

# Introduction COVID19 Disease Map & WikiPathways

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ISMB/ECCB 2021 - Tutorial 8  
22 July 2021

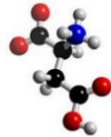


# Outline

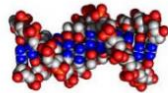
- Introduction
- COVID19 Disease Map
- WikiPathways

# Molecular systems biology

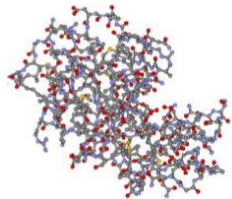
Molecules of life do not function in isolation ....



metabolites



genes

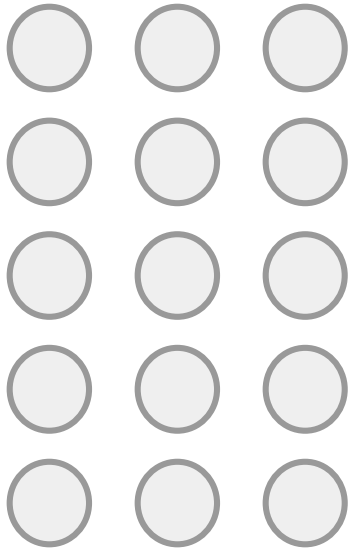


proteins



but form complex networks that define a cell ....

