

Virtual Human Platform for Safety Assessment

Co-creation of a useful and sustainable platform

Prof. Chris Evelo
Maastricht University
Brussels, October 28 2025



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THE CHALLENGE

NO REFLECTION ON HUMAN-RELEVANT SCENARIOS

Current animal testing regimes do not reflect human-relevant scenarios, such as differences in susceptibility due to age, gender, timing of exposure, or disease state.

25% REPRODUCTIVE VALUE

Only 25% of published results obtained with animal data can be reproduced.

60% PREDICTIVE VALUE

The results of a laboratory animal can only predict the results in reproductive toxicity of another species by 60%.



9,338,162 ANIMALS

Were still being used for research and testing in the EU in 2017.

IMPLEMENTATION OF INTEGRAL MULTIDISCIPLINAIIR METHOD

Comparing data from new in vitro and in silico methods as alternative integrated method needs multidisciplinary approach.

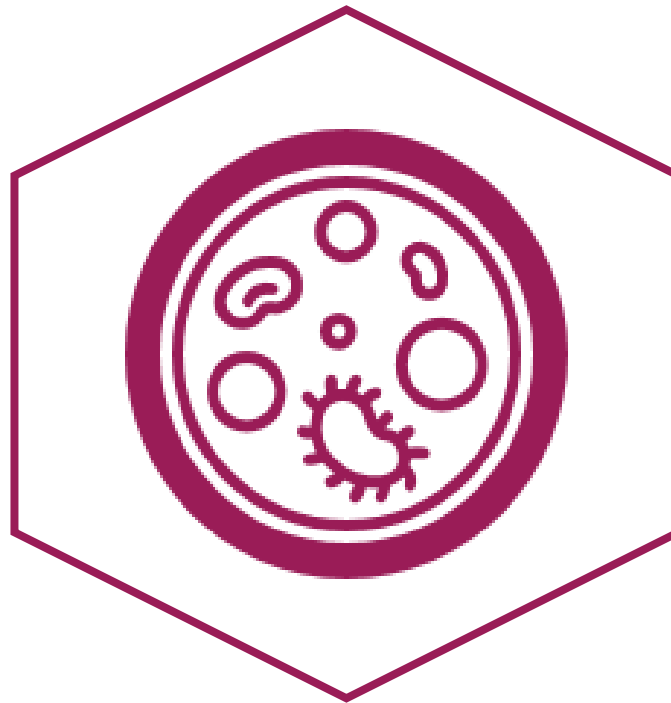
ONLY 22% DECREASE

In 10-years time, the use of animals is only decreased by 22% with the current approach to gradually refine, reduce and replace animal testing.

OUR VISION



Assessing the safety of chemicals and pharmaceuticals for vulnerable groups such as infants, the elderly or diseased



Unravelling the interaction of chemicals and pharmaceuticals with human biology and physiology



Safety assessment based on human data: institutional transition that makes animal testing redundant

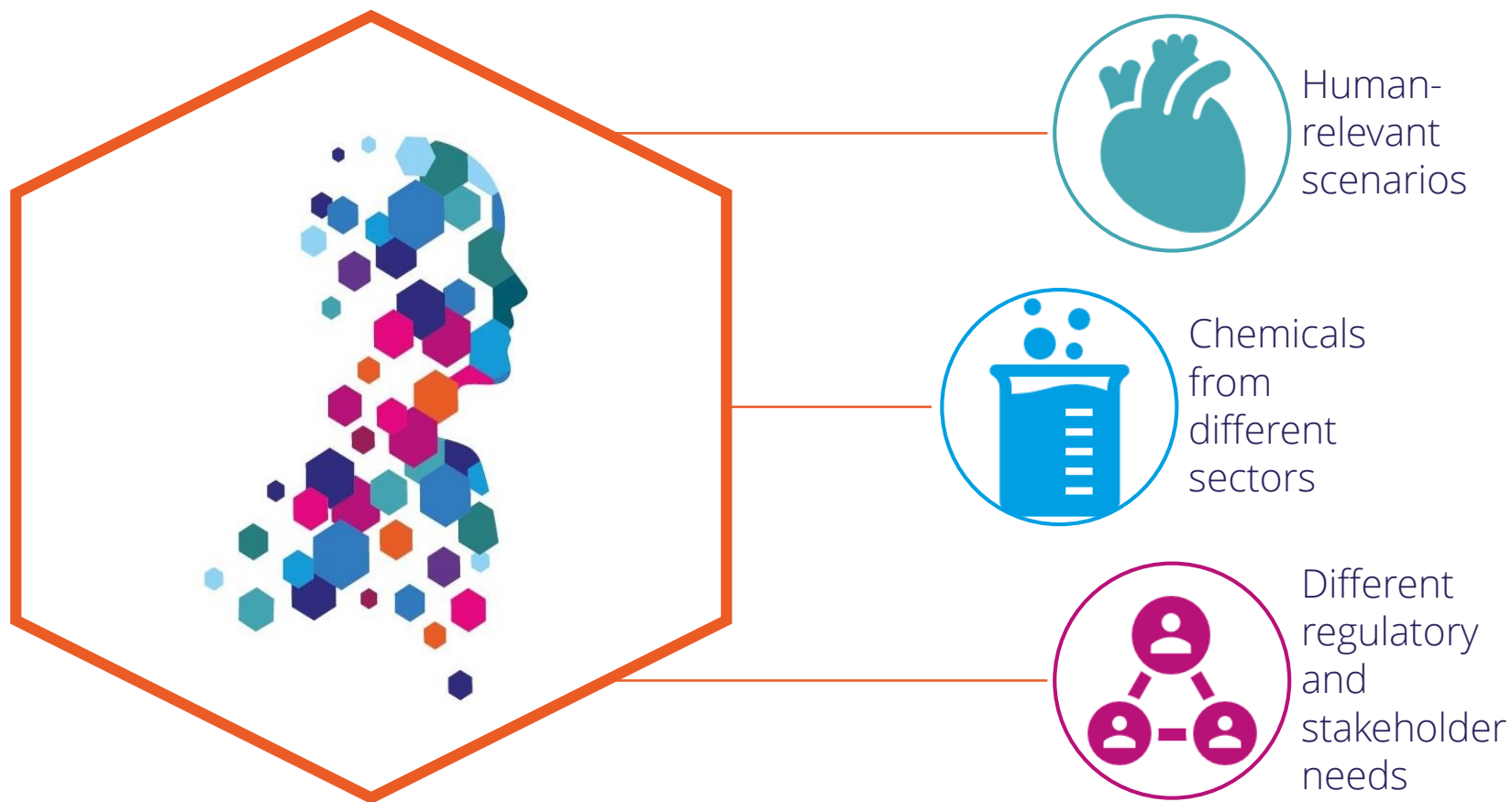


OUR MISSION

- Improving the prediction of the potential harmful effects of chemicals and pharmaceuticals.
- Accelerating transition from animal-based testing to innovative safety assessment.



