Introduction
COVID19 Disease Map &
WikiPathways

Martina Summer–Kutmon, PhD

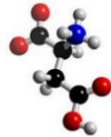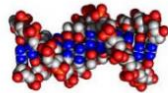ISMB/ECCB 2021 - Tutorial 8
22 July 2021

Outline

- **Introduction**

- COVID19 Disease Map
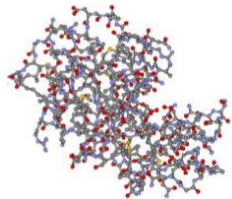
- WikiPathways

Molecular systems biology

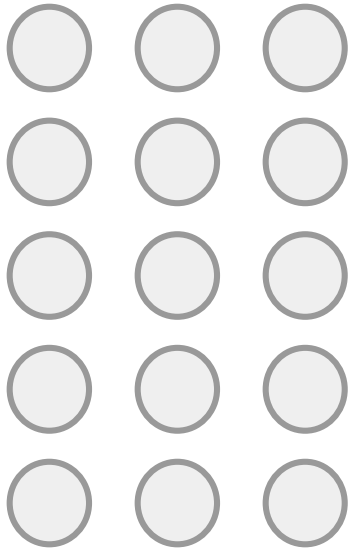Molecules of life do not function in isolation ....

metabolites

genes

proteins

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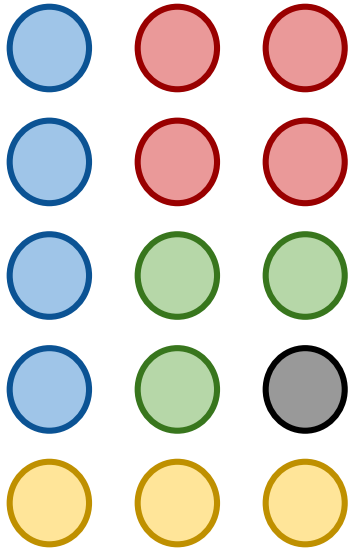
Introduction

Quantitative

measurements

Isolated data points

Introduction

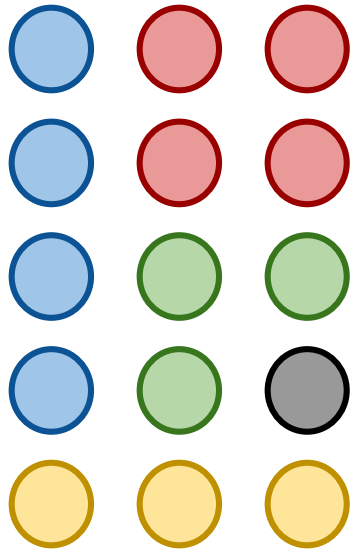**Comparative statistics**
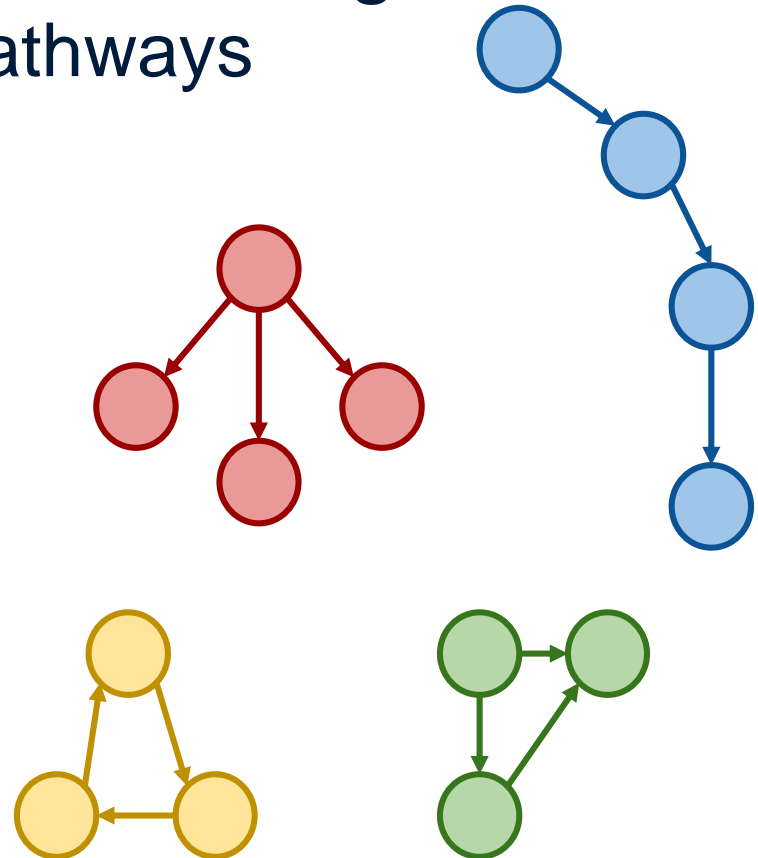Isolated lists
Clustering
Isolated groups
Gene sets
Functional groups

