A MULTI-OMICS WORKFLOW

4

employing

ADVANCED IN VITRO SYSTEMS

2

My table of contents is hidden in this long title

enabled with

MICROFLUIDICS

3

for

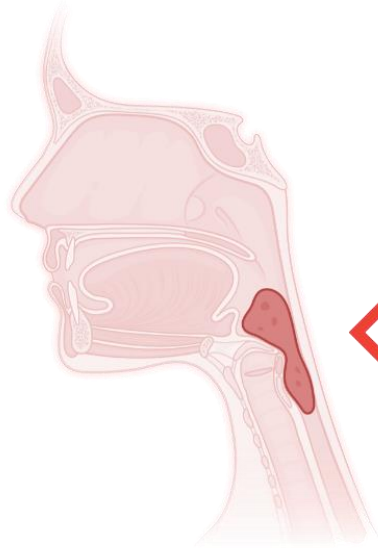# FOOD AND FEED SAFETY ASSESSMENT

1

11th October 2024

Contaminants in the food chain, *Food safety research conference in Luxembourg*

TLI

TWO APPROACHES. ONE SAFETY GOAL

Food chain residues and contaminants

Traditional approach to toxicity testing

Animal studies

Epidemiological data

In vitro studies with human cell cultures

New approach methodologies (NAMs)

?

TⓈLI

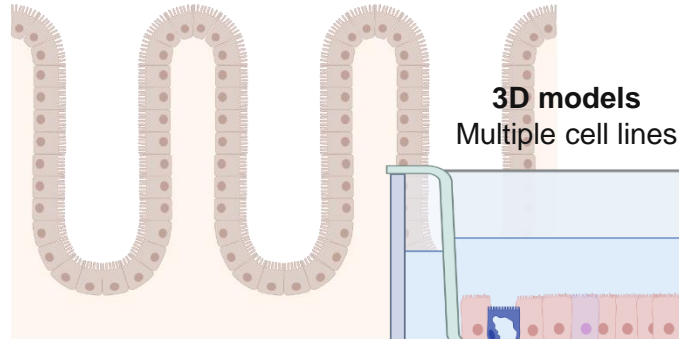# INCREASING COMPLEXITY. CLOSER TO REAL-LIFE SITUATION
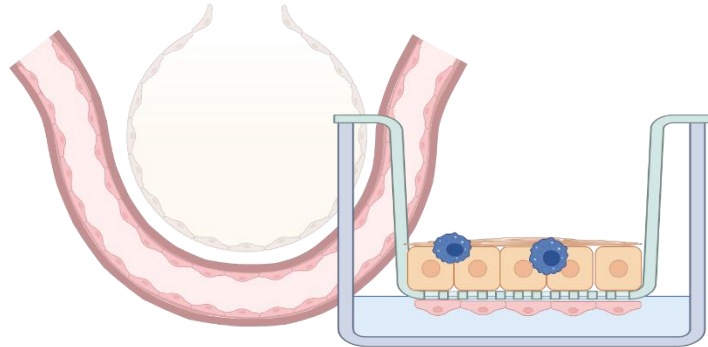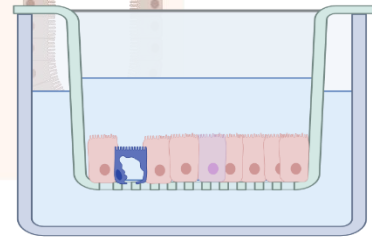

2D mono-culture
Epithelial cell line
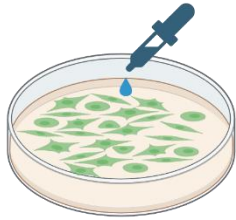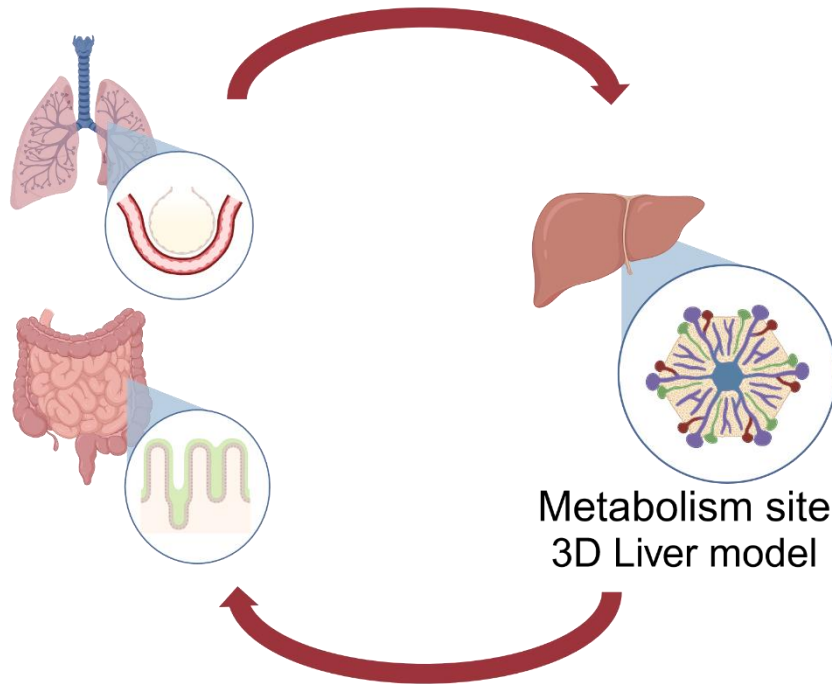
Live cell