# Introduction

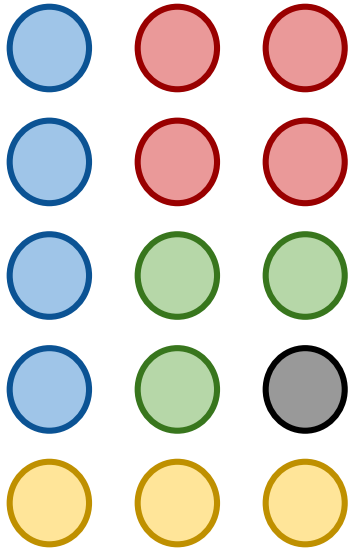


**measurements**

**Quantitative**

Isolated data points

# Introduction



**Comparative statistics**

Isolated lists

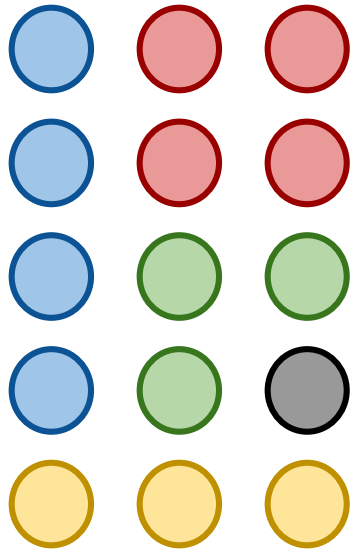
**Clustering**

Isolated groups

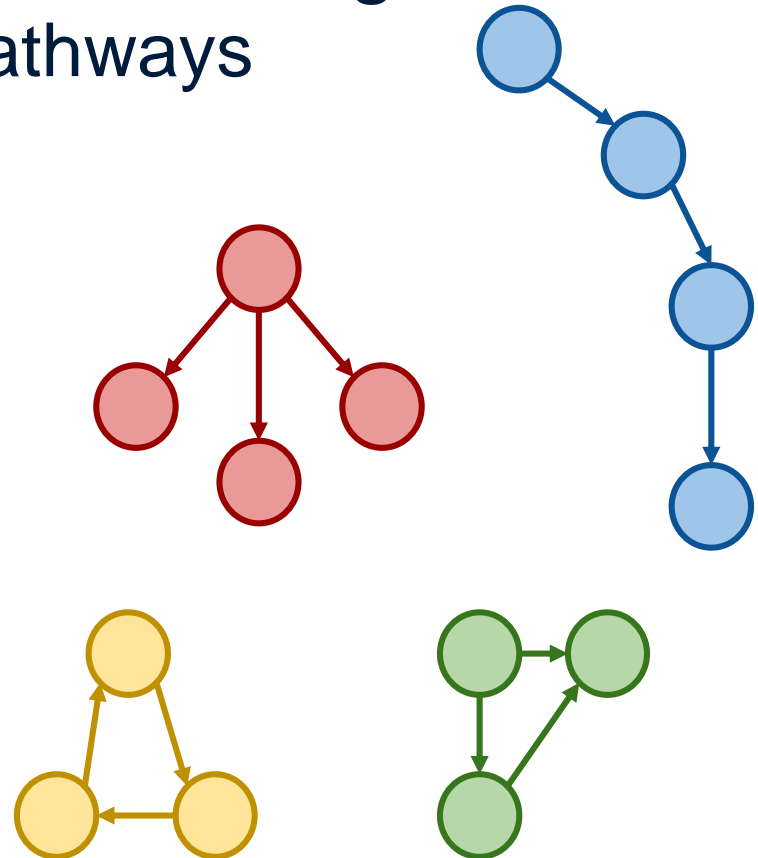
**Gene sets**

Functional groups

# Introduction

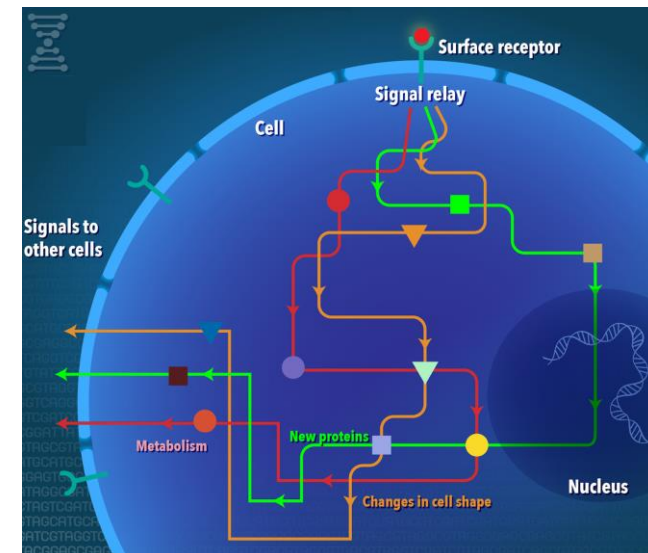


Functional organization  
Pathways

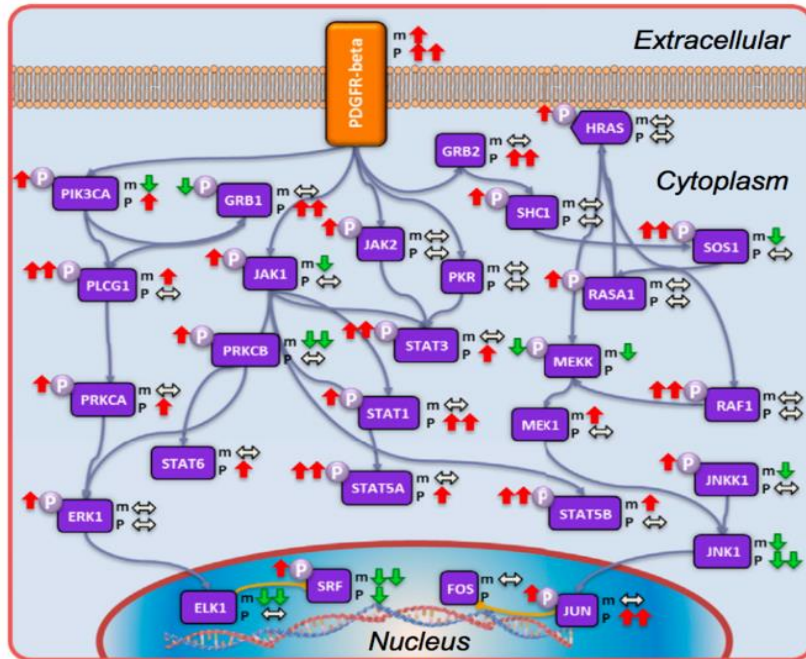