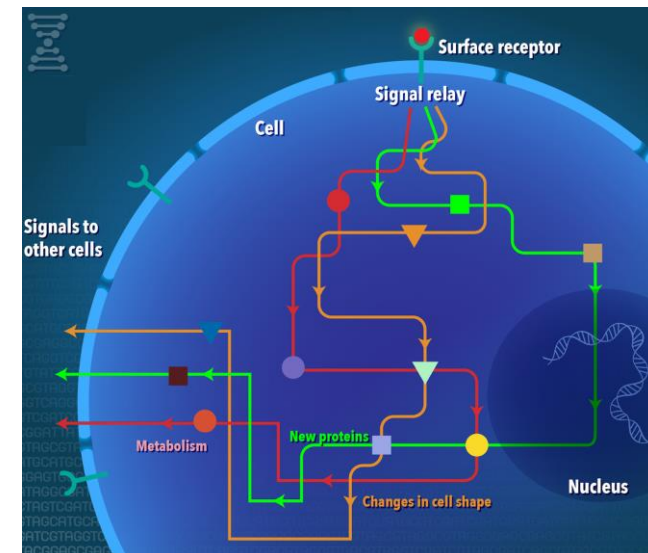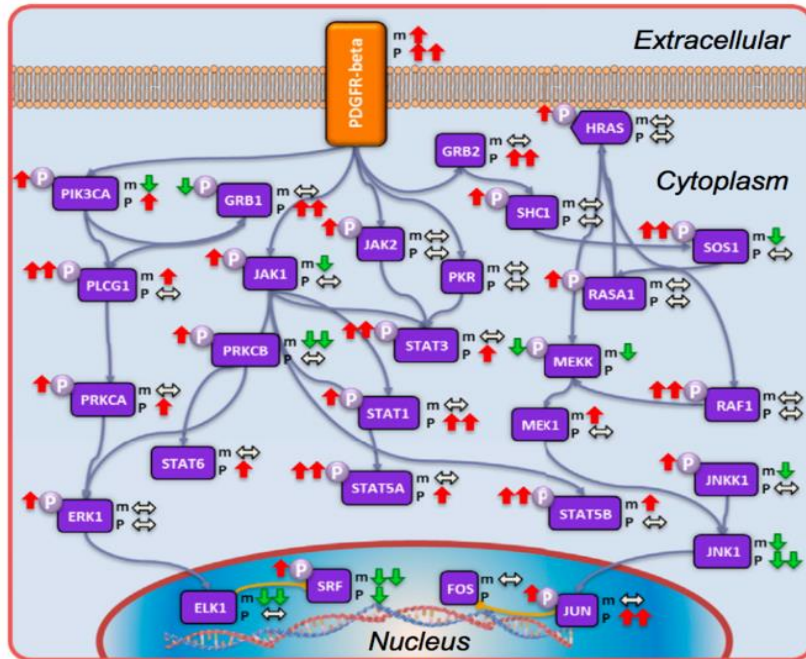# Introduction