Dead cell

3D models
Multiple cell lines

Even more complex…

INCREASING COMPLEXITY. CLOSER TO REAL-LIFE SITUATION

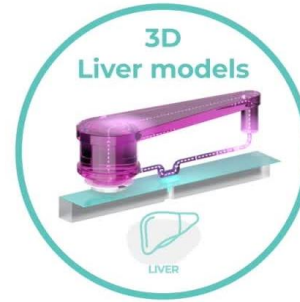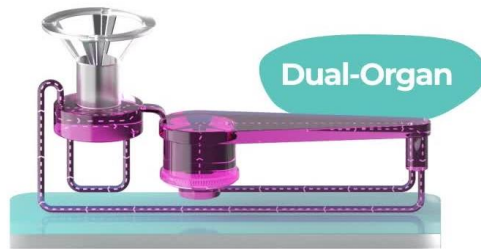# MICROPHYSIOLOGICAL SYSTEM
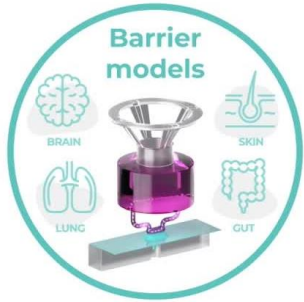
WORK IN PROGRESS

Lab life is made up of small details

Downscaling

Adapting the models while preserve functions
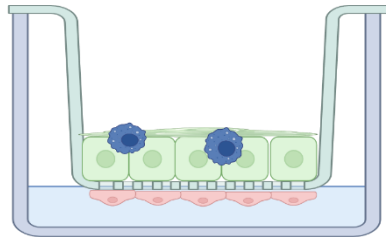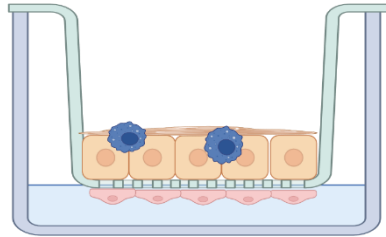
Cell culture media optimization

?

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST
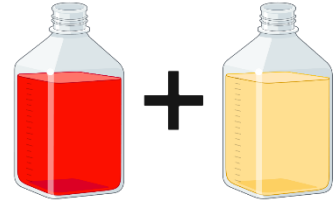
THE PIPELINE OF THE TULI PROJECT (OC/EFSA/IDATA/2023/02)