# Pathway models

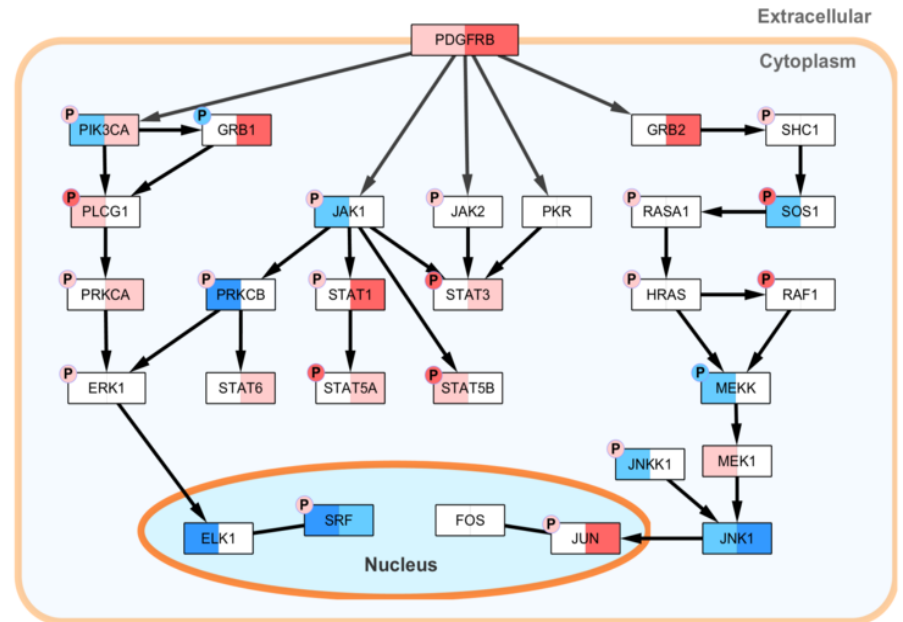
- Detailed curation of biological processes
- More than images > machine-readable pathway models
- Essential to better understand, validate and simulate molecular mechanisms



# Biological pathways



**Static image**  
Zhang et al, Cell 2016



**PDGFR-beta pathway with  
transcriptomic/phosphoproteomic data**  
[www.wikipathways.org/instance/WP3972](http://www.wikipathways.org/instance/WP3972)