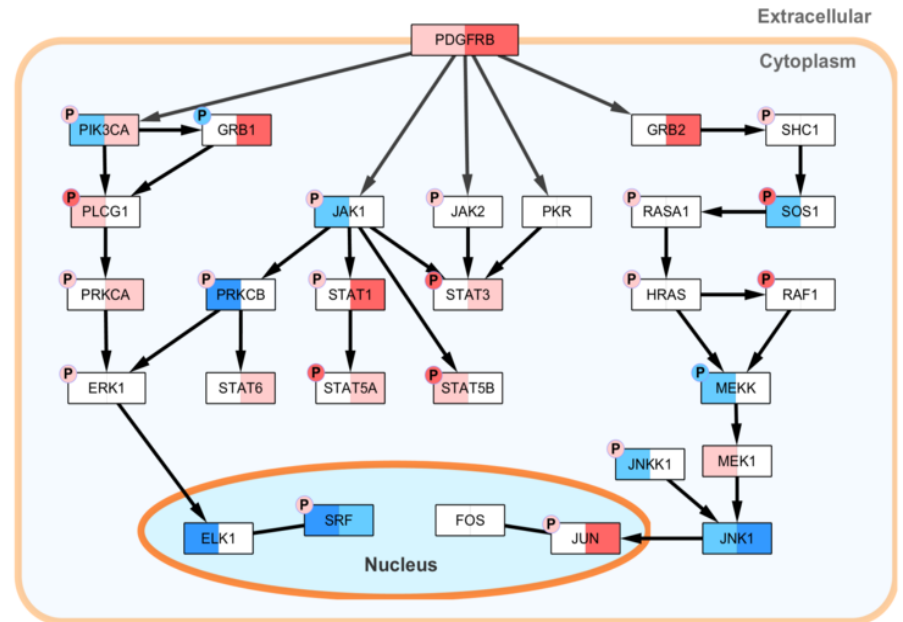**Functional organization**
Pathways

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

Outline

- Introduction

