

Computational  
&  
Systems Biology

# Gene Ontology

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# Gene Ontology & Functional enrichment analysis

## ❖ Gene Ontology is

A hierarchy of roles of genes and gene products independent of any organism.

## ❖ Composed of three independent ontologies:

- Molecular Function
- Biological Process
- Cellular Component

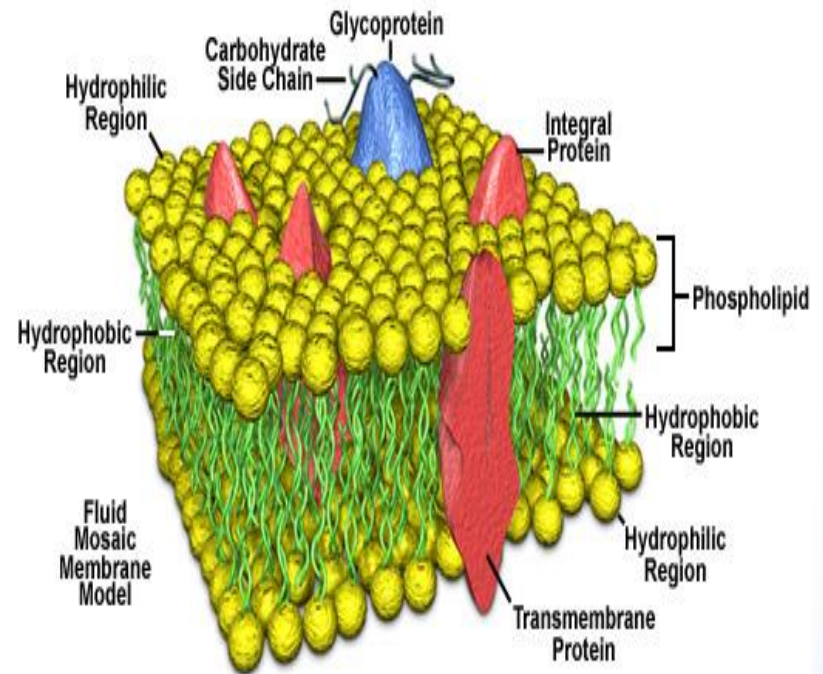
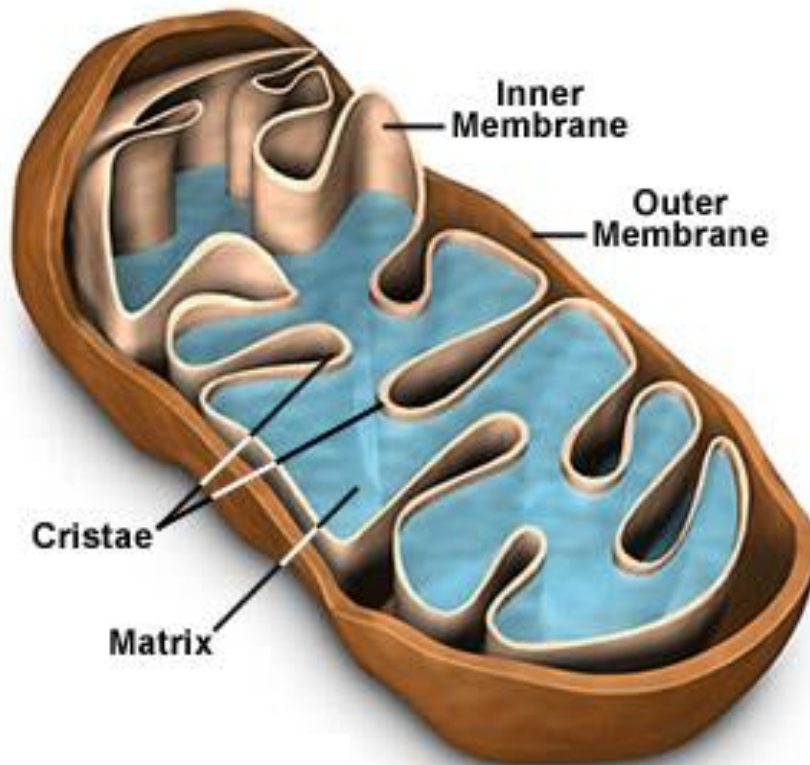
# How does GO work?

What information might we want to capture about a gene product?