# Outline

- Introduction
- **COVID19 Disease Map**
- WikiPathways



# COVID19

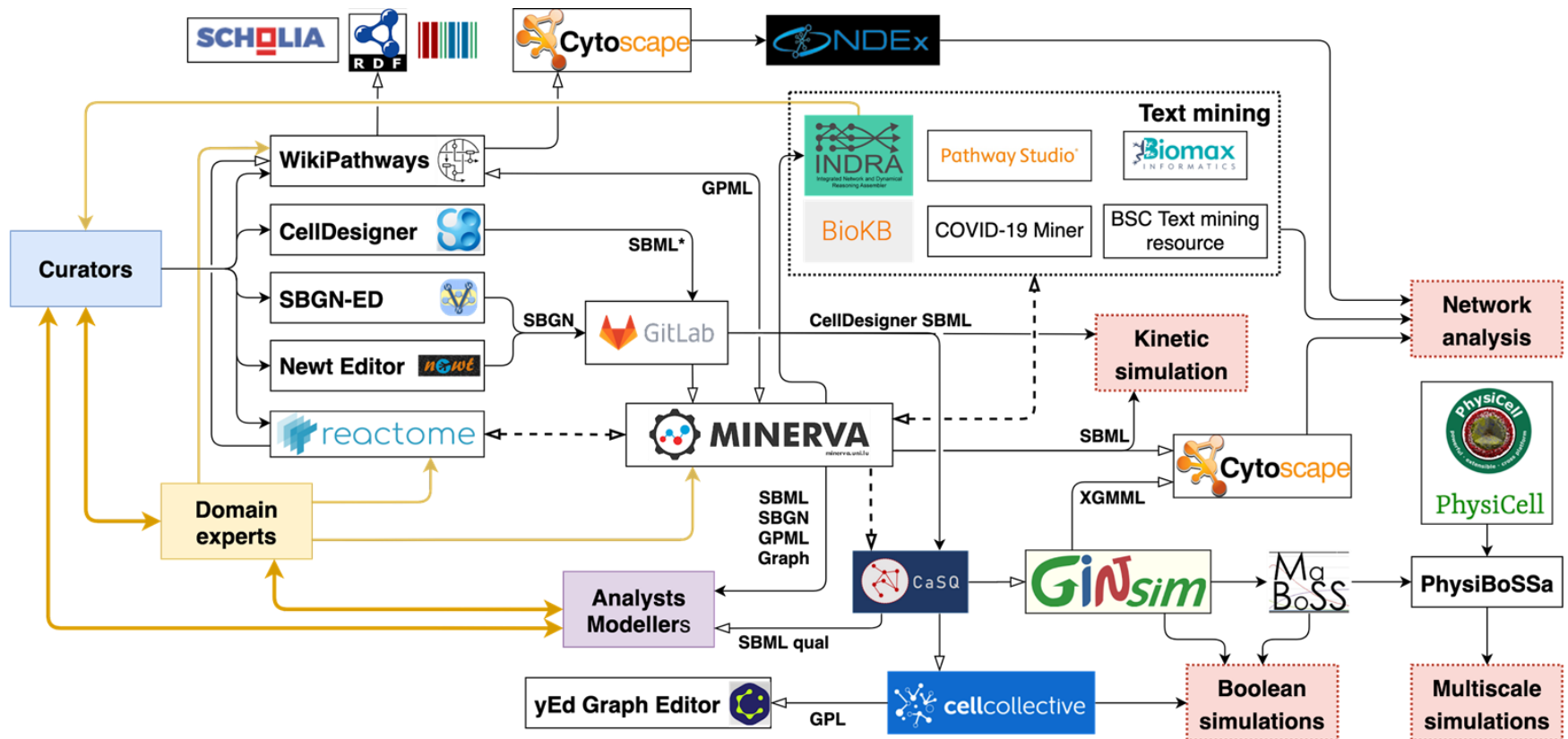
- Over 146,000 publications about COVID19 / SARS-CoV2 since 2020\*
- Molecular pathophysiology is complex
  - biological pathways
  - cell types
  - organs

\* PubMed query “covid-19[Title/Abstract] or sars-cov-2[Title/Abstract]”