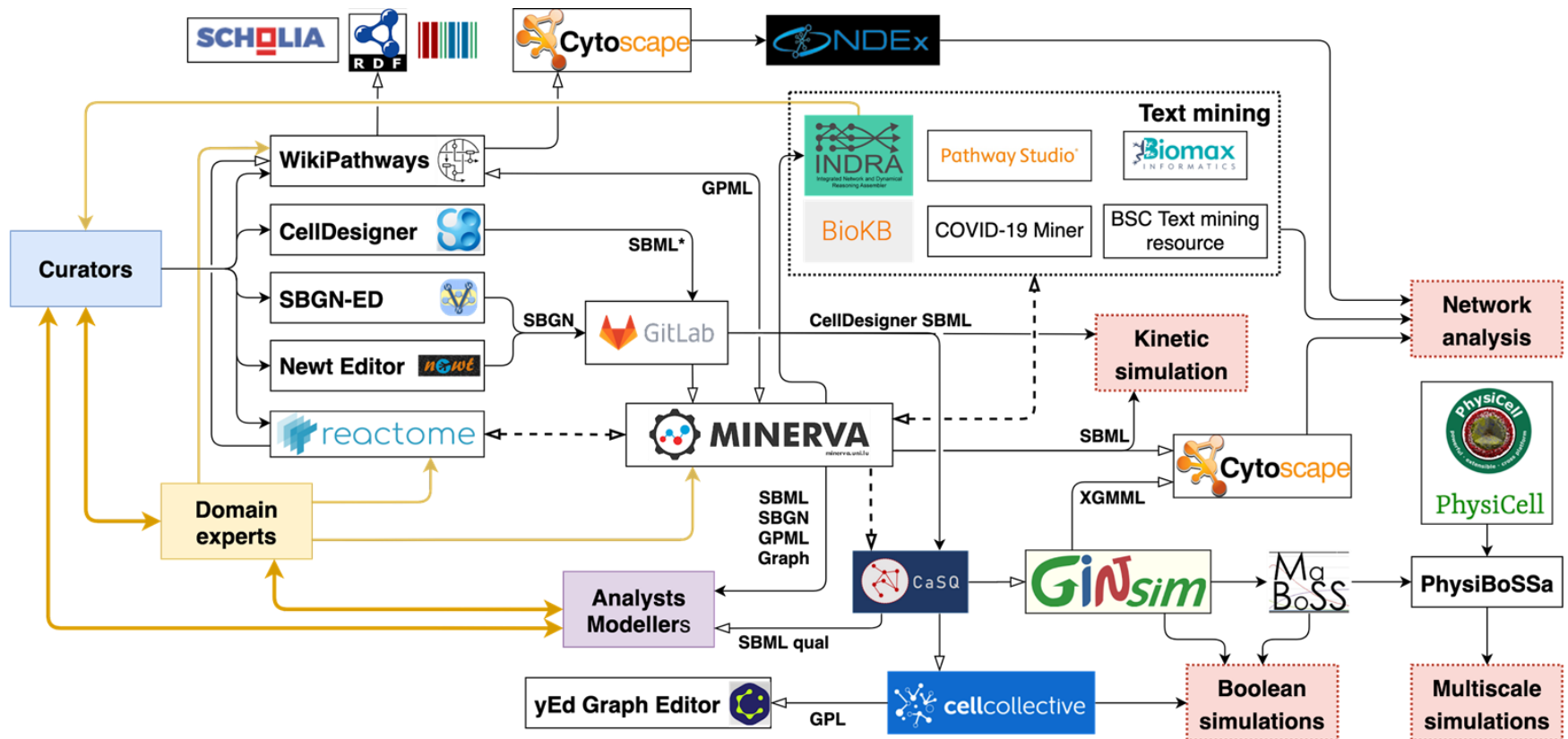- **COVID19 Disease Map**

- 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
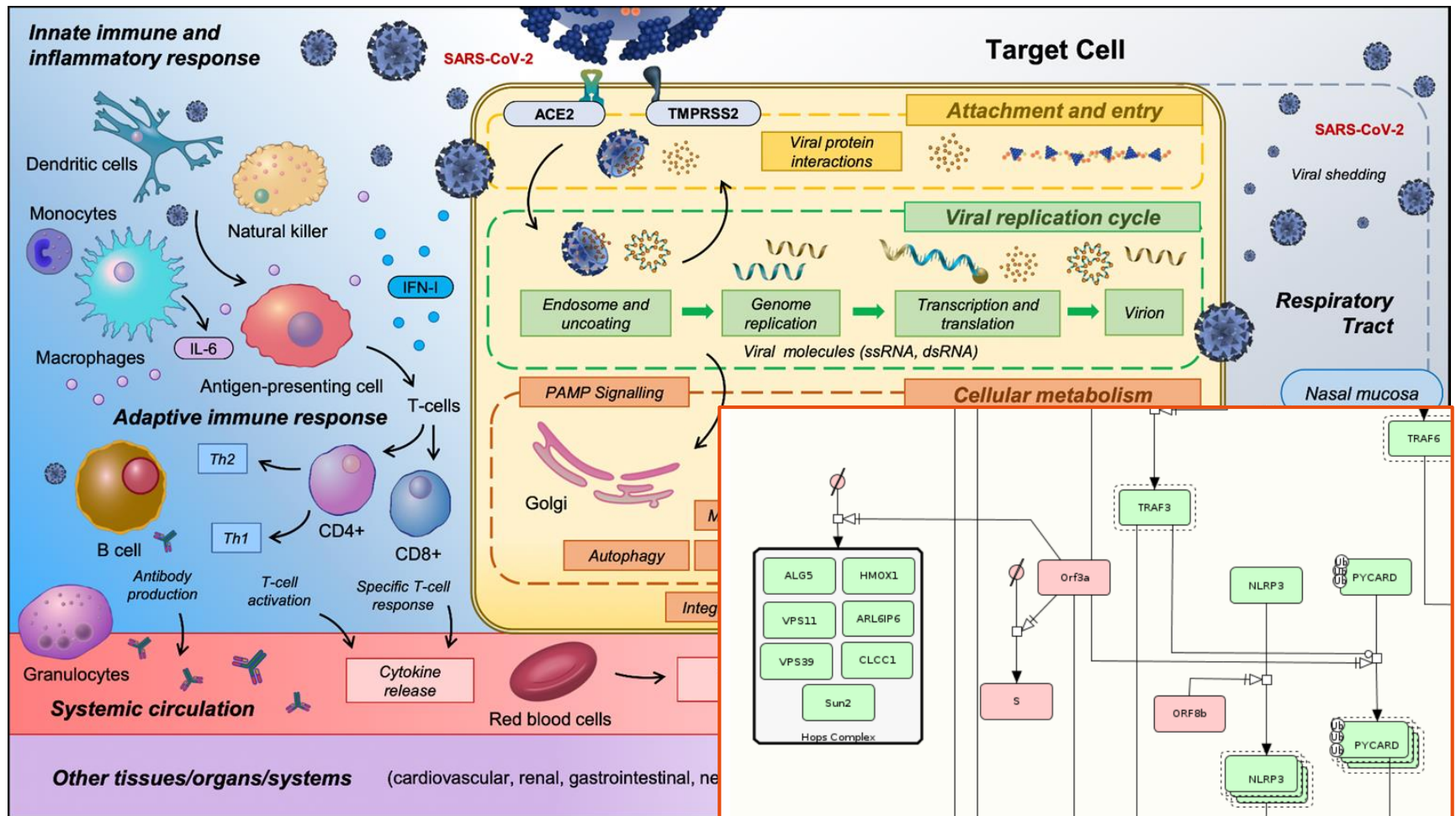
COVID19 Disease Map