INTEGRATING DATA INCLUSIVELY





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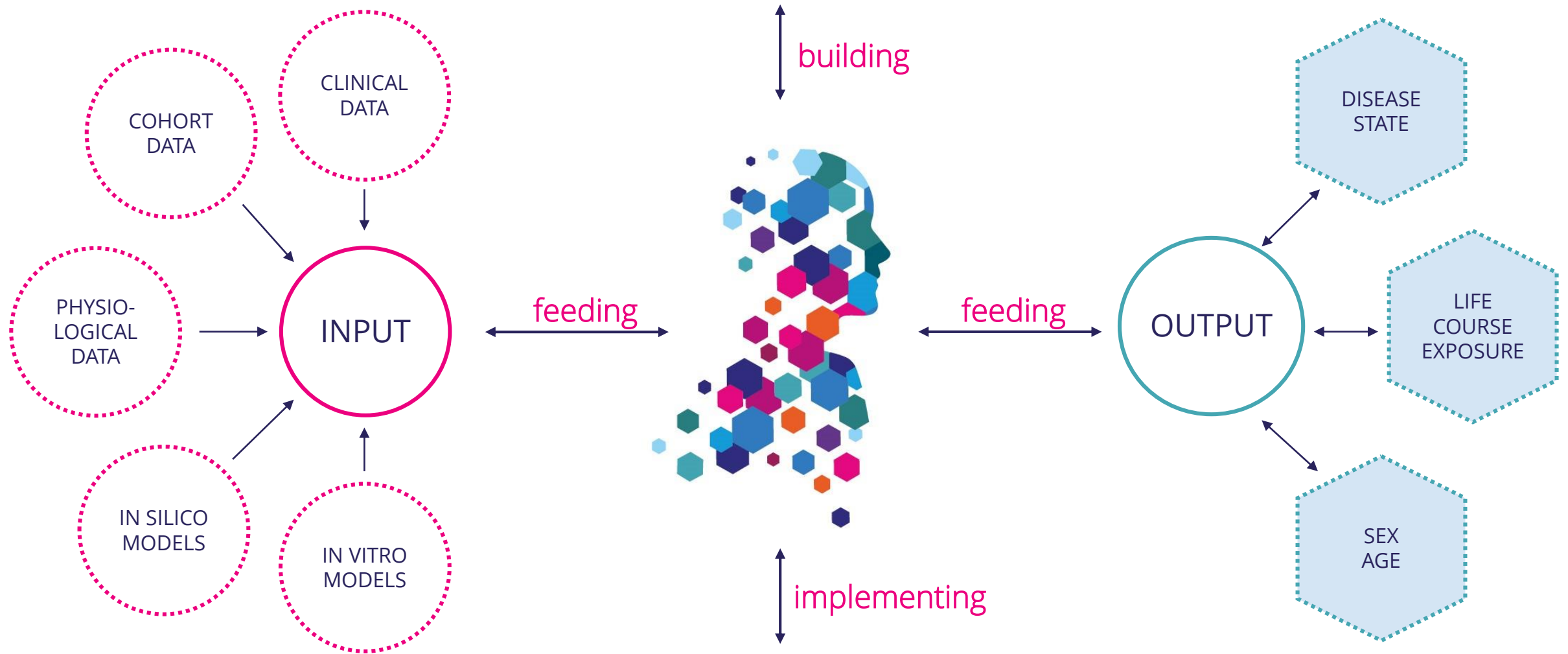
Concept Article

The Virtual Human Platform for Safety Assessment (VHP4Safety) Project: Next Generation Chemical Safety Assessment Based on Human Data

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VIRTUAL HUMAN PLATFORM



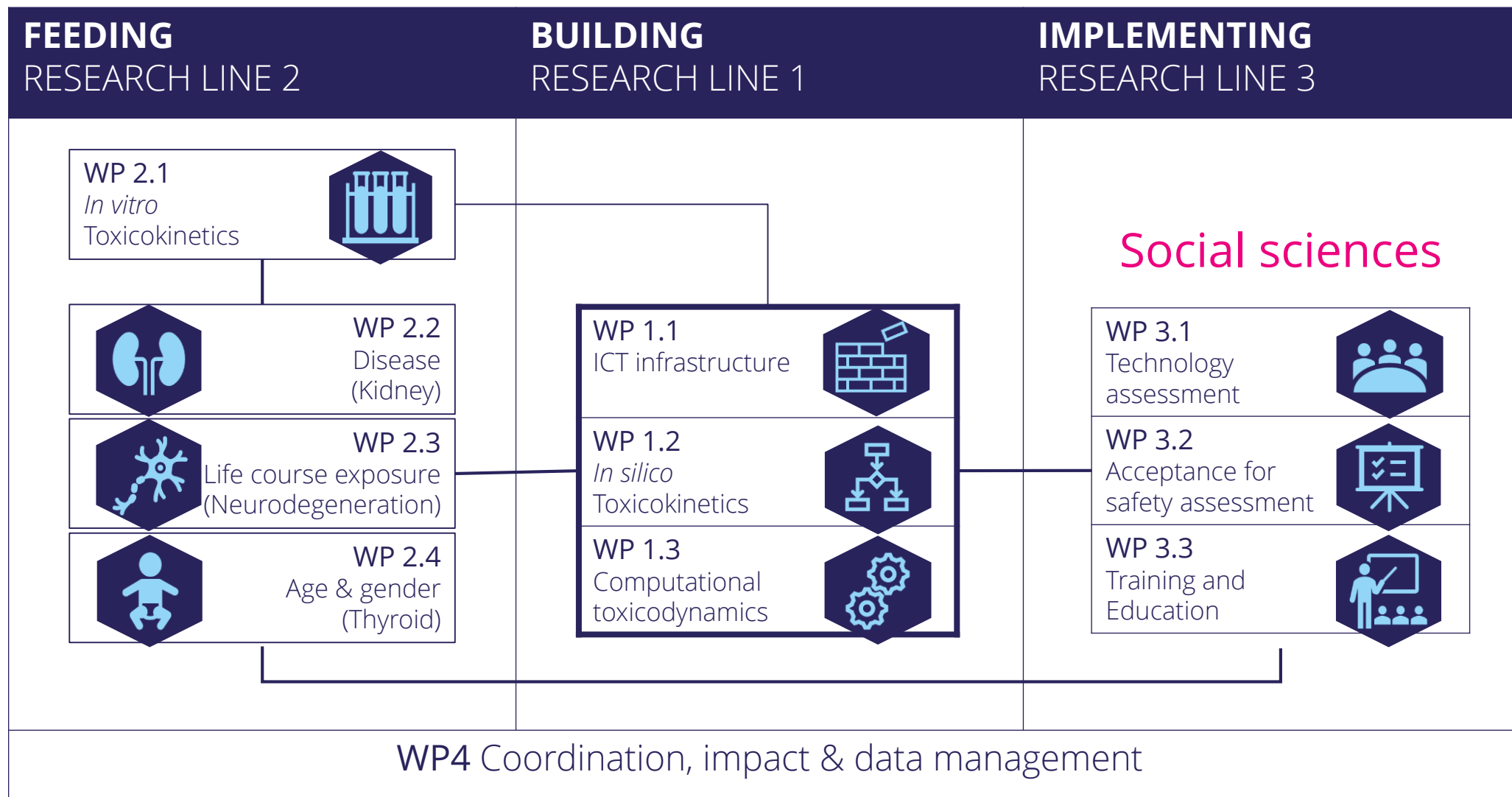
SAFETY assessment BASED
ON HUMAN DATA



PROJECT APPROACH



Regulatory and
stakeholder
needs towards
impact





Case studies

- **Disease state:** kidney function failure (KFF) after transplantation
- **Life course exposure:** pesticides and Parkinson's Disease (PD)
- **Sex and age:** pesticides and thyroid-mediated brain development (TM BD)



In vitro models & integration with data sources, in silico tools, and services

- Patient-derived organoids
- Human stem cell models of neurodegeneration
- Age and sex differentiated *in vitro* models

Output of VHP4Safety Case Studies

- Differences in susceptibility to medicine treatment and kidney function failure in risk assessment
- Life course exposure to pesticides and development of PD in risk assessment
- Age and sex differences in TM-BD upon pesticide exposure in risk assessment





Bioinformaticians are really good at solving problems nobody has (or thinks they have)

I can help you create an ontology, so you can get your (meta)data in RDF and use SPARQL queries in a Jupyter notebook.