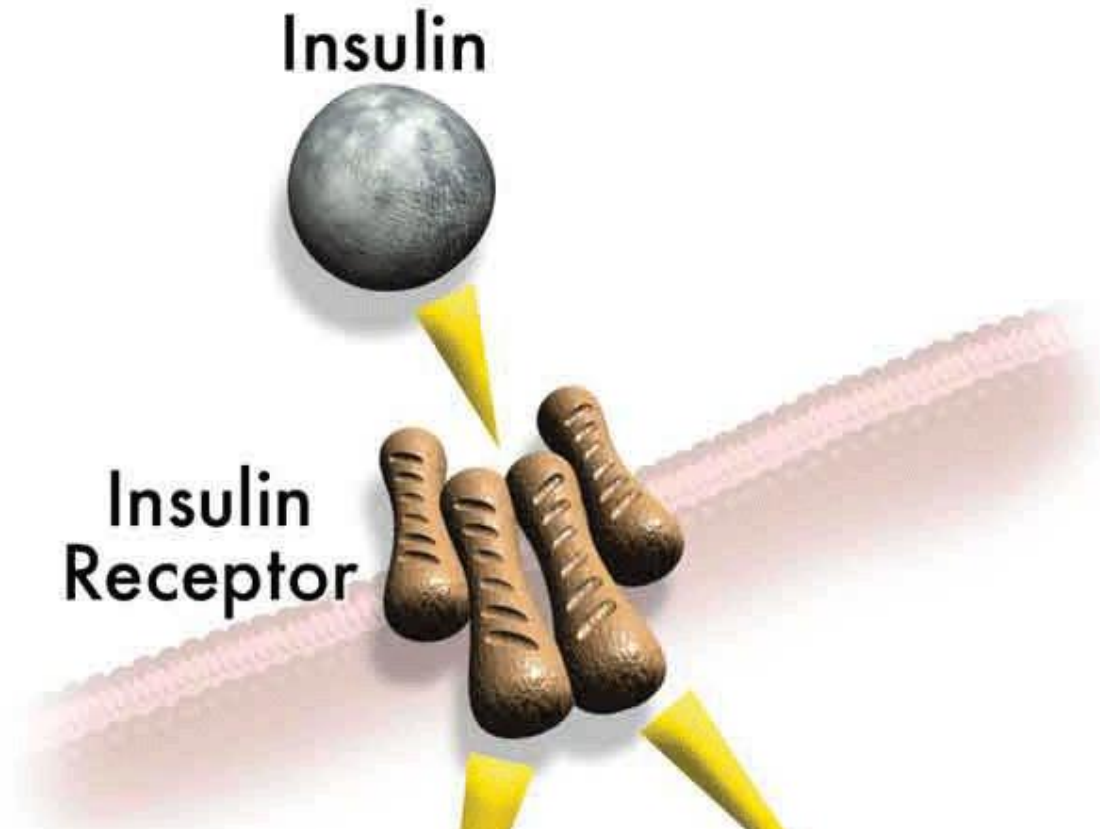
- What does the gene product do?
- Where and when does it act?
- Why does it perform these activities?

