



# FHAIVE

Faculty of Medicine and Technology, Tampere University

Thesis Fair 30.11.2023



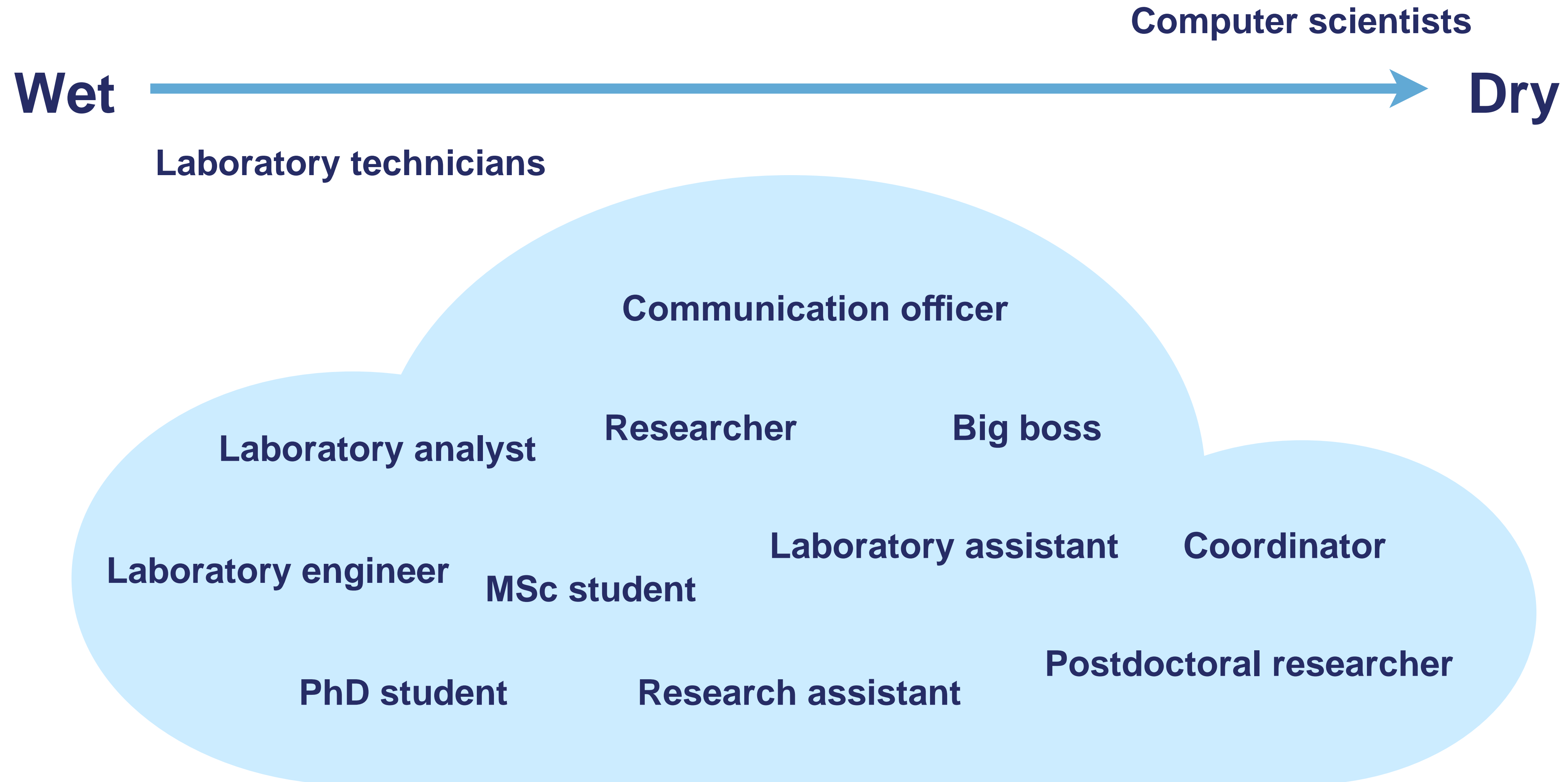


- **FHAIVE stands for Finnish Hub for Development and Validation of Integrated Approaches**
- **FHAIVE is the GLP national reference laboratory of Finland for validation of alternative methods (ECVAM)**
- **Coordination of the Finnish 3R Centre**
- **Chemical safety, drug safety and efficacy, drug repositioning, biologics**