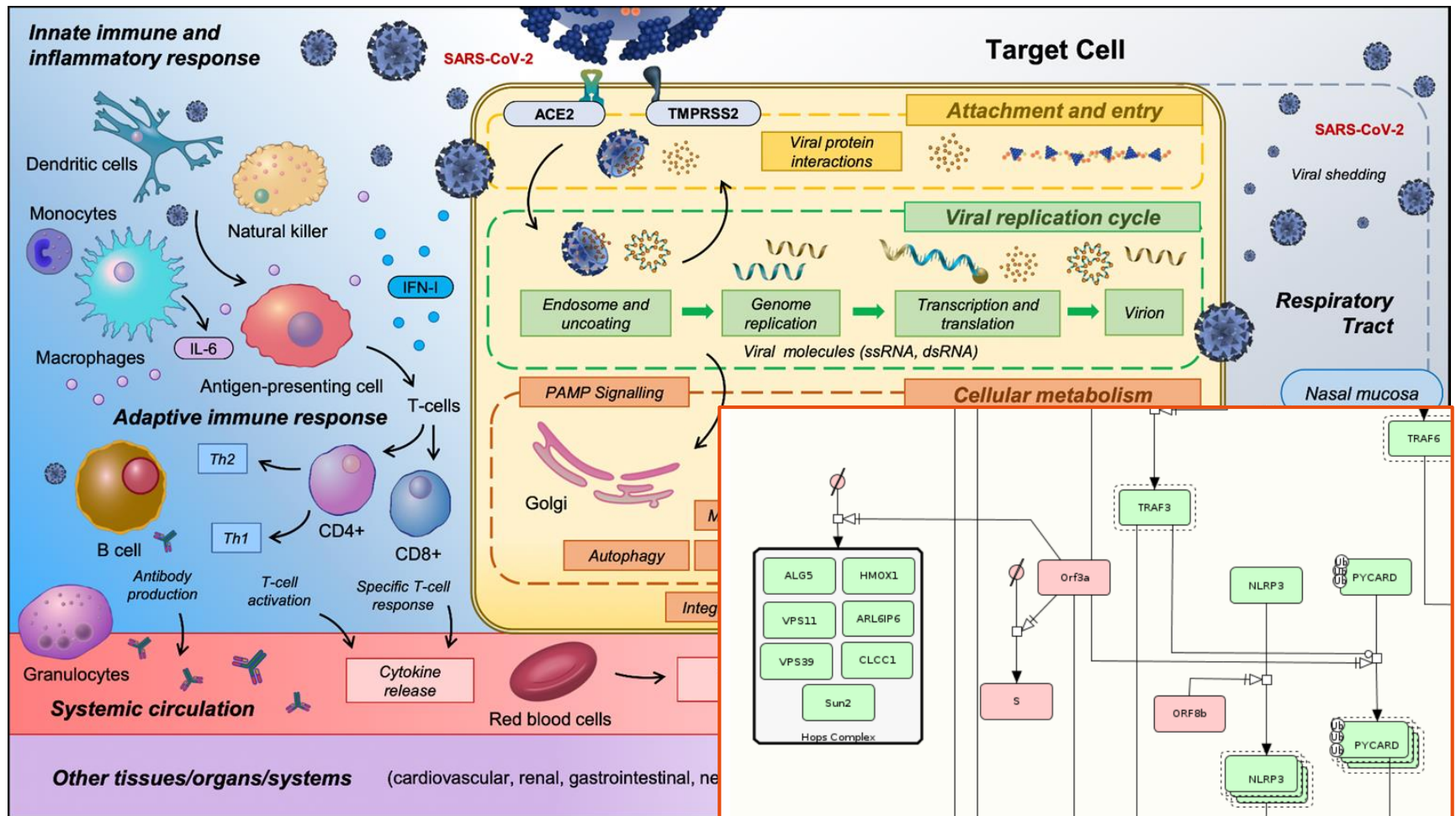
# COVID-19 Disease Map

- Collaborative effort
  - 230 biocurators, domain experts, modellers and data analysts from 120 institutions in 30 countries
  - Participation of established resources and communities (Disease Maps, Reactome, WikiPathways)
- **Aim:** an open-access collection of curated computational diagrams and models of molecular mechanisms implicated in the disease

# COVID-19 Disease Map Integration



# COVID-19 Disease Map



# COVID19 Disease Map

- 41 diagrams
- 1,836 interactions between 5,499 elements
- supported by 617 publications and preprints
- Models are available in SBML, SBGNML and GPML
- Conversions and integration supported by MINERVA

# Outline

- Introduction
- COVID19 Disease Map
- WikiPathways



# WikiPathways

- Launched in 2008 as an experiment in community-based curation of biological pathways



**Too much data!**

Difficult to keep knowledge  
up-to-date, accessible and  
integrated



Taking advantage of direct  
participation by a greater portion  
of the community  
(crowdsourcing)