# Cellular Component

- where a gene product acts



# Molecular Function

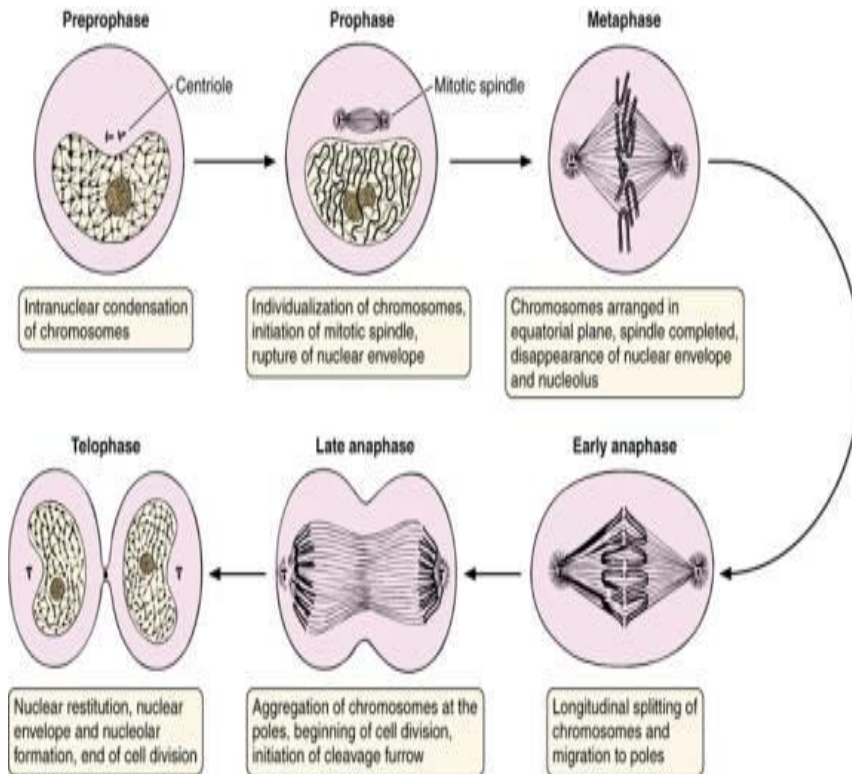


insulin binding  
insulin receptor activity

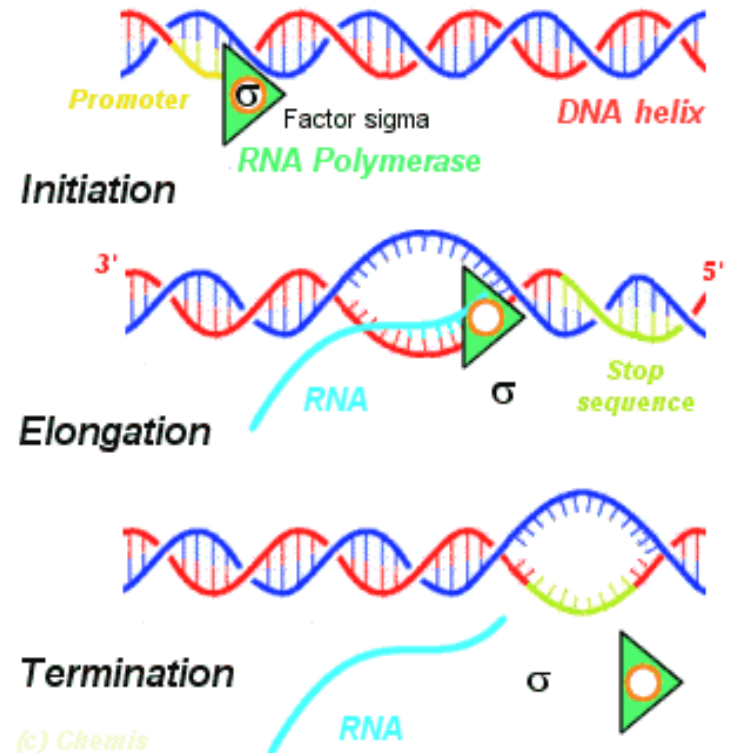


# Biological Process

a commonly recognized series of events

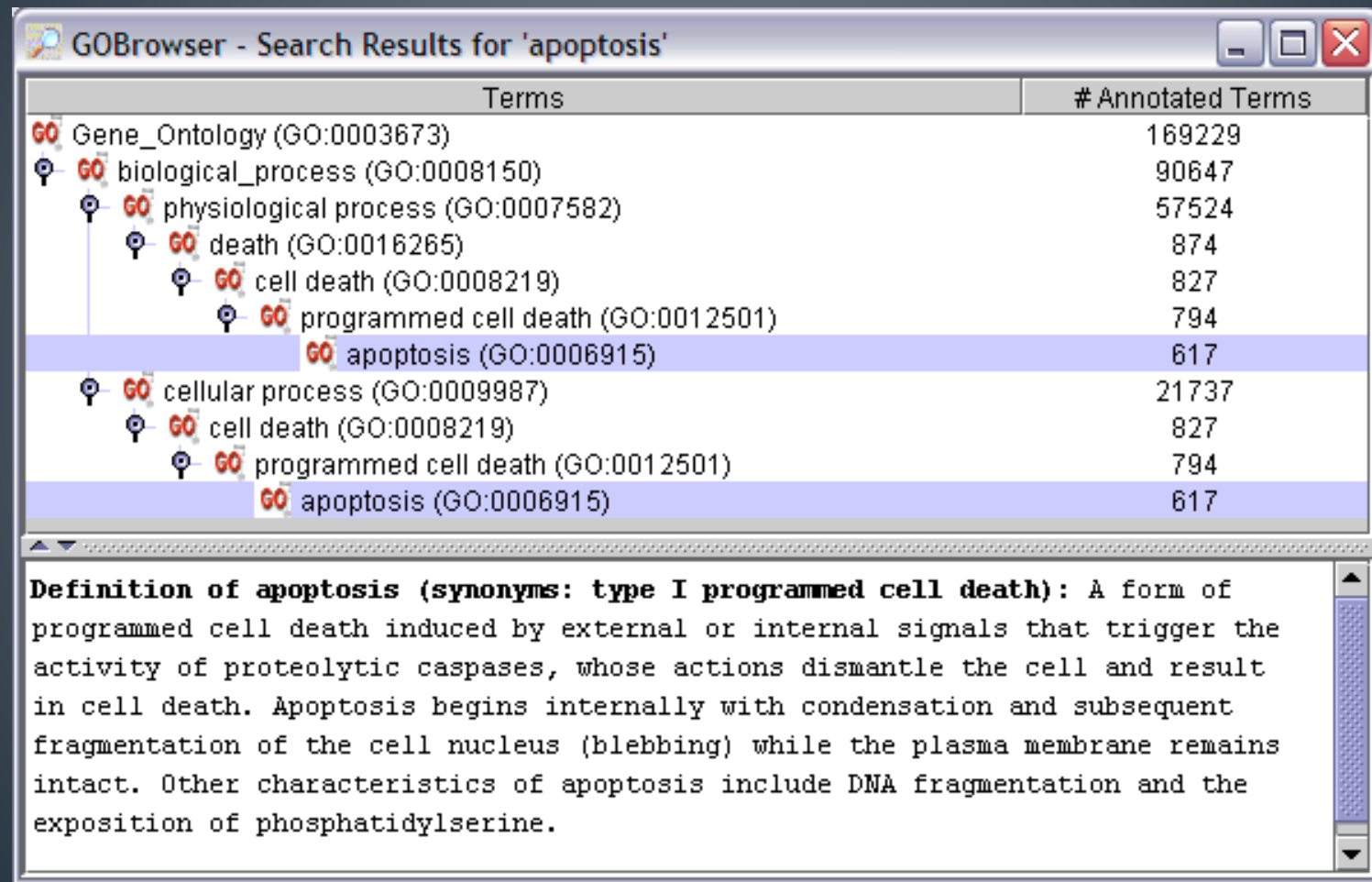


cell division



transcription

# Gene Ontology & Functional enrichment analysis

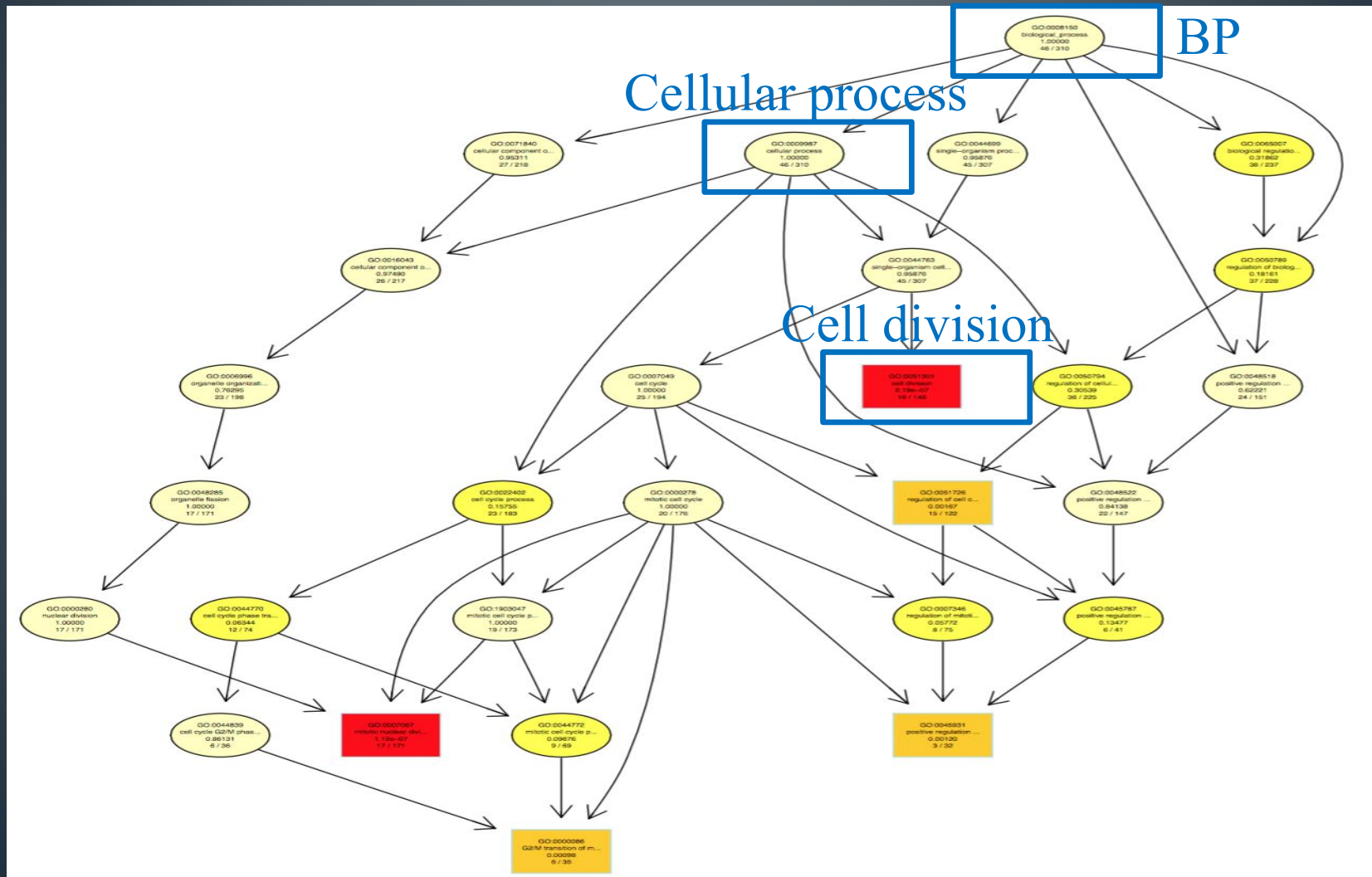


The screenshot shows the GOBrowser application window titled "GOBrowser - Search Results for 'apoptosis'". It displays a hierarchical tree of Gene Ontology terms. The terms are listed in a table with two columns: "Terms" and "# Annotated Terms". The