I sometimes ruin my data in Excel making sort errors

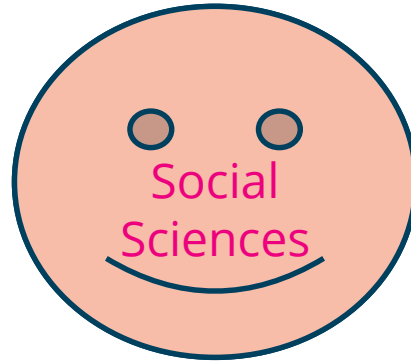




Co-creation also means connecting cultures and expectations

Data Scientists

- + Can build the foundations
- + Try to automate and reuse
- May want to be too perfect
- Do not (fully) understand needs



Applied Scientists/Modellers

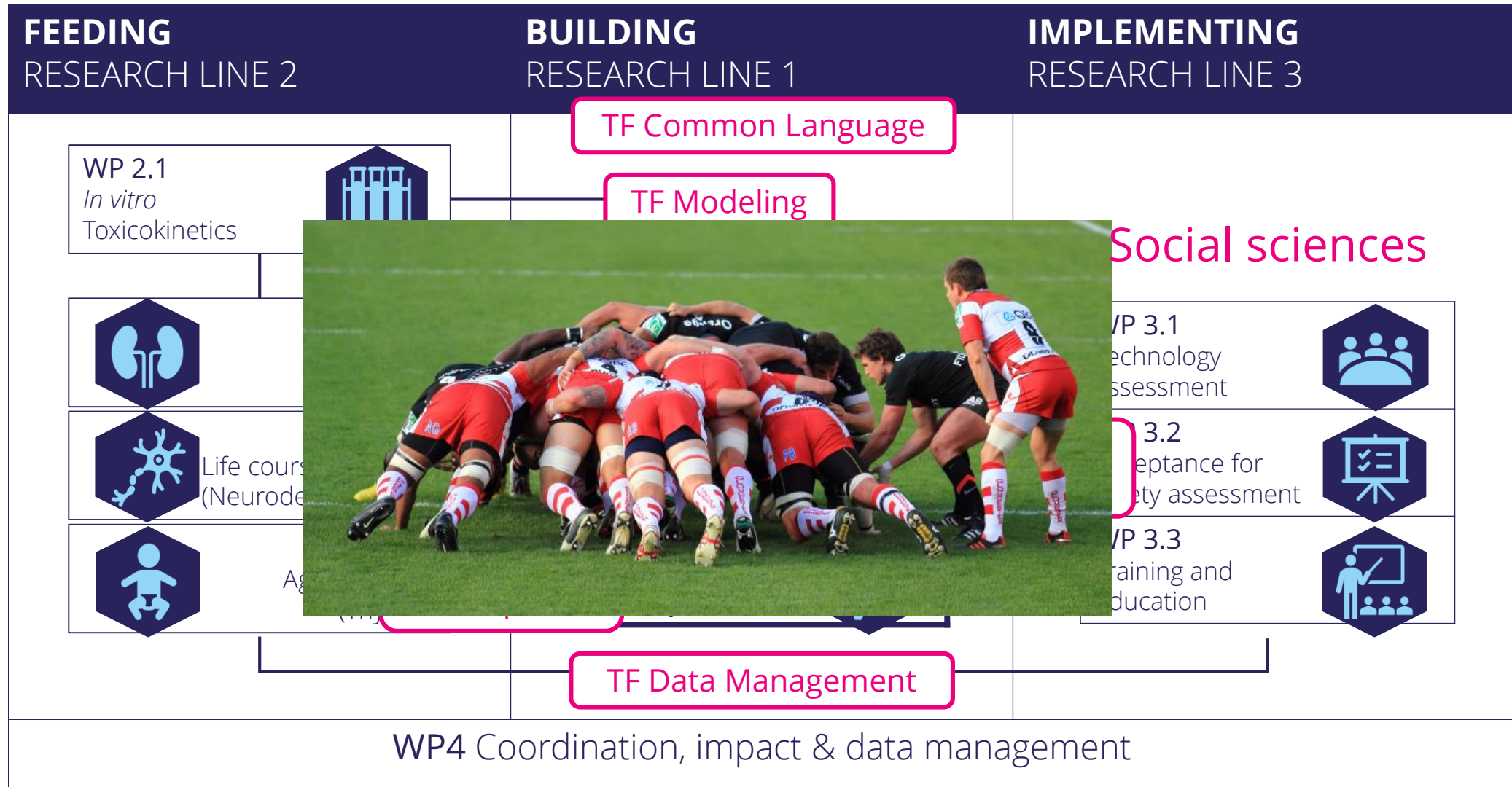
- + Focus on specific aspects
- + Understand the details
- + Understand limitations
- Can ask for "better rails for a plane"