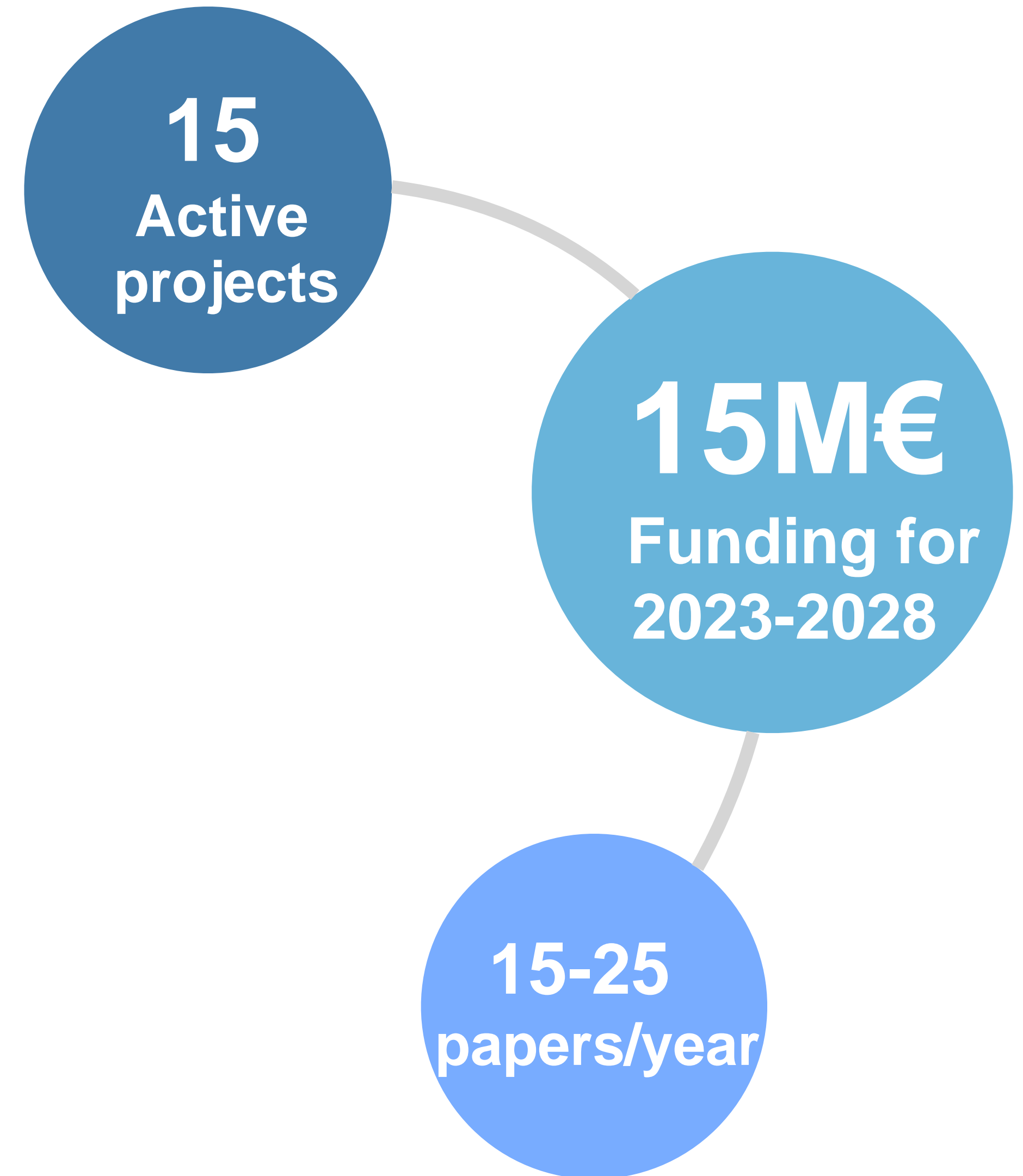
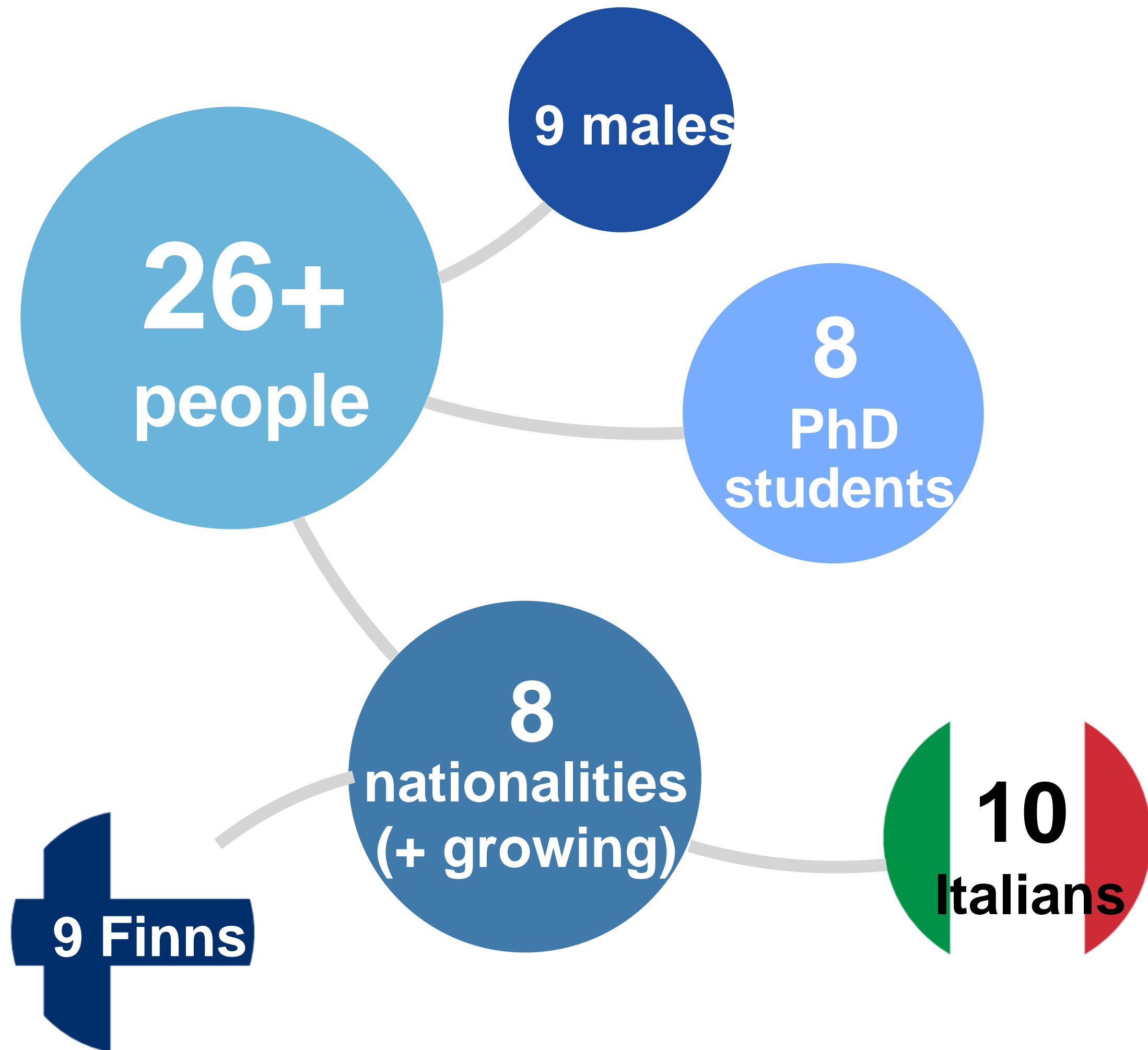