terms are organized into a tree structure, with "Gene\_Ontology (GO:0003673)" at the top, followed by "biological\_process (GO:0008150)", "physiological process (GO:0007582)", "death (GO:0016265)", "cell death (GO:0008219)", "programmed cell death (GO:0012501)", and "apoptosis (GO:0006915)". The "apoptosis (GO:0006915)" term is highlighted in blue. Below the table, there is a text box containing the definition of apoptosis.

Terms	# Annotated Terms
Gene_Ontology (GO:0003673)	169229
biological_process (GO:0008150)	90647
physiological process (GO:0007582)	57524
death (GO:0016265)	874
cell death (GO:0008219)	827
programmed cell death (GO:0012501)	794
apoptosis (GO:0006915)	617
cellular process (GO:0009987)	21737
cell death (GO:0008219)	827
programmed cell death (GO:0012501)	794
apoptosis (GO:0006915)	617

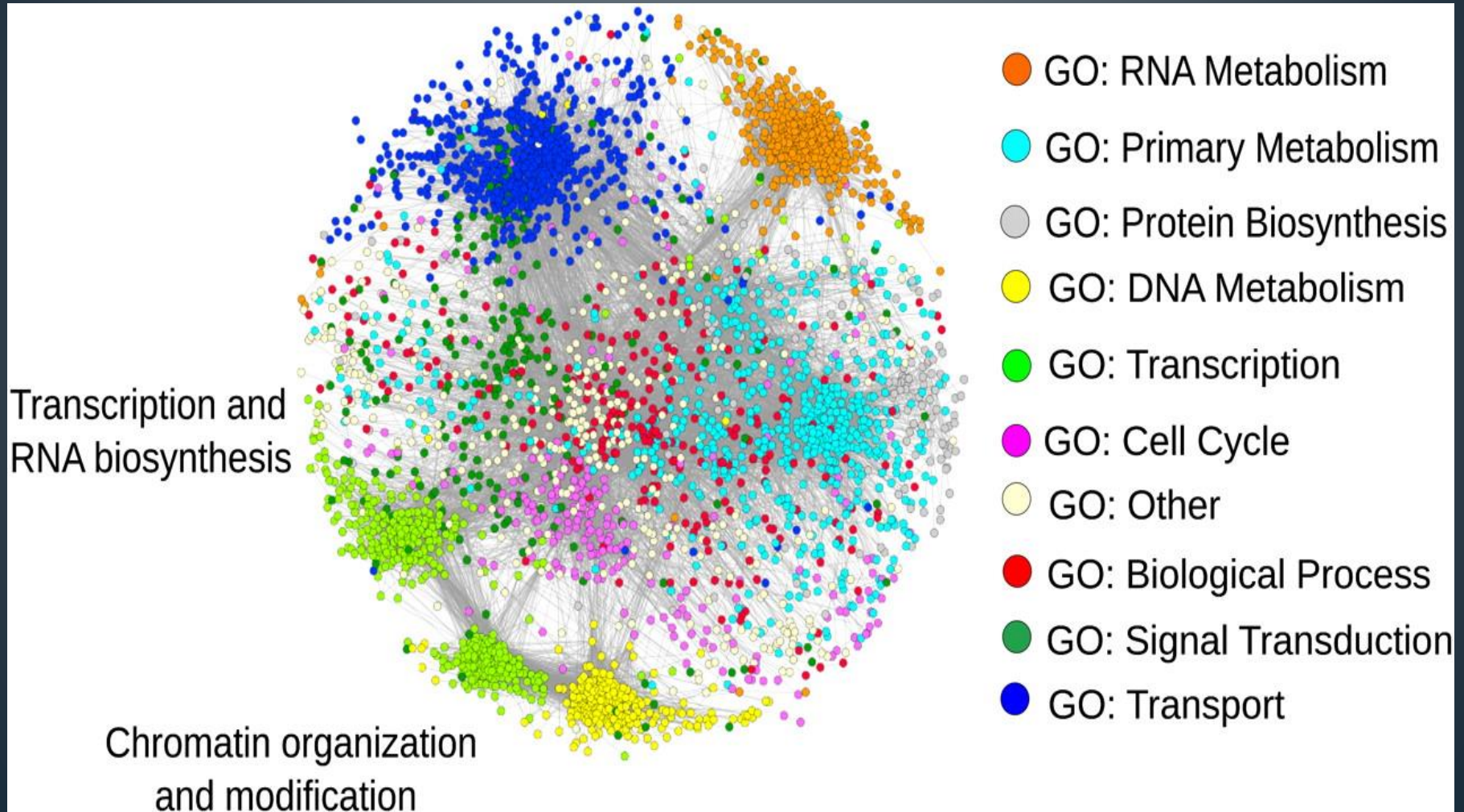
**Definition of apoptosis (synonyms: type I programmed cell death):** A form of programmed cell death induced by external or internal signals that trigger the activity of proteolytic caspases, whose actions dismantle the cell and result in cell death. Apoptosis begins internally with condensation and subsequent fragmentation of the cell nucleus (blebbing) while the plasma membrane remains intact. Other characteristics of apoptosis include DNA fragmentation and the exposition of phosphatidylserine.