Risk Assessors

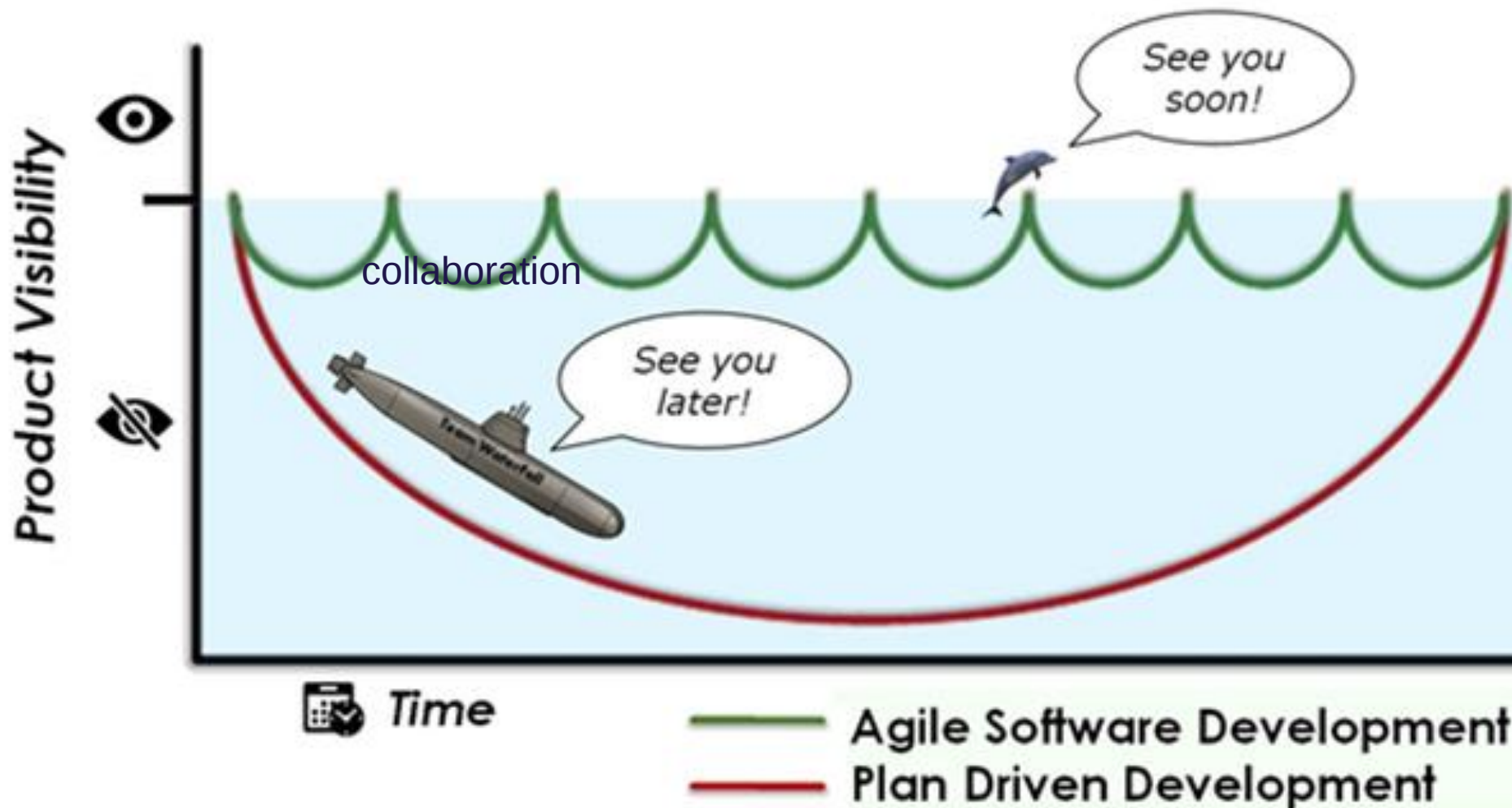
- + See the whole picture
- + Are result driven
- May oversimplify (e.g. linear AOPs)
- Think in examples

How did we solve this?

PROJECT APPROACH



Plan driven vs agile



Scrum sprint review



Get feedback often

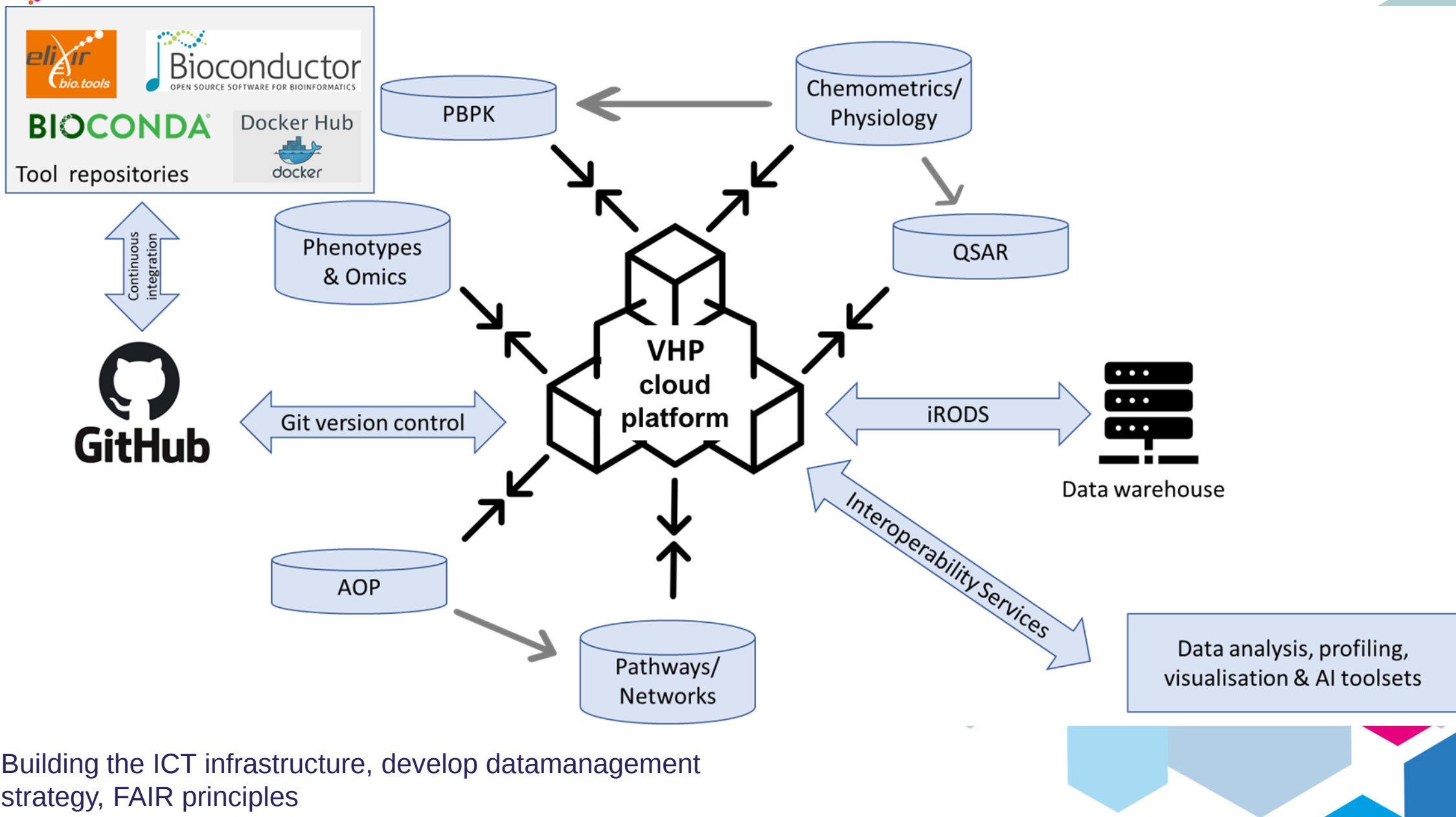
- + Works!
- + Creates urgency
- + Makes us finish
- + Aligns expectations
- We try to show the best part
- Impressed stakeholders try to be nice
- Feedback mechanisms do not align