# Working at FHAIVE



# FHAIVE in numbers



# Current paradigms in Toxicology

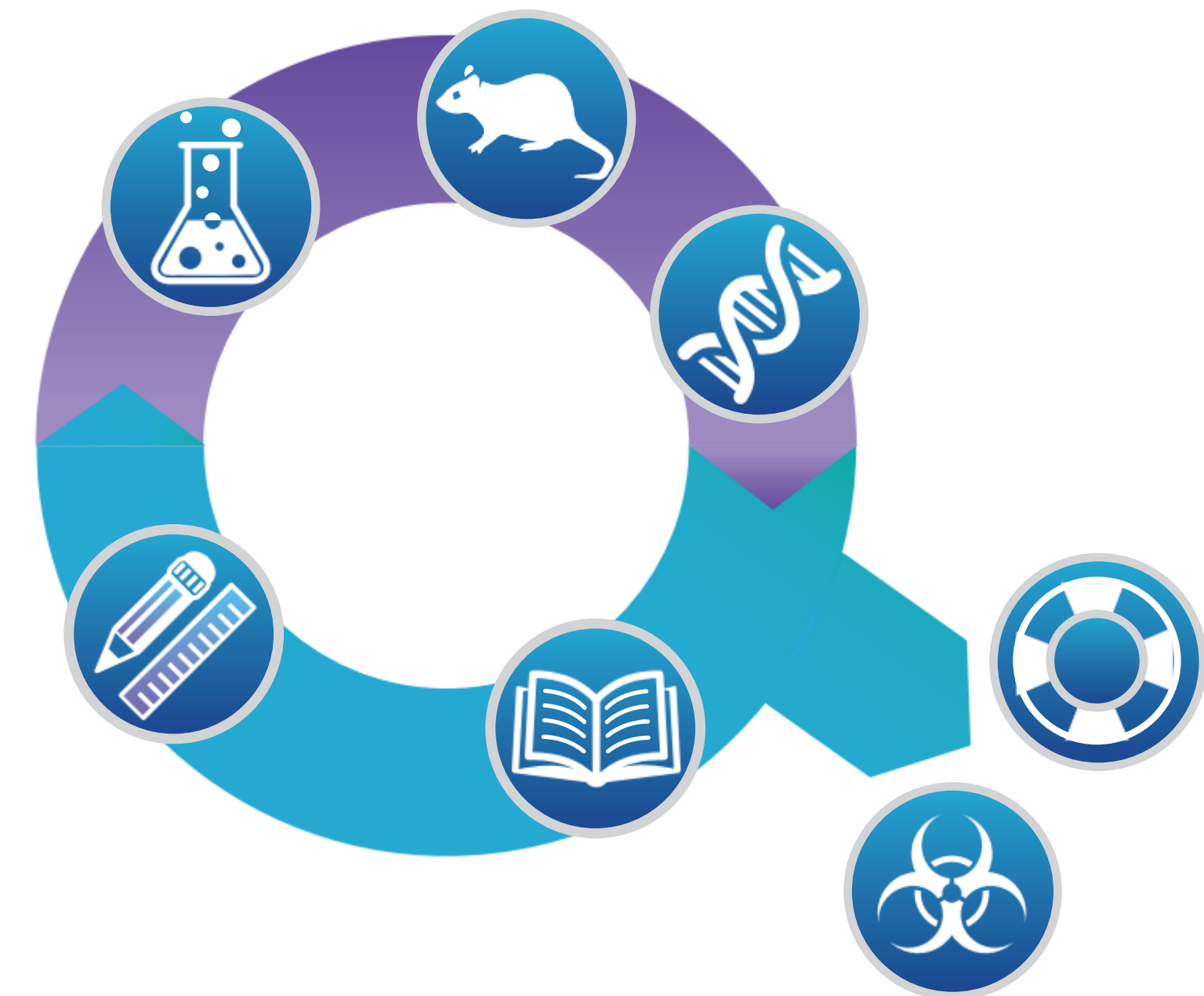


## Traditional toxicology



- One chemical at a time
- Focuses mainly on phenotypic effects
- Limited knowledge to design new compounds

## Systems toxicology



- Focuses also on mechanisms
- Knowledge to design new compounds
- Lacks standardisation, not regulatory accepted



# Some FHAIVE success stories

Not only toxicology!

**Cheminformatics**  
Deregulate  
ACE2, TMPRSS2, CTSL, CTSL



**Bioinformatics**  
Alter virus-related genes  
Revert virus transcriptomic alteration  
Target central genes in co-expression networks