# WikiPathways

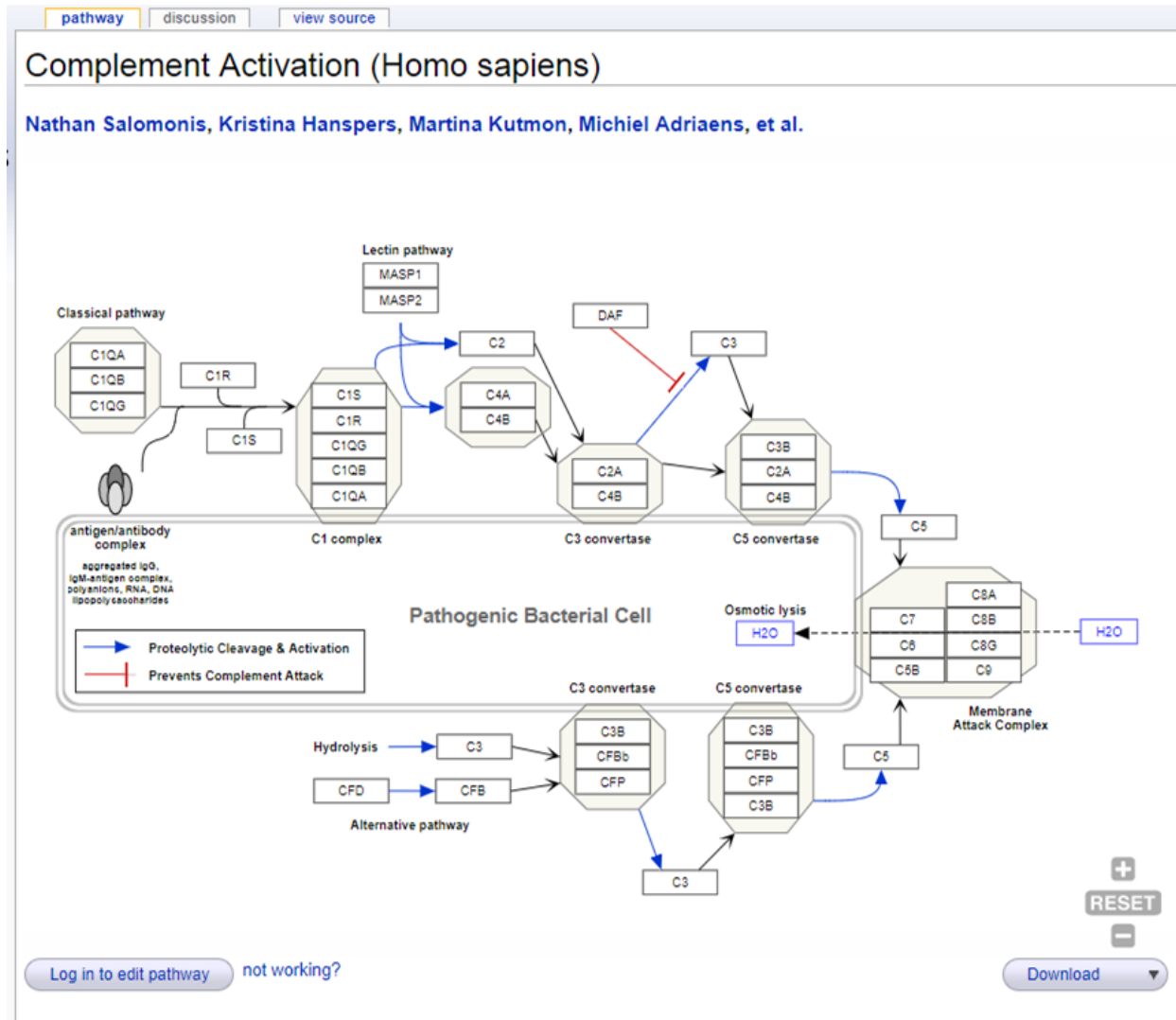
- **A wikipedia for pathways**
  - Build on MediaWiki (same software wiki package as used by wikipedia.org)
  - Collection and curation of knowledge
  - Community curated
    - Everybody can contribute pathways
    - Everybody can edit and curate pathways
    - Everybody can use the pathway collections

# WikiPathways

- **Advantages**

- Fast
  - New findings can be added immediately
- Collaborative
  - Researchers can exchange ideas and discuss pathways
  - Collaborations with other manually curated pathway databases (Reactome, NetPath)
- Flexible
  - Pathways under development or hypothetical pathways
  - Disease specific pathways
  - Cell-type specific pathways