VHP4SAFETY
virtual human platform for safety assessment

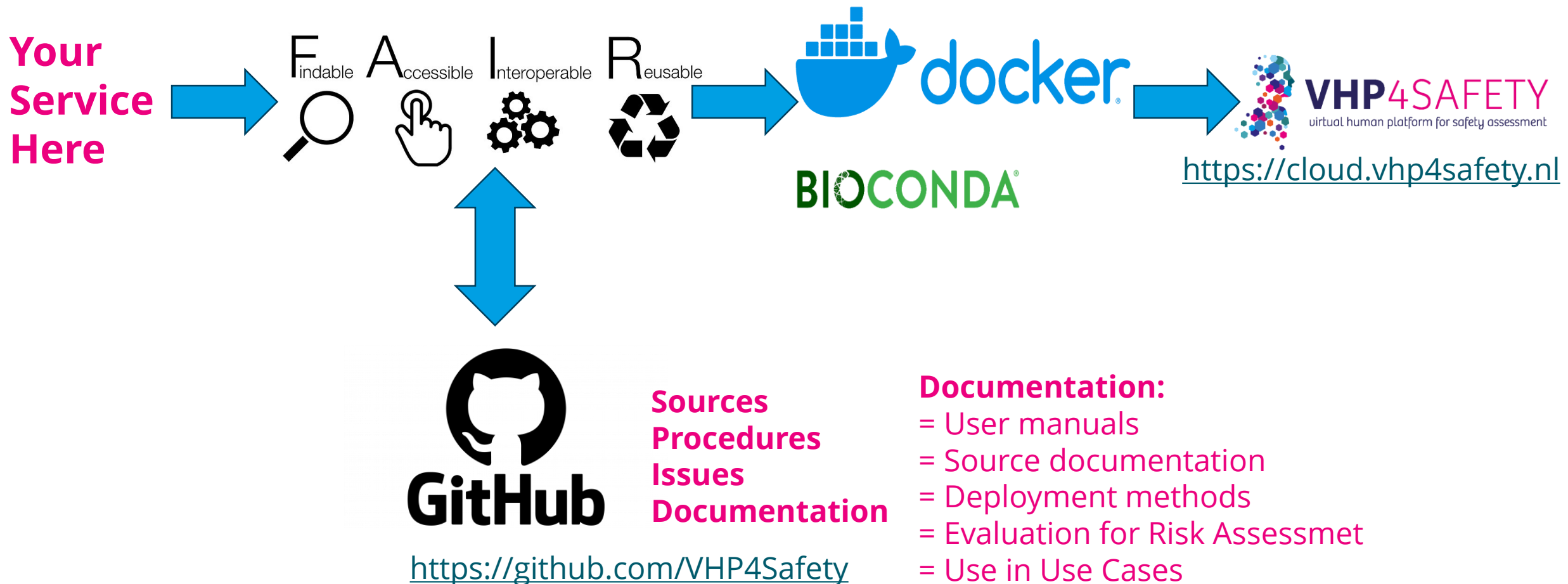
Building it together, hackathons and designathons





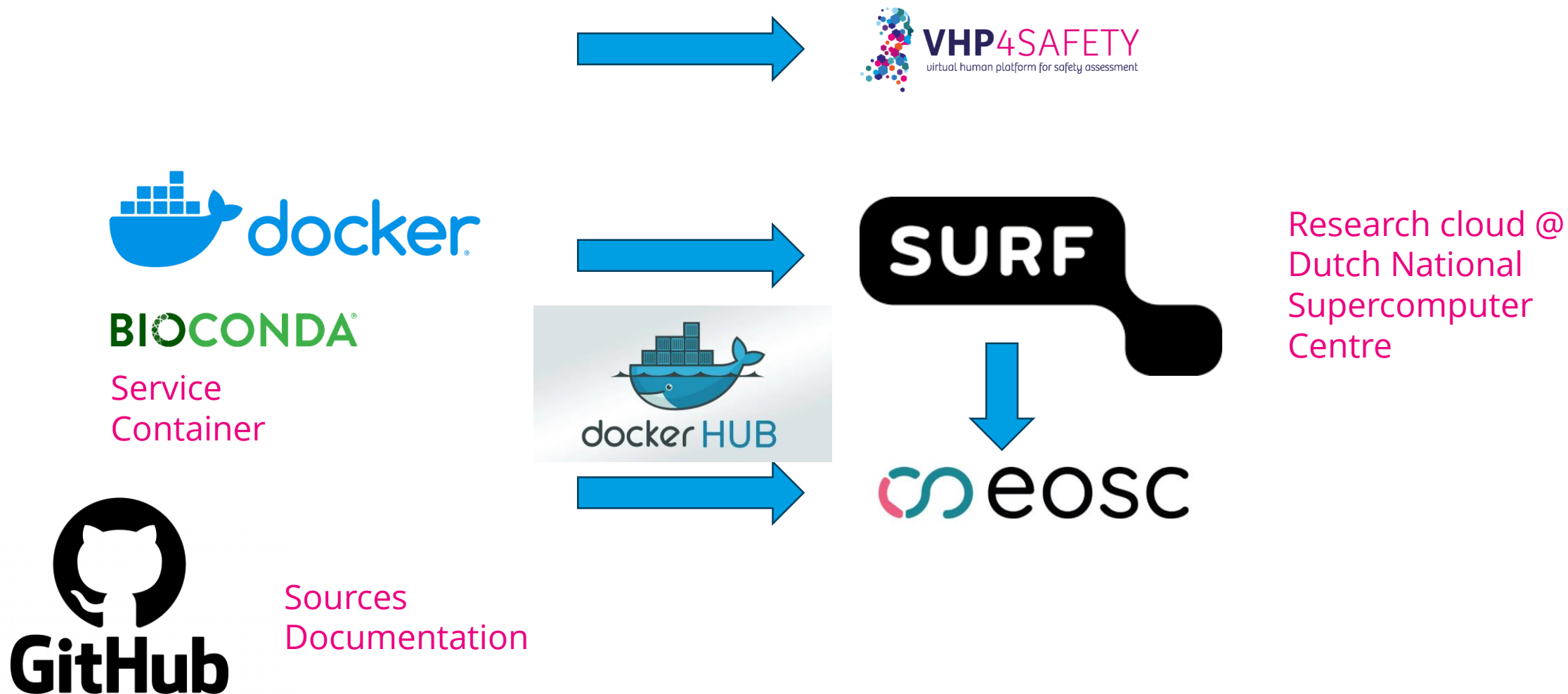
Building the ICT infrastructure, develop datamanagement strategy, FAIR principles