**Active**  
Present in active drugs from *in vitro* screenings

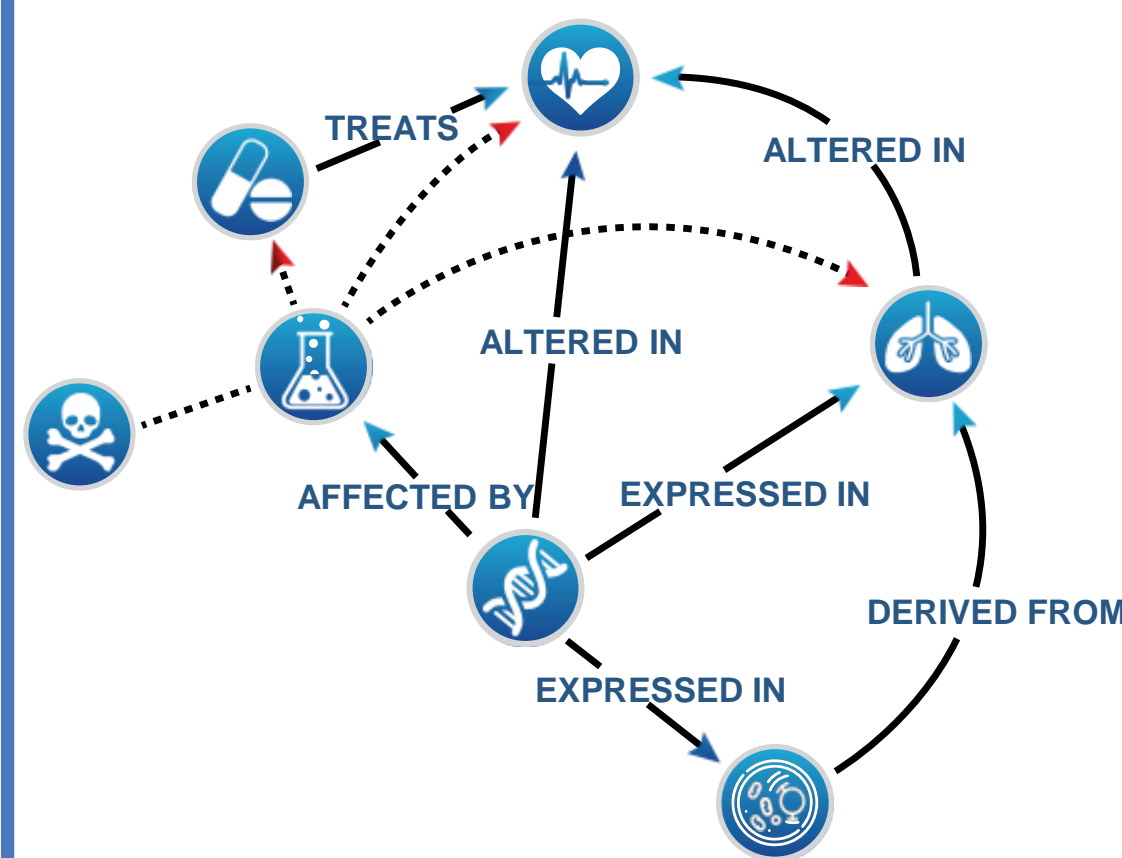
**NEXTCAST**  
bypass to knowledge



## NEXTCAST

Integrated software for drug discovery and chemical safety assessment

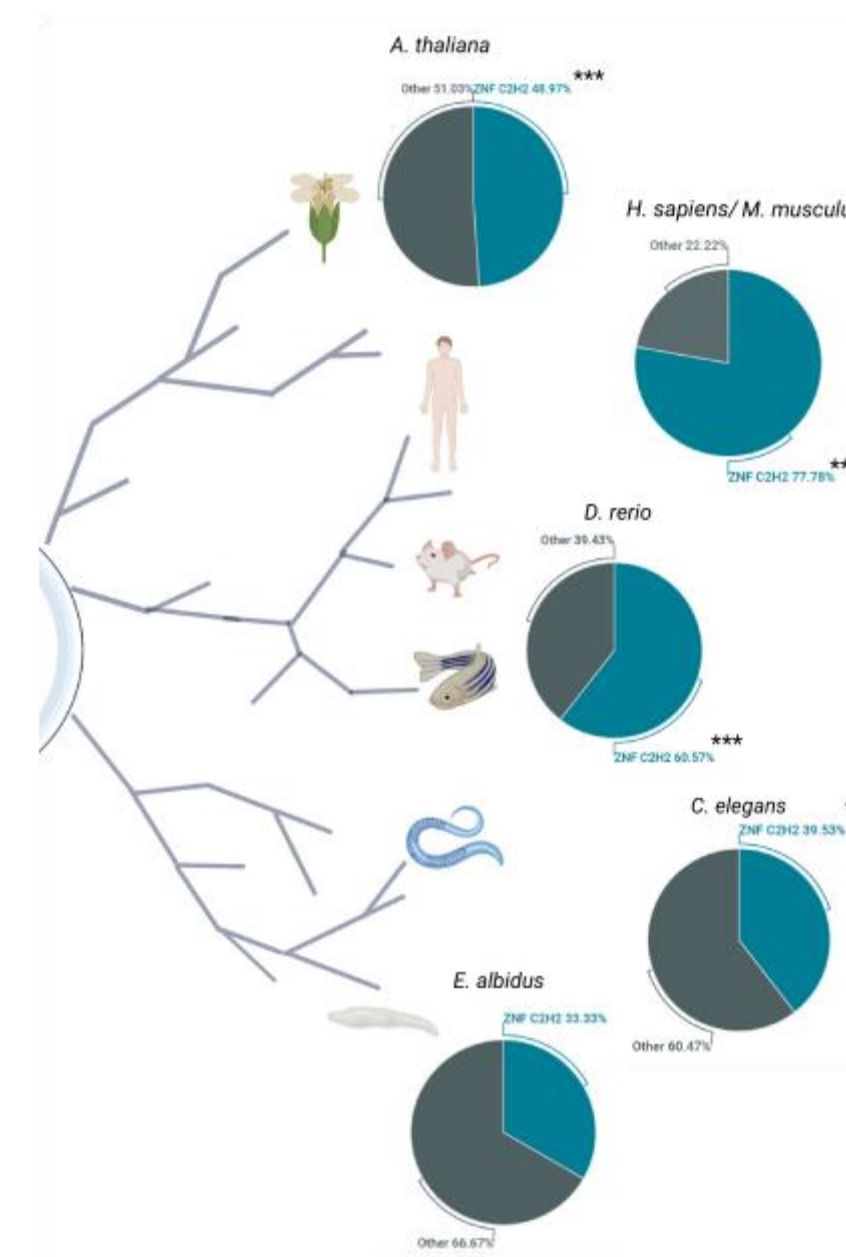
Serra et al. CSBJ 2022



## UNIFIED KNOWLEDGE SPACE

The biggest knowledge graph (60M+ data points) in toxicology and pharmacology

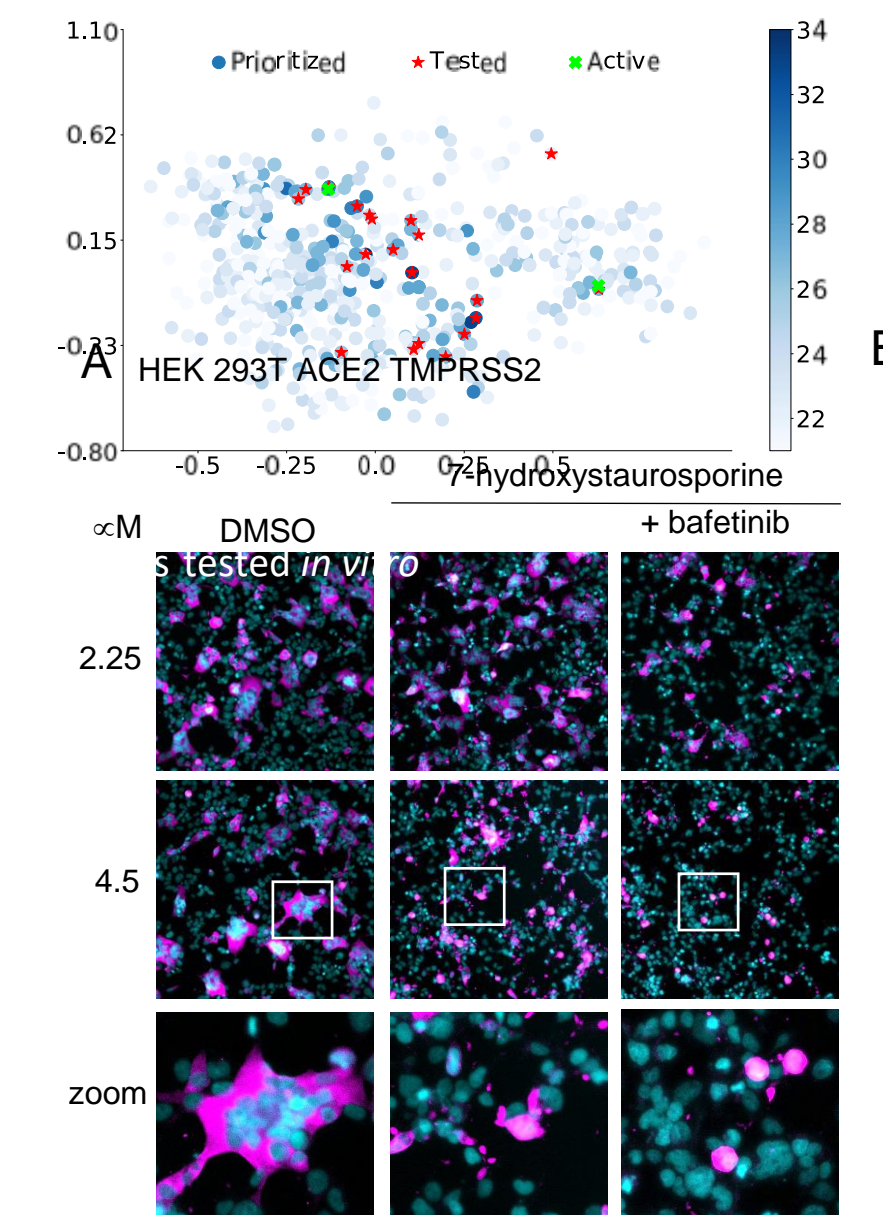
Pavel et al. CSBJ 2021



## ONE HEALTH MODEL

The first multi-species model that explain molecular responses to nano-articulate

del Giudice et al. Nature Nano 2023



## NOVEL COVID DRUGS

Identification and validation of COVID-drugs by a novel integrated, fast and cheap method Serra et al. Brief. Bioinfo. 2022