- 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

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- **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**)
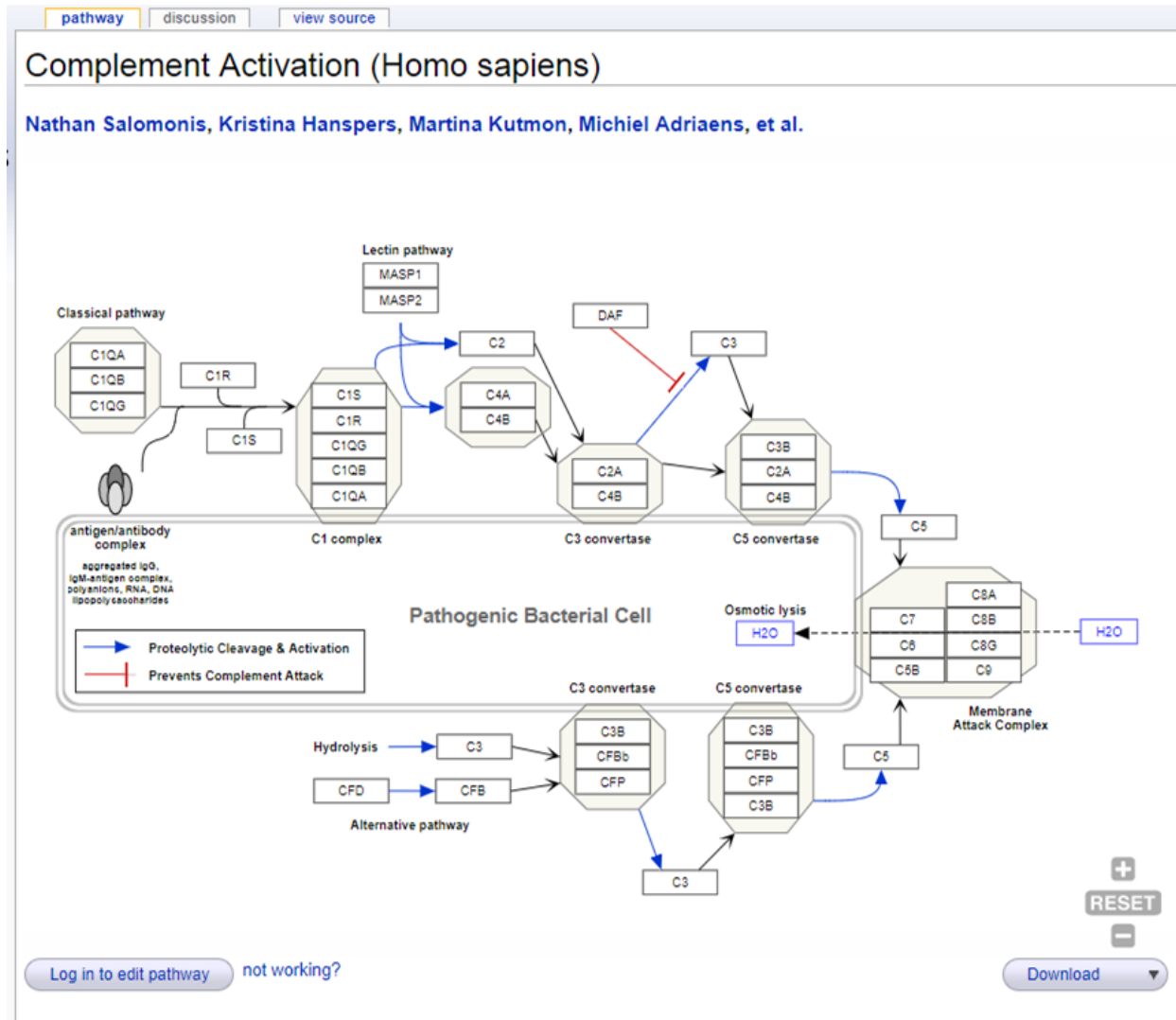
WikiPathways