# Gene Ontology & Functional enrichment analysis

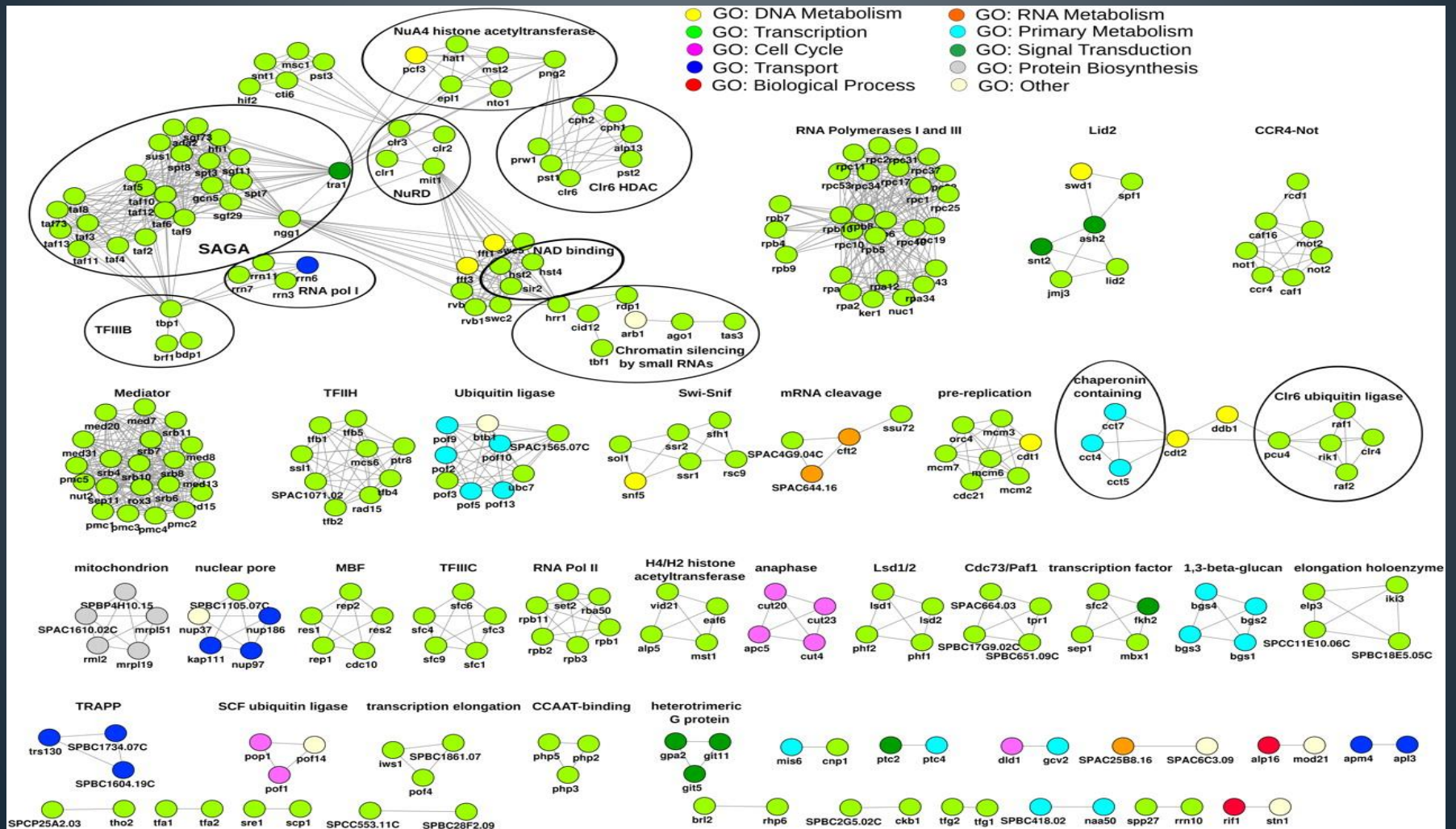




# Functional enrichment analysis