# Why FHAIVE



- **YOU ARE PASSIONATE ABOUT SCIENCE**
  - **YOU LOOK FOR A PAID JOB**
  - **YOU WANT TO HAVE AN ACADEMIC CAREER**
  - **YOU WANT TO HAVE A CAREER IN CHEMICAL OR PHARMACOLOGICAL OR BIG DATA OR AI INDUSTRY**
  - **YOU WANT TO HAVE A CAREER IN A REGULATORY AGENCY (e.g. TUKES, ECHA, EFSA, EMA, OECD)**
- **We do cutting-edge science**
  - **We work in a highly multi-disciplinary field**
  - **Cell & molecular biology, toxicology, pharmacology, big data science, AI, bioinformatics, bioengineering...**
  - **We have significant amount of funding (15M€ for 2023-28)**
  - **We have many projects (active 15)**
  - **We pay all our MSc. students.**
  - **>75% MSc theses are published as papers**
  - **Our students finish their PhD in 4,5y with avg. 20 articles**
  - **At least one thesis article is in high impact journals**
  - **We collaborate a lot internally, opportunities to contribute**
  - **Our network of international collaborators is huge**
  - **We collaborate with many big industries**
  - **ASTRAZENECA, SANOFI, NOVARTIS, PFIZER, BASF, SOLVAY...**
  - **We are a GLP facility**
  - **We are subcontractors of EFSA**
  - **We collaborate with ECHA and TUKES**
  - **We are part of several OECD expert groups**



# What can FHAIVE offer?

- **Opportunities in the lab: Summer jobs, thesis work, research assistant, researcher (without the need to do a PhD or to test it out), PhD, PostDoc...**
- **Note that short term contracts (e.g., summer jobs) not possible in the wet lab!**
- **Collaborations with international academic partners and industry**
- **Pharma, regulators...**





# Potential projects





# Comparing the properties of different cell counters: LunaFL Cell Counter, Cellometer Auto T4 and Countess

- Culturing two cell lines and optimizing their calculation protocols
- Reviewing the current Standard Operating Procedures (SOPs)
- Producing a SOP for Countess (if necessary)
- Approximately 6 weeks of work.

Suitable for example for a laboratory engineering thesis.

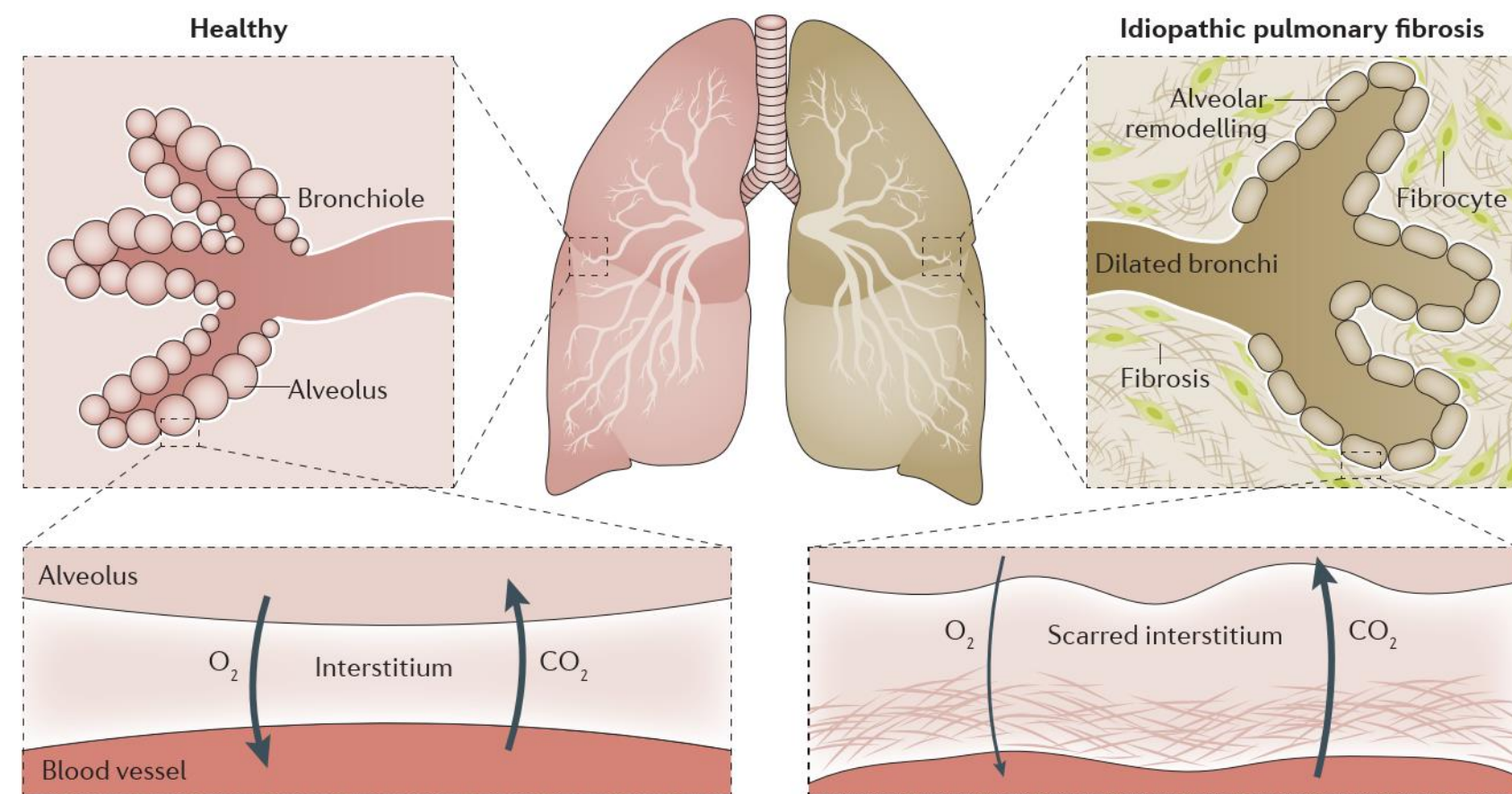


**Contact person: Hanna Juppi**  
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# Exploring the Immune Component of Lung Fibrosis



(Martinez et al. 2017)