Building in a reusable way

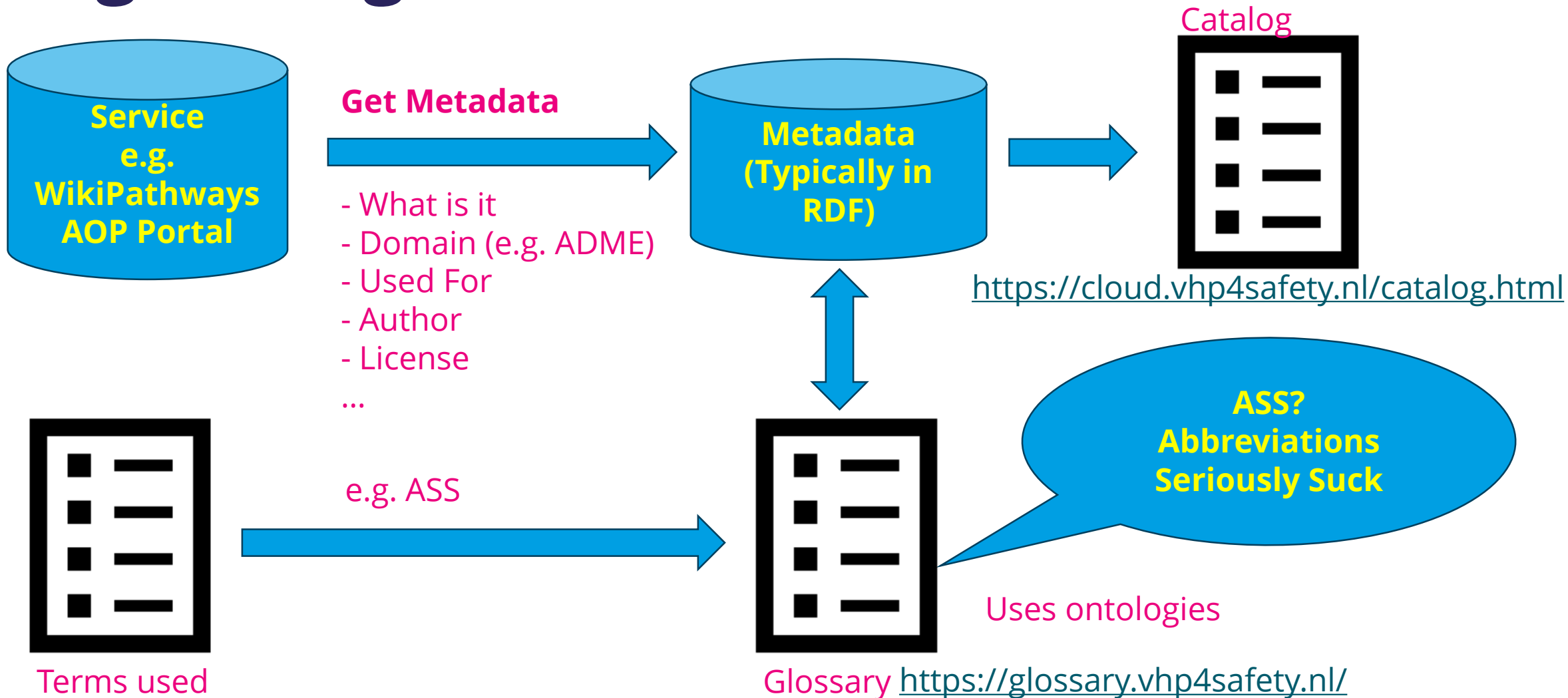


Sustainability through redeployment

Spending time during the project instead of money after the project



Organising the tools



Presenting services in a meaningful way

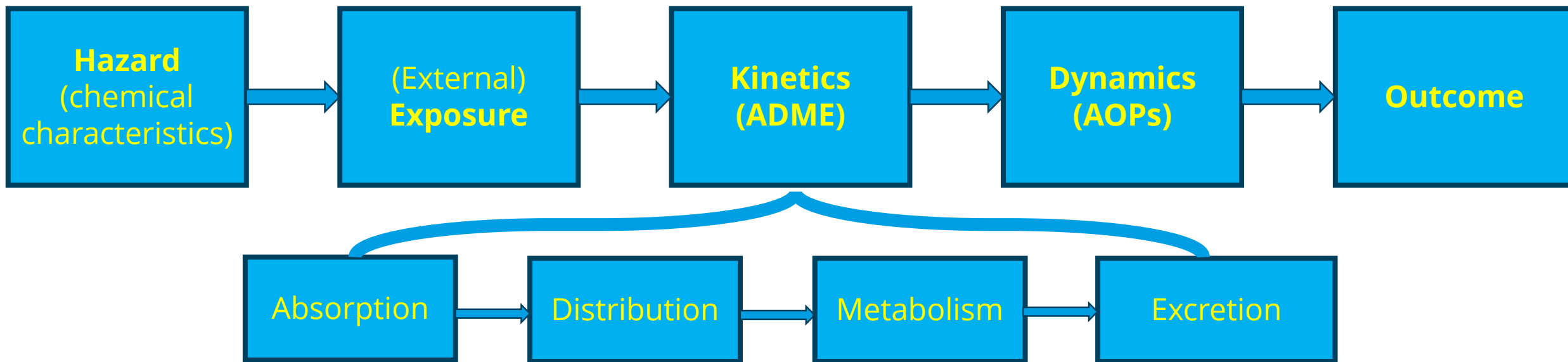
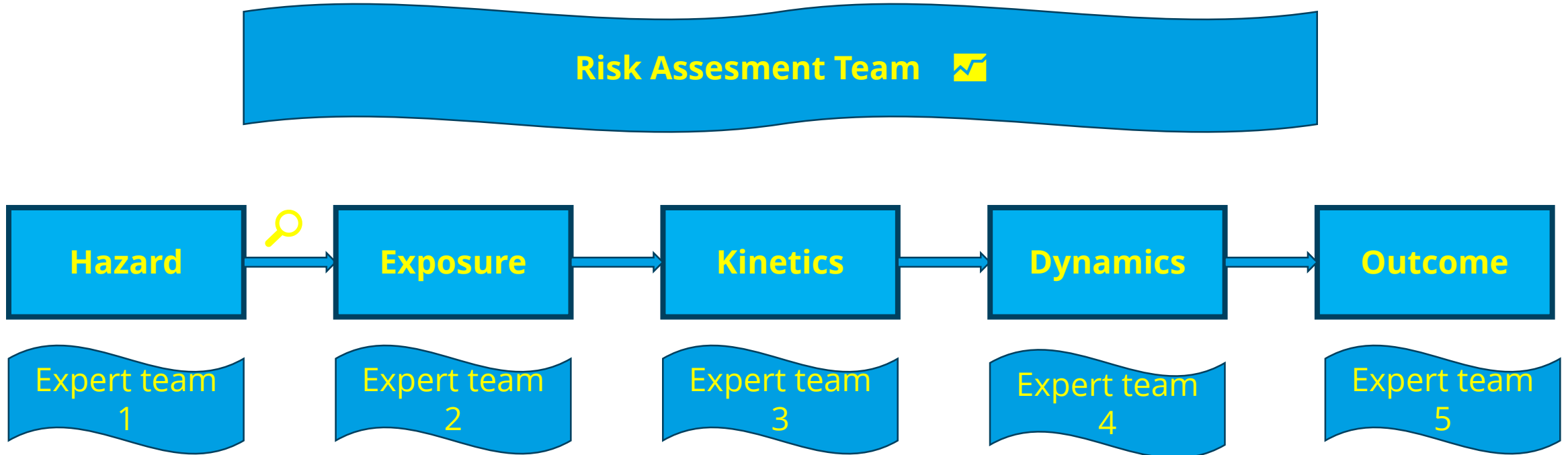