# Pathway pages

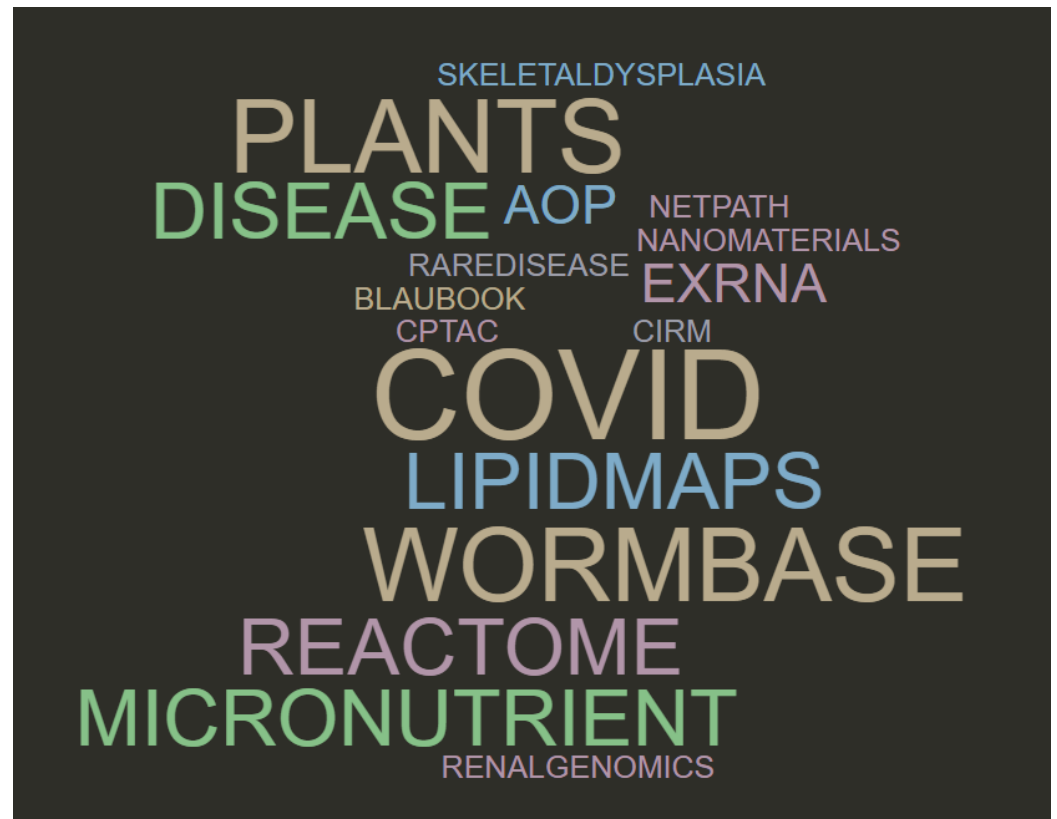


Title  
Authors  
Clickable diagram  
Quality tags  
Ontology tags  
Bibliography  
History  
External references