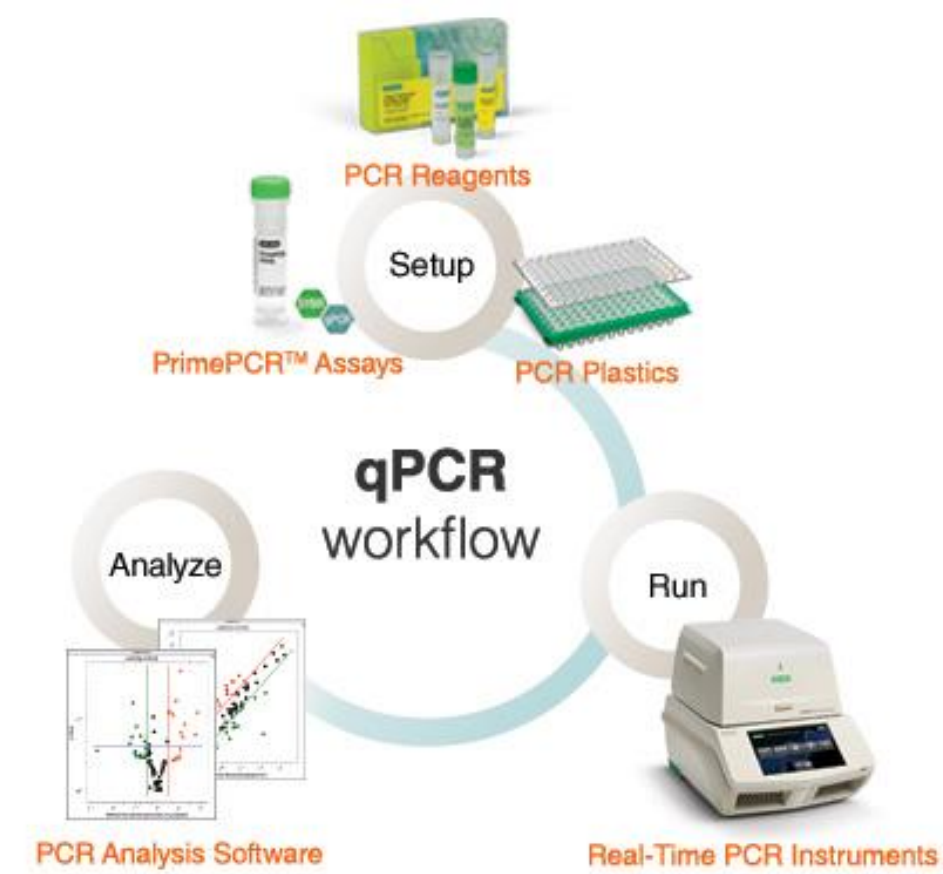
You will co-culture macrophages that have been exposed to profibrotic chemicals (bleomycin and TGFB to start) with lung fibroblast cells and look at the effect on the fibroblasts through qRT-PCR. Exploring gene expression of Collagen, alphaSMA and other important indicators of fibrosis.

Skills you will learn:

- Cell culture
- Cell co-culture
- RNA isolation
- qPCR
- qPCR analysis

Optional but nice skills that you might already have:

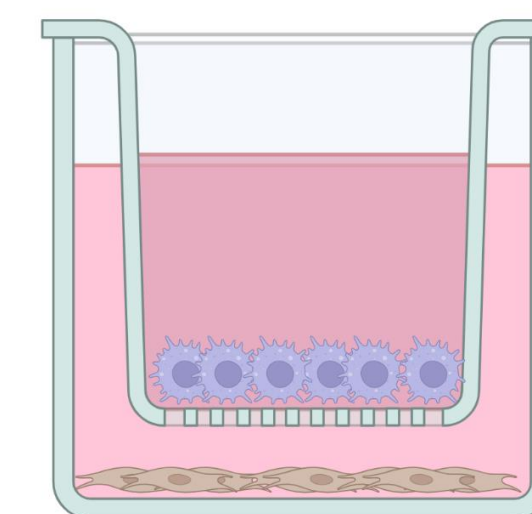
- Cell culture familiarity
- R and Rstudio familiarity



Contact person:  
**Jack Morikka**  
jack.morikka@tuni.fi

## CO-CULTURE SYSTEMS

Transwell system



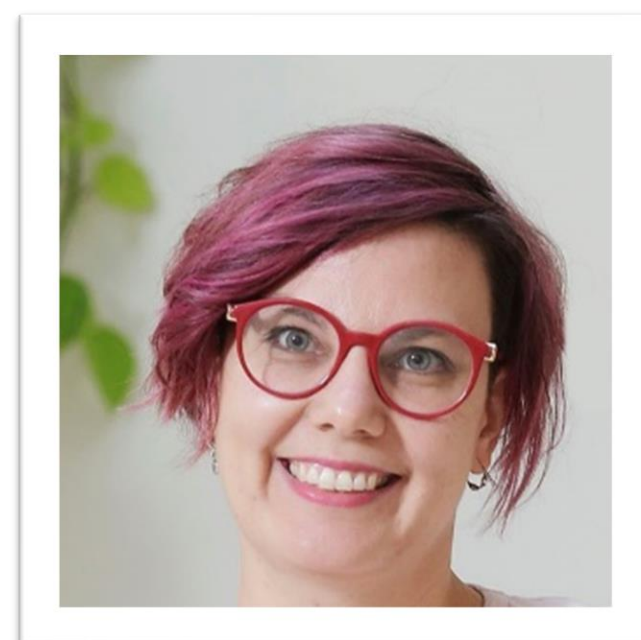
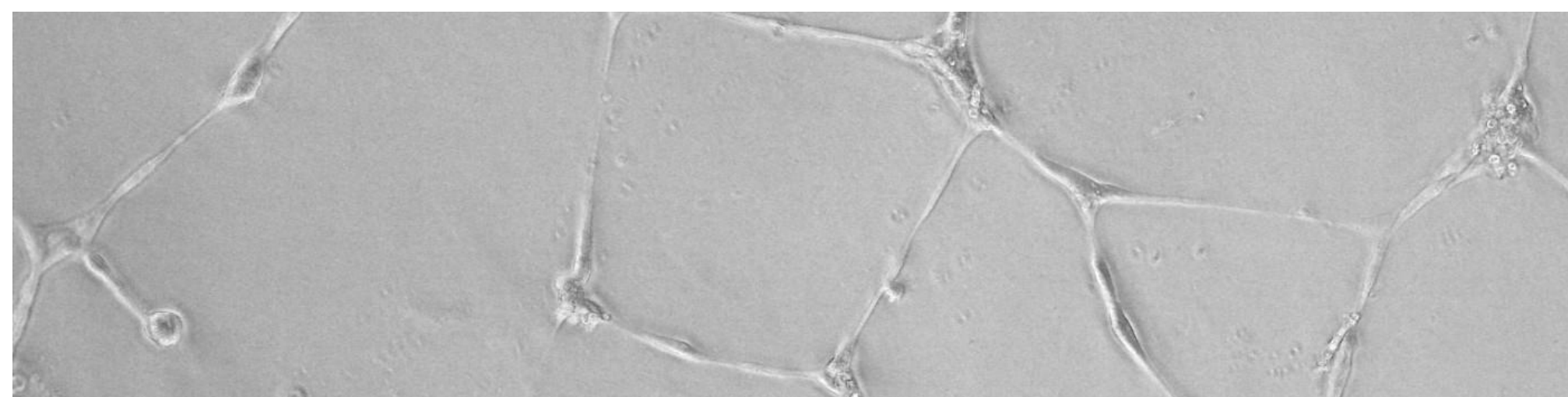
: Fibrotically activated macrophages (THP-1)