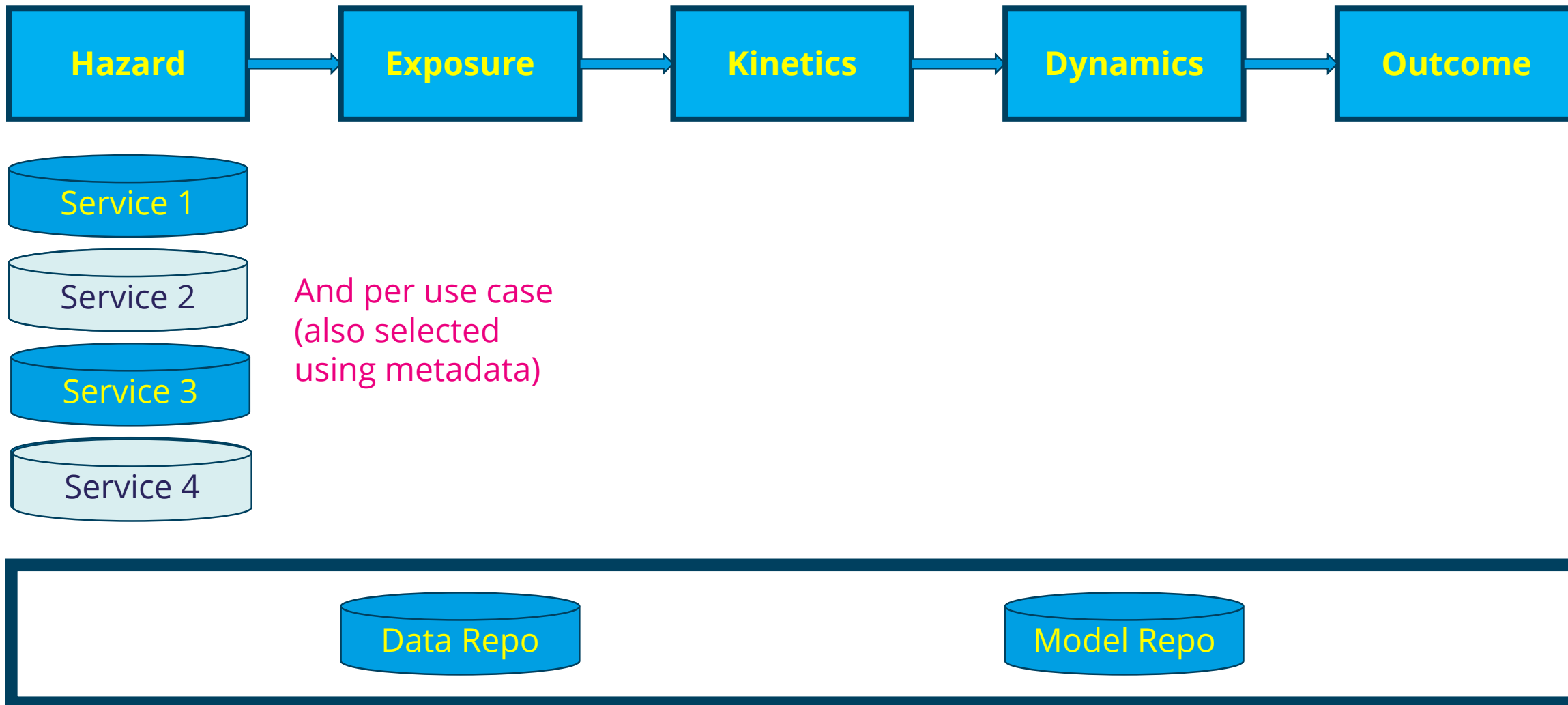
Illustration about the compound based view “how does it behave? How does it interact? what does that cause?” that is recognised by toxicologists and used to organise the services (aka our blue boxes).

Who is doing what?



The work focussed view. It illustrates what typically is a multi-year process. We also link services from case study descriptions

Metadata organise services per domain



Two example tools to look at today

- **ToxTemp Assistant**

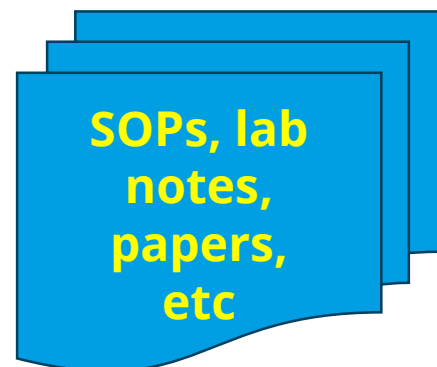
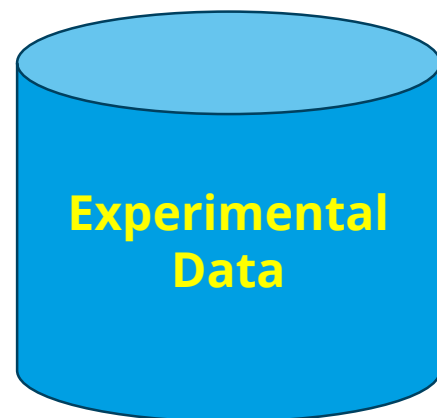
LLM based AI support to help fill a ToxTemp template describing in vitro studies and the data derived from using documents researchers already have.

- **AOP integration tools**

A knowledge based landscape of tools and services to create, organise, use, extend and analyse AOPs, preparing for quantitative predictions.

Examples come from our Parkinsons case study, but they support generic approaches and were used in all three case studies.

Annotating Data using LLM Support



ToxTemp Assistant



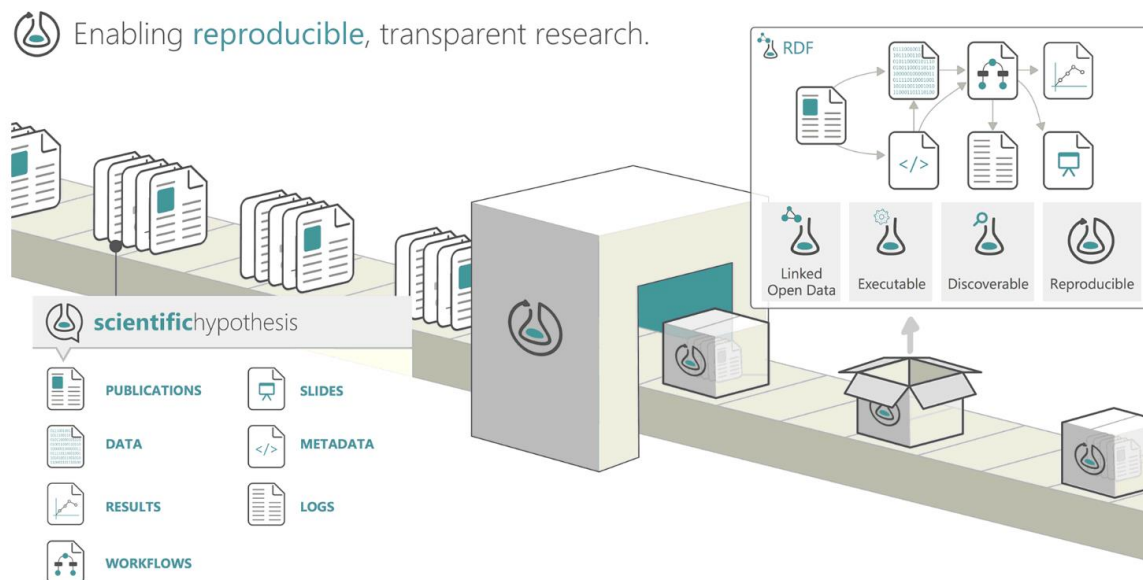
Expert Inspection

Organising and keeping it together

Experimental
Data

Filled
Toxtemp

SOPs, lab
notes,
papers,
etc

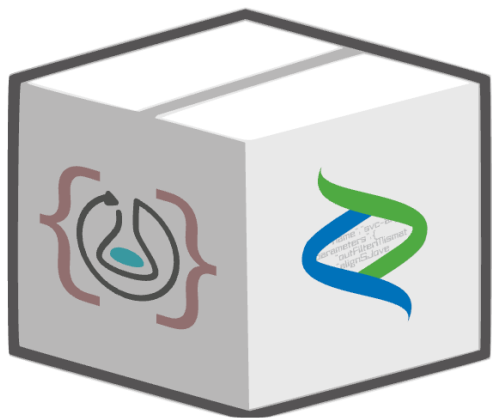


Research Object Crate

RO-Crate has been developed as a schema.org-based JSON **lightweight approach** to the next generation Research Object serialization.