Discussion page  
Download

# Community portals

- Special interest groups
- Portal pages to highlight communities



# WikiPathways content

- **Statistics**

- 2,995 pathways
- 777 contributors



- **July 2021 release**

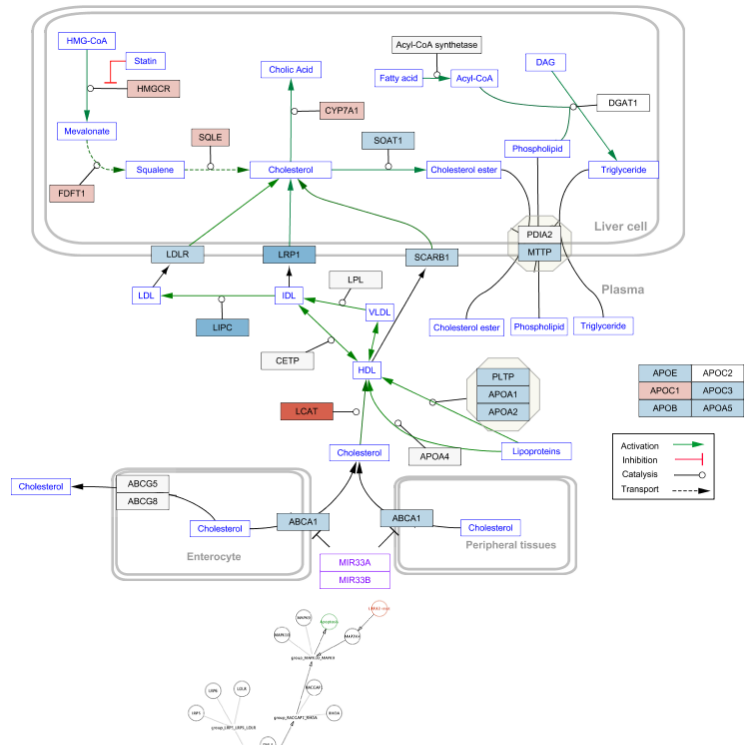
- Curated collection
- 2,078 pathways in 25 species
- Focus still mainly on human pathways
- In the last month: 368 edits from 26 contributors and 10 new pathways

# Data accessibility

- Download
  - For each pathway
  - Collections in monthly releases
- Data formats
  - GPML (graphical pathway markup language)
  - PNG, SVG, PDF (images)
  - BioPAX (biological pathway exchange language)
  - Gene lists / GMT files

# Data accessibility

- Programmatic access
  - REST API
  - RDF, semantic web
  - rWikiPathways
  - Cytoscape app
  - NDEx
  - wikidata



**NDEx v2.4.3**

WP545 - Complement Activation - Homo sapiens

Nodes: 81 Edges: 27  
PUBLIC Q Read Only  
@context: view namespaces

Owner: WikiPathways Project  
Created: Sep 27, 2019 10:39:58 PM  
UUID: f88f5f37-e166-11e9-bb65-0ac135e8bacf  
Format: Unknown  
Your Privileges: None

Description: The complement system is a biochemical cascade that helps, or complements, the ability of antibodies to clear pathogens from an organism. It is part of the immune system called the innate immune system that is not adaptable and does not change over the course of an individual's lifetime. However, it can be recruited and brought into action by the adaptive immune system. The Classical pathway of activation of the complement system is a group of blood proteins that mediate the specific antibody response. [source: Wikipedia] The Classical pathway begins with circulating C1q binding to an antigen on the surface of a pathogen, which activates the pathway and leads to the formation of C3 convertase.

Query Terms (i.e., AKT1 or WNT\*) Type: 1-step neighborhood

Open in Cytoscape



Main page  
Community portal  
Project chat  
Create a new Item  
Create a new Lexeme  
Recent changes  
Random item  
Query Service  
Nearby  
Help  
Donate

Print/export  
Create a book  
Download as PDF  
Printable version

Tools

Item Discussion Read View history Search Wikidata

## Complement Activation (Q30225577)

The complement system is a biochemical cascade that helps, or complements, the ability of antibodies to clear pathogens from an organism, part of the immune system called the innate immune system that is not adaptable and does not change ov...

▼ In more languages  
Configure

Language	Label	Description	Also known as
English	Complement Activation	The complement system is a biochemical cascade that helps, or complements, the ability of antibodies to clear pathogens from an organism. It is part of the immune system called the innate immune system that is not adaptable and does not change ov...	
German	No label defined	No description defined	
Dutch	No label defined	No description defined	
French	No label defined	No description defined	

# Summary



# Summary

- COVID19 molecular mechanisms
- Curation efforts in COVID19 Disease Map projects
- How can you use these models when analysing your omics data?
  - Reproducible data analysis workflows
  - Integration of different resources

# Questions?

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