: Fibroblasts (MRC5)



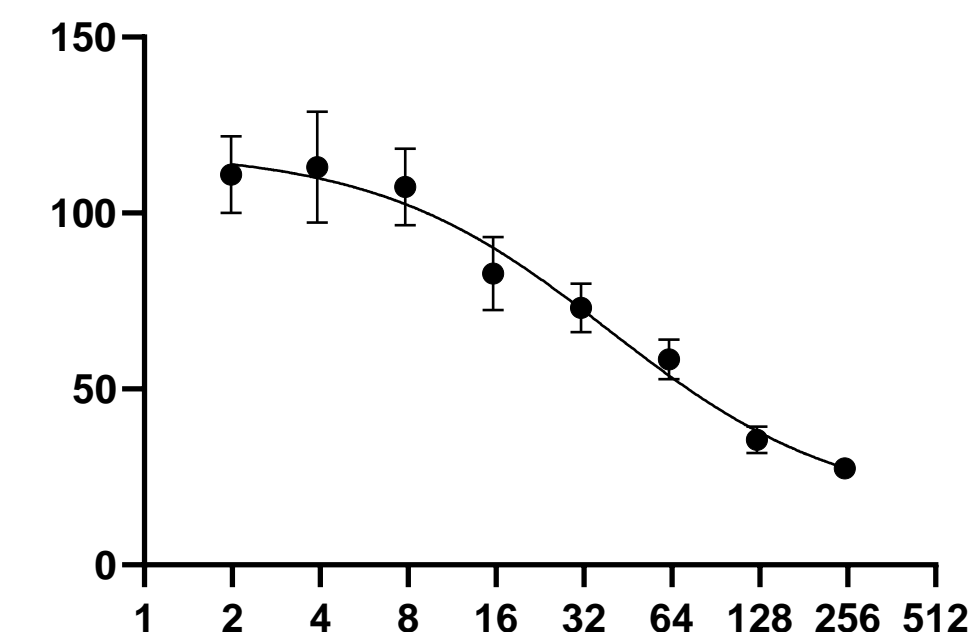
# In vitro models towards mechanistic toxicity

- Mechanistic toxicity
  - 2D cell culture models
  - endothelial and immune cells
  - omics data generation
- towards mechanistic understanding of underlying mechanisms of toxicity



Contact person: Laura Ylä-Outinen  
[laura.yla-outinen@tuni.fi](mailto:laura.yla-outinen@tuni.fi)

Toxicity of bleomycin to HUVEC cells



- Skills you need:
  - Curiosity
  - Open minded
  - Willingness to learn new and patience to apply those skills
  - Some lab experience is plus but not needed
- Skills you will obtain:
  - Working in laboratory
  - Cell culture
  - Basics on working in GLP
  - High-throughput data generation
  - qPCR and other molecular biological skills
  - Data analysis and reporting
  - Thesis process



# Disease diagnosis support system

## Tasks in practice

- Update the curation performed by Zhou et al. and obtain a new version 10 years later.
  - Retrieve data from public databases (python programming skills required)
  - Curate the retrieved associations (data analysis skills required)
- Implement and benchmark machine learning models for disease prediction from symptoms.
  - Design machine learning pipelines (python programming skills required)
  - Testing and model evaluation (data analysis skills required)



**Contact person:**  
**Angela Serra**

**[angela.serra@tuni.fi](mailto:angela.serra@tuni.fi)**

## Required skills

### Project development:

- Python
- Jupyter notebooks
- git

### Data collection/curation:

- API calls with requests package
- Json/xml parsing
- regular expressions
- Data manipulation with pandas

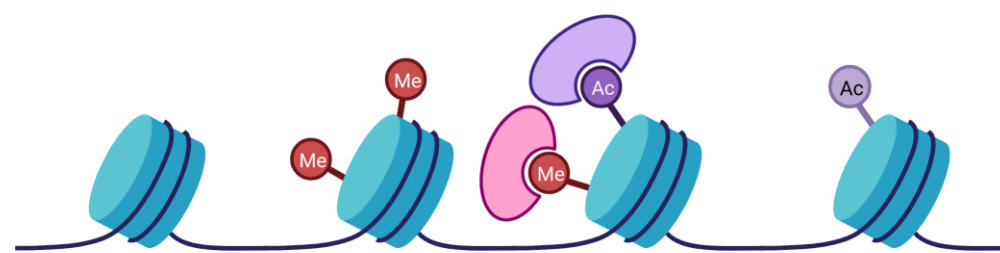
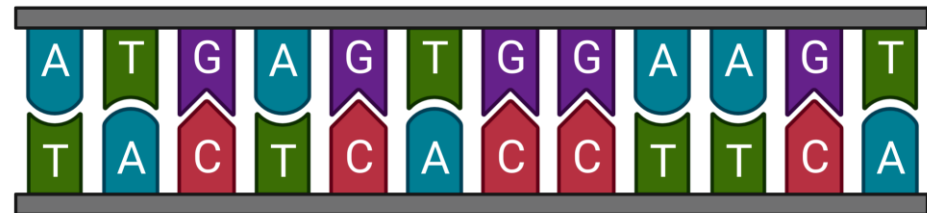
### Data modeling:

- Numpy
- matplotlib
- Scipy
- scikit-learn

# Resilient and sensitive human genes: Inner Demons and Inner Angels?

## Questions:

- Can we predict the behaviour of genes?
- What are the underlying rules?



Contact person:





Lena Möbus

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## Tasks:

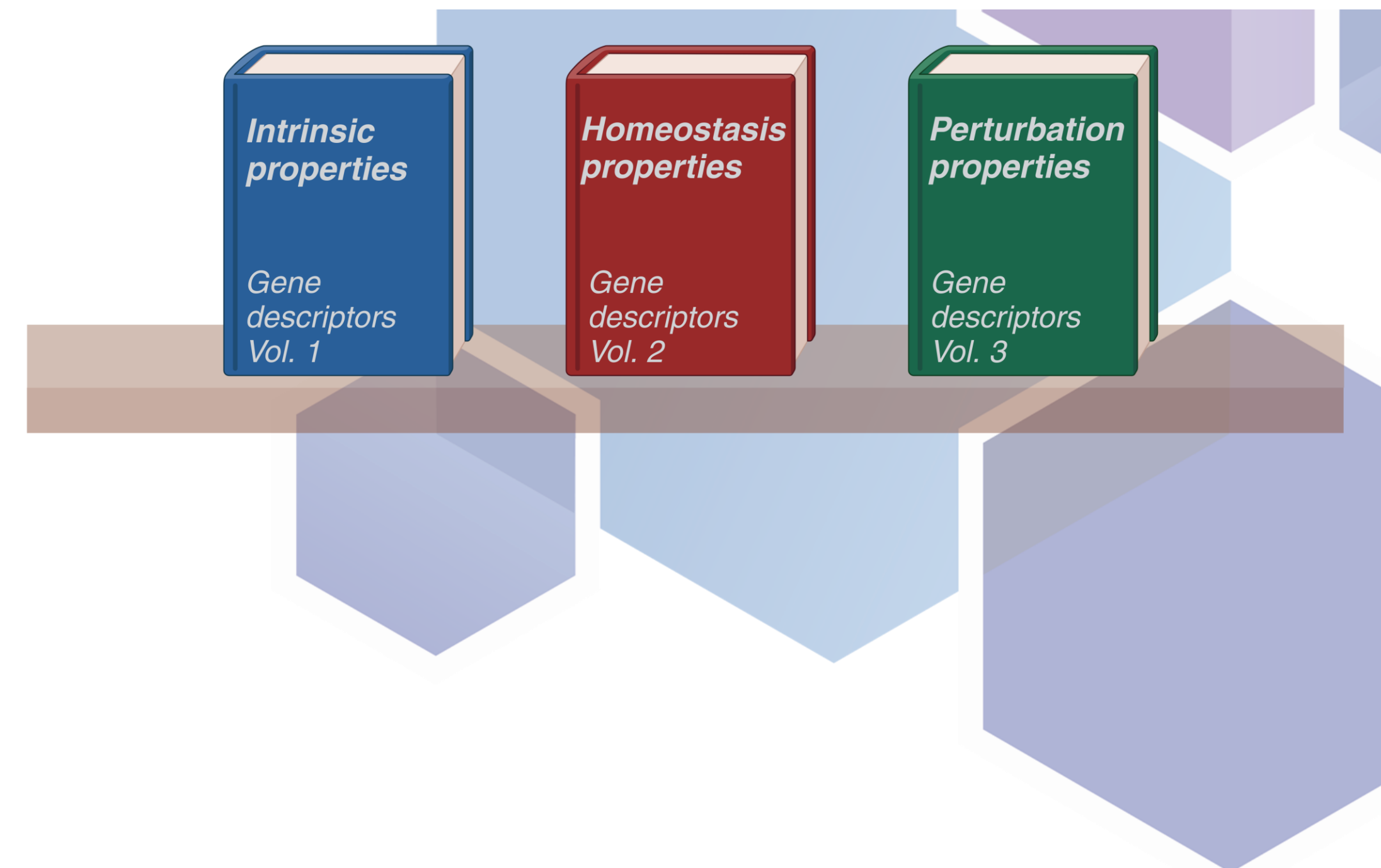
- Create a library of gene characteristics
- Statistics about relationships

**Predictive features of gene expression variation  
reveal mechanistic link with differential expression**

Olga M Sigalova , Amirreza Shaeiri , Mattia Forneris , Eileen EM Furlong  ✉, Judith B Zaugg  ✉

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Molecular Systems Biology (2020) 16: e9539 | <https://doi.org/10.15252/msb.20209539>





# Network models of diseases to design novel therapeutic strategies

Field of work: human complex diseases, such as pulmonary fibrosis, psoriasis and atopic dermatitis

Complex human disease could be imagined as a system represented by a bi-layer network, where we have a layer of symptoms and a layer of molecular interactions (which, in a disease are disrupted). By knowing the system in every of its interacting components, we aim to design drug treatments that counteract and neutralise the perturbations of the disease.



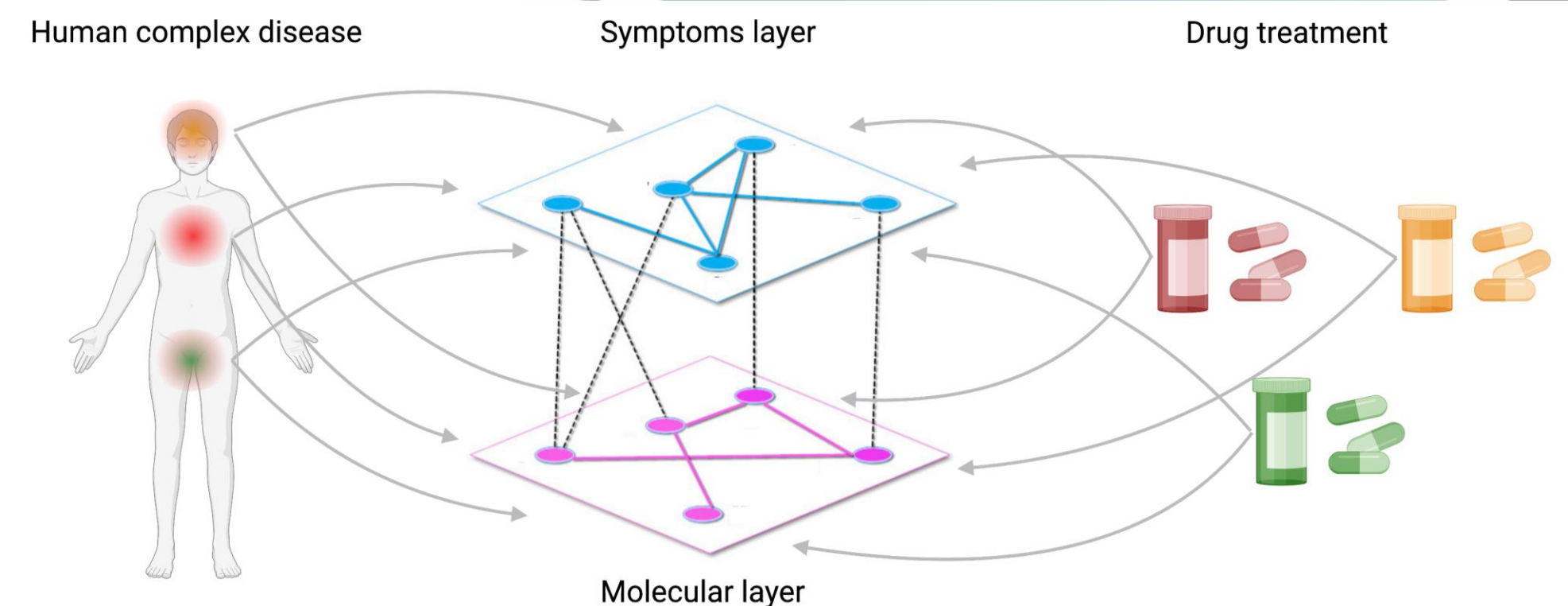
**Contact person:**  
**Antonio Federico**  
**[antonio.federico@tuni.fi](mailto:antonio.federico@tuni.fi)**

## Tasks:

- building and handling molecular networks (mainly co-expression networks)
- omics data and tools to handle network
- interpret the results to leverage biological relevance to the findings

## Desirable skills:

- Knowledge of basic molecular biology
- Coding skills are not mandatory, but an advantage





**Do you have something else  
in mind?  
Let us know!**