2020-10-30: The specification **RO-Crate 1.1** has been released. Join the **community** to help further develop RO-Crate!

Sharing at Different Levels



Crated Data or Model

FAIRDOM



Project level sharing



Use RO-Crate Metadata
To list data on platform

Global sharing

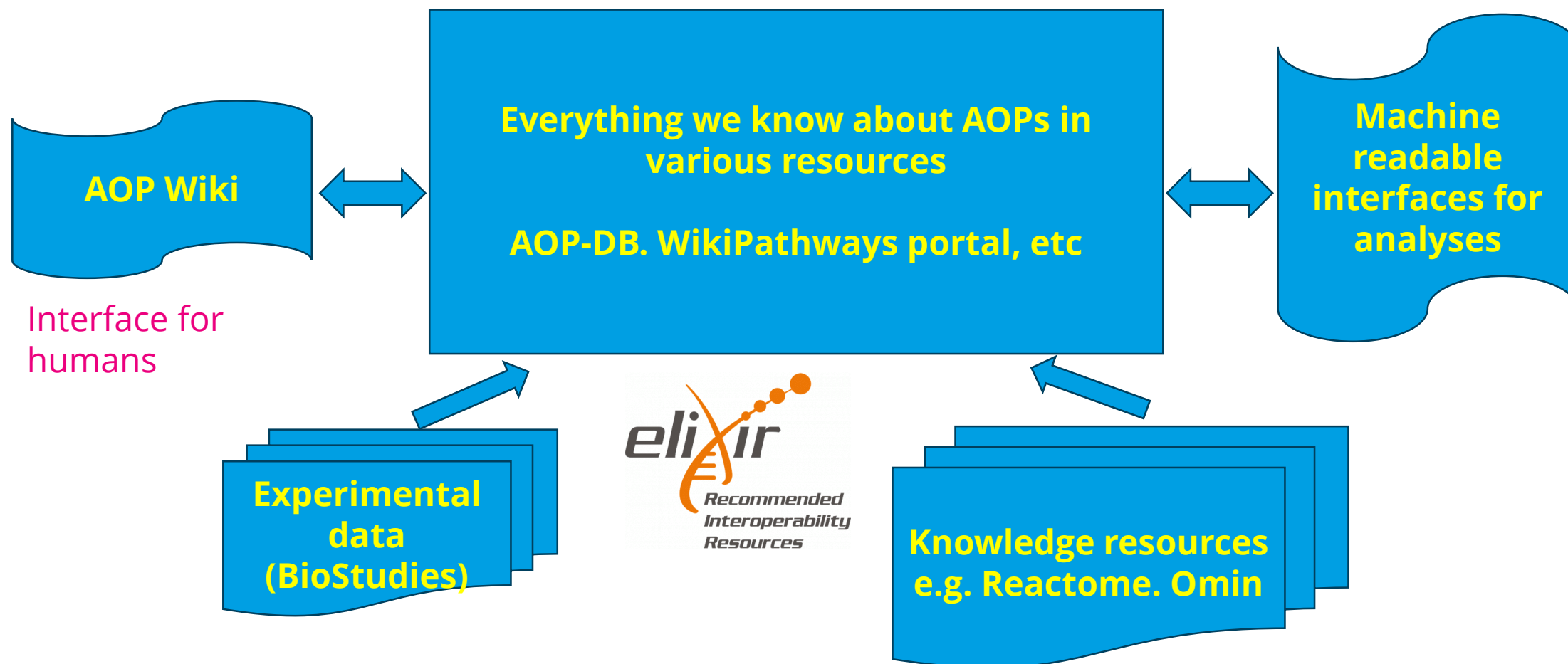


BioModels

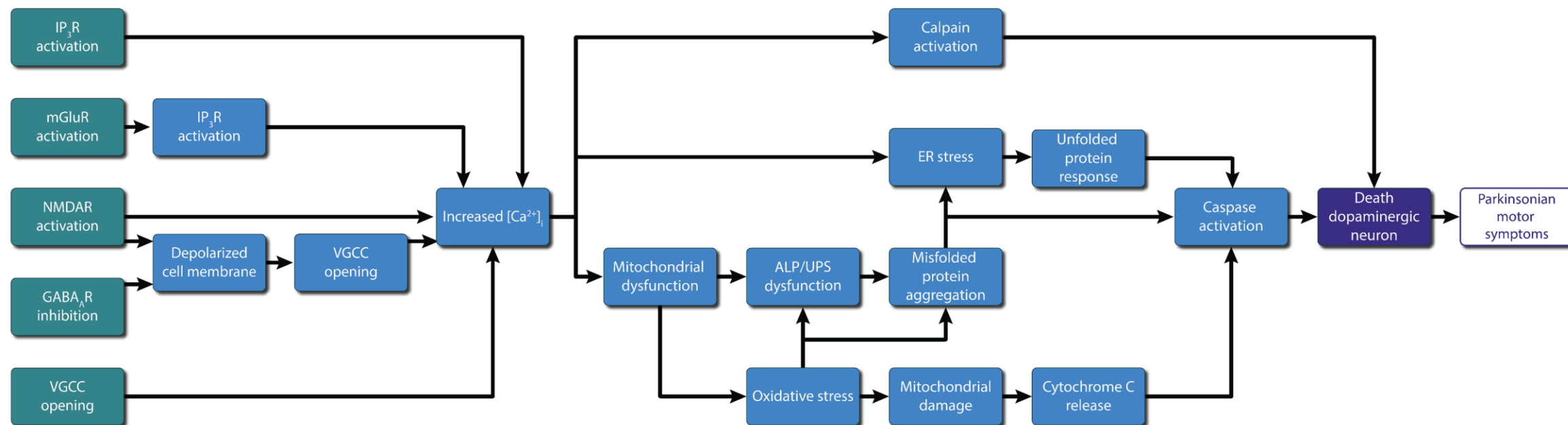


Organising Knowledge, the AOP example

A landscape of knowledge and tools working together



AOPs developed, Parkinsons example



Physiological maps → AOP networks

- Kidney function failure
- Parkinson's disease
- Thyroid-mediated brain development

Check out the platform!

platform.vhp4safety.nl



THE VIRTUAL HUMAN PLATFORM

TOWARDS SAFETY ASSESSMENT BASED ON HUMAN DATA

Tools

Select any of the VHP tools to streamline your risk assessment process and get results relevant to your research.

41 tools available

Case Studies

Have a look at our case studies to see how multiple VHP tools can be combined to best answer your research question.

3 case studies

Data

Find all the (meta)data you need to use the VHP tools and run workflows as efficiently as possible.

0 datasets



Thank you!

Contact us:



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Reusing models with AI support

Modellers cannot reuse or even communicate and understand each others models:

An AI based solution workflow

- Document code
- Consistent namespaces
- Modular design
- Convert into SBML (Systems Biology Modelling Language)
- Share model, input, results, papers etc in RO_Crates
- Execute using COPASI
- Convert (back) to other languages
- Convert math content in LaTeX and describe