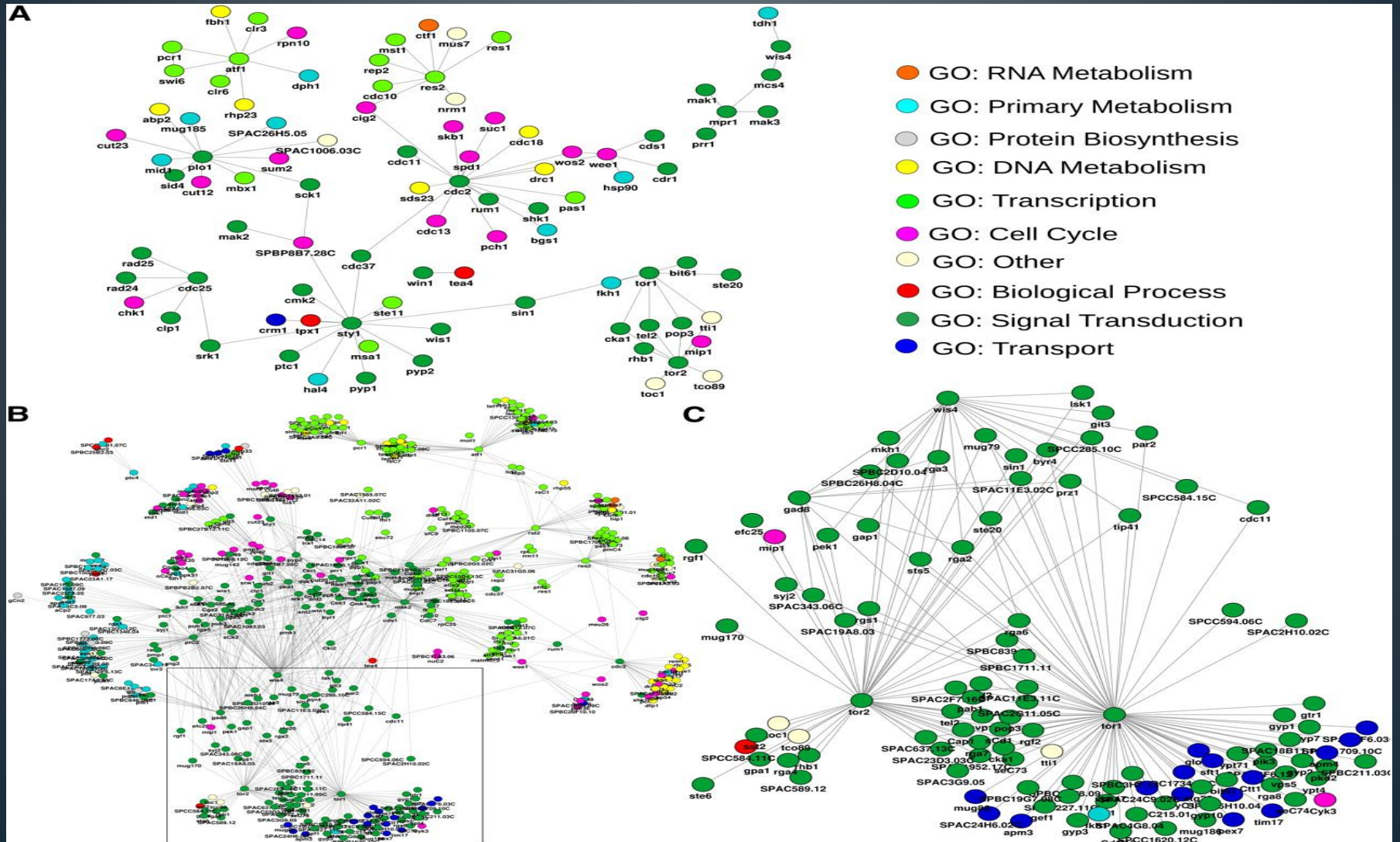


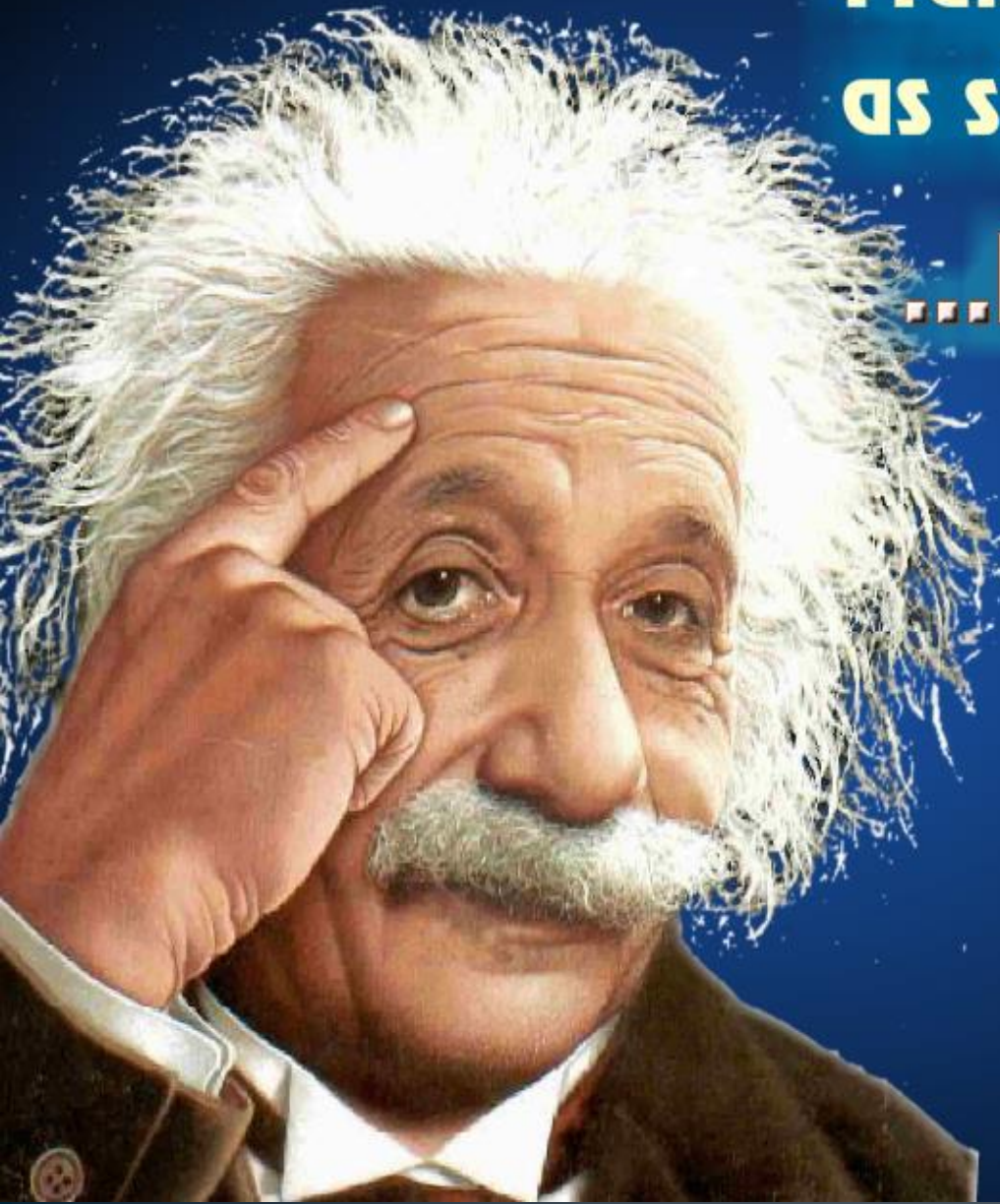
# Functional enrichment analysis



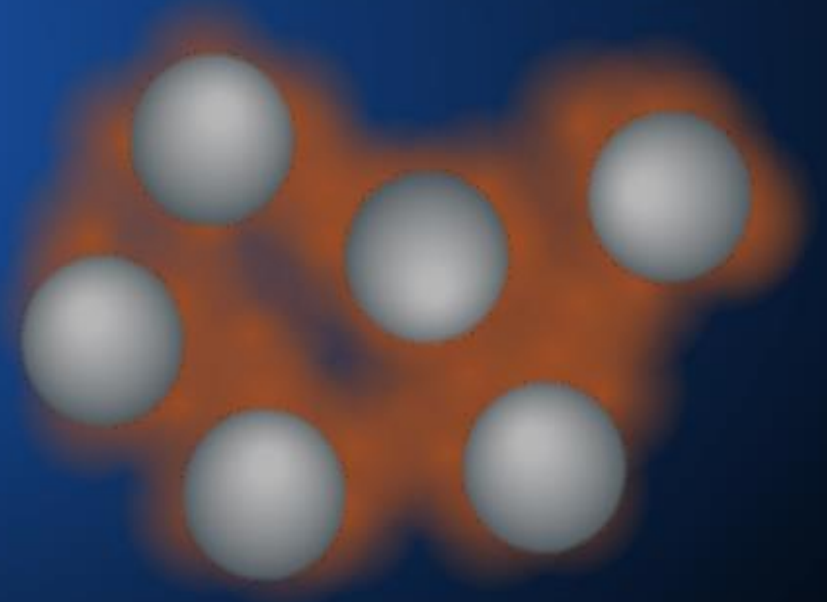


# Functional enrichment analysis





**Make everything  
as simple as possible.  
...but not simpler.**



**Systems biology**