- **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
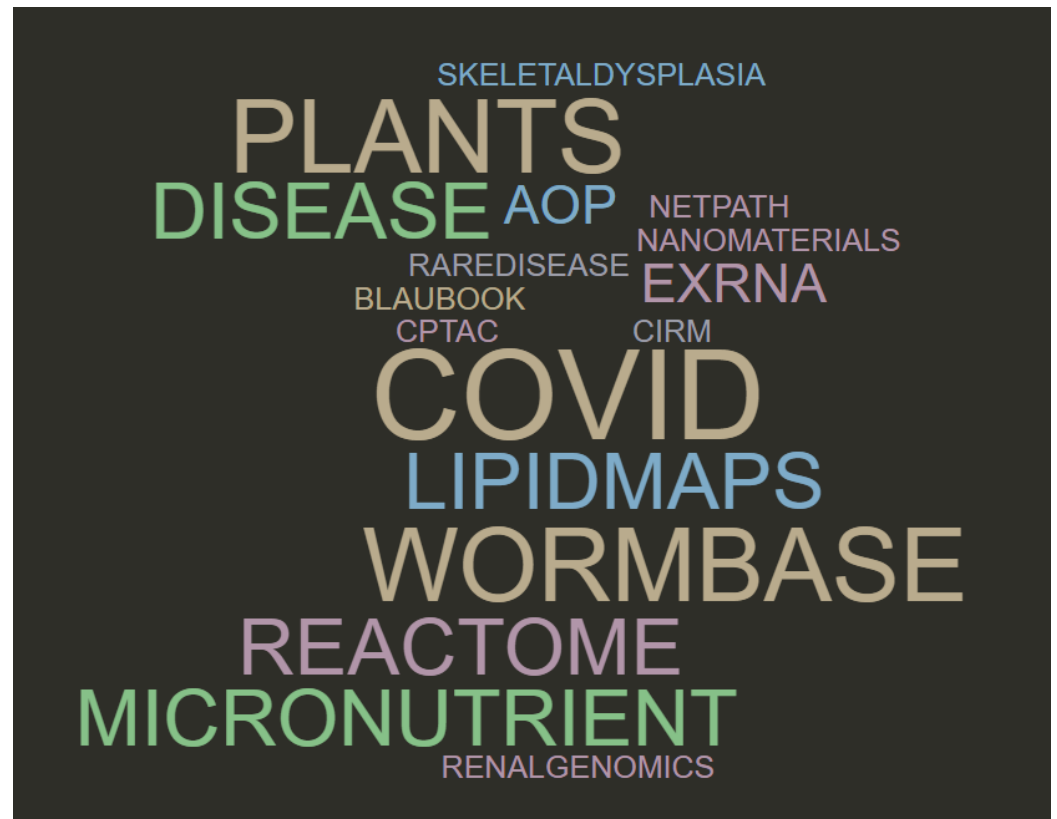   - Cell-type specific pathways

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
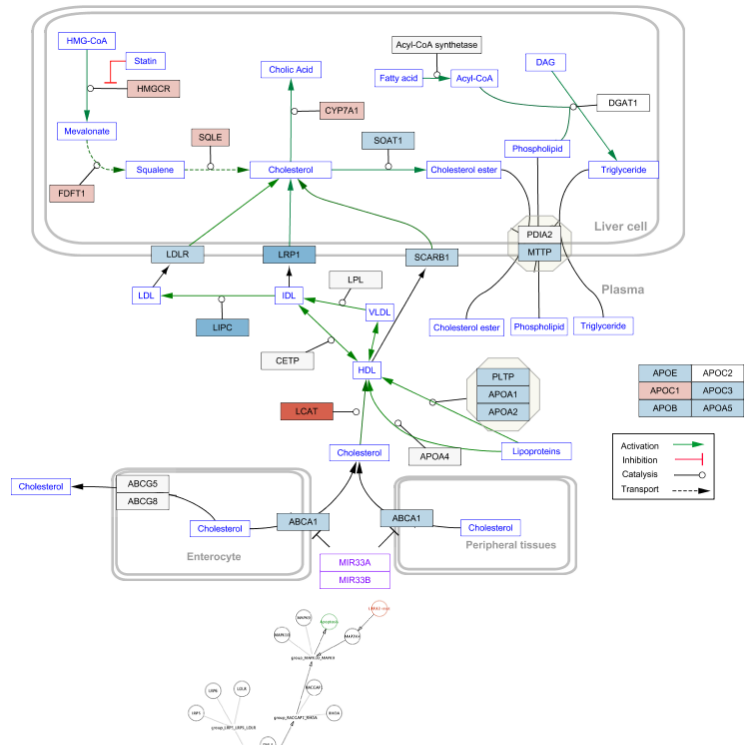 - 777 contributors

- **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

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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