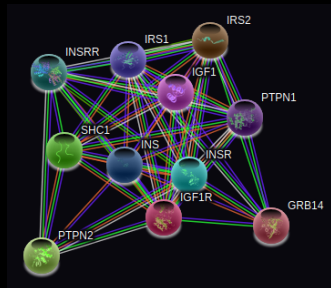
## Basic Exercises – STRING database

- ex 1 – 4

## Advanced Exercises – STRINGapp for Cytoscape

- ex 5 & 6

STRING [Doncheva et al., 2018]





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Tecnologia e ciência se encontram aqui

Oferecemos uma vasta gama de serviços especializados em consultoria e análise de dados biológicos. Auxiliamos na extração e interpretação de resultados obtidos a partir de dados biológicos gerados por tecnologias de Nova Geração.

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# References



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Doncheva NT, Morris JH, Gorodkin J and Jensen LJ (2018)

Cytoscape stringApp: Network analysis and visualization of proteomics data.



Jeong et al. (2001)

Nature, 411 (3).



Rual et al. (2005)

Nature, 437 (4).



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