PHASE I

LUNG LIVER

GUT LIVER

Exposure to one set of data-rich chemicals

Transcriptomics

Metabolomics

Epigenomics

Sample analysis

Training dataset

Feeding data into the bioinformatic pipeline

MECHANISTIC INFORMATION
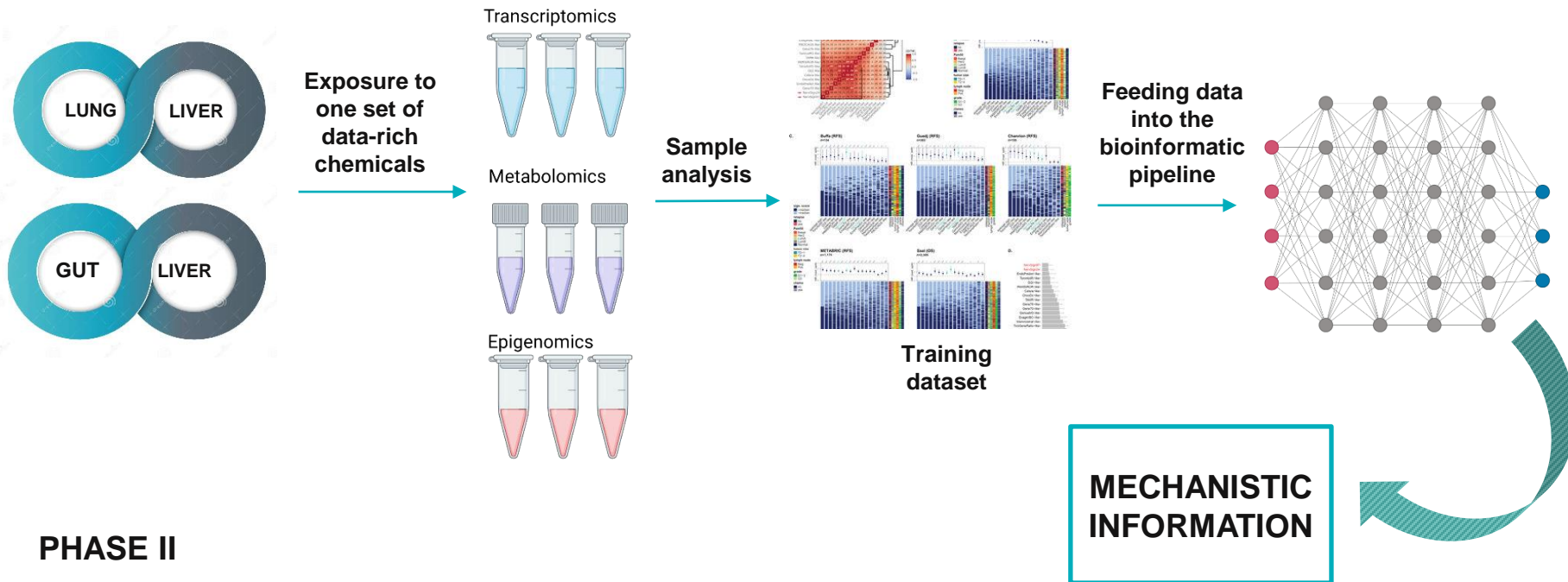
PHASE II

Exposure to a set of data-poor chemicals
Prove the usefulness and predictive power of the pipeline

MULTI-OMICS: A MULTIDIMENSIONAL DEEP DIVE INTO CELLULAR RESPONSES

Assessing early upstream biological events can lead to quicker decision-making

Transcriptomics

Information about all RNA transcribed in a cell type

Expression signatures can be linked to a particular exposure of a specific tissue

Metabolomics

Characterises metabolic pathway disruptions

Detection of dysregulated metabolites

Epigenomics

Captures the chronic/long-term perturbations

Chromatin accessibility changes- alterations in the gene expression regulation

Data interpretation based on the AOPs framework

Stressor → Molecular initiating event (DNA binding, Covalent protein modifications) → Key event: Gene activation → Key event: Protein synthesis changes → Key event: Tissue damage → Adverse outcome (Chronic effects, Sub-chronic effects, Sub-lethal effects, Lethal effects)

TLI
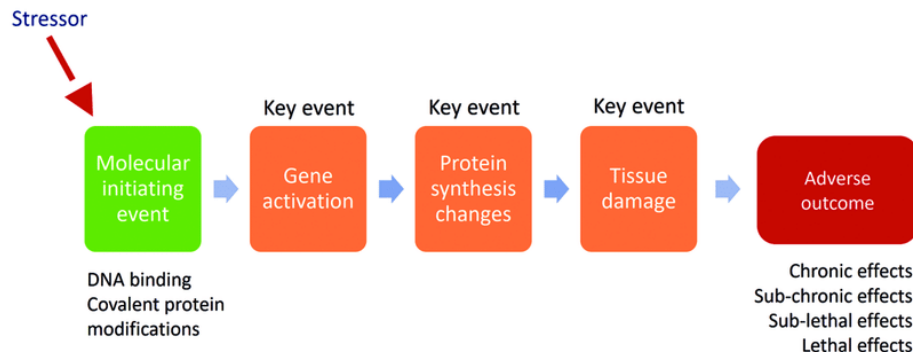
MULTIPLE DOSES AND TIME POINTS FOR QUANTITATIVE EFFECTS

Substance	Category
Aflatoxin B1	Mycotoxins
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	Dioxins and furans
Bisphenol A	Bisphenols
Perfluorooctane sulfonate (PFOS)	PFAS
Trimellitic anhydride	Sensitizers
Tebuconazole	Pesticides

Selection criteria

Food and/or feed relevance

Diversity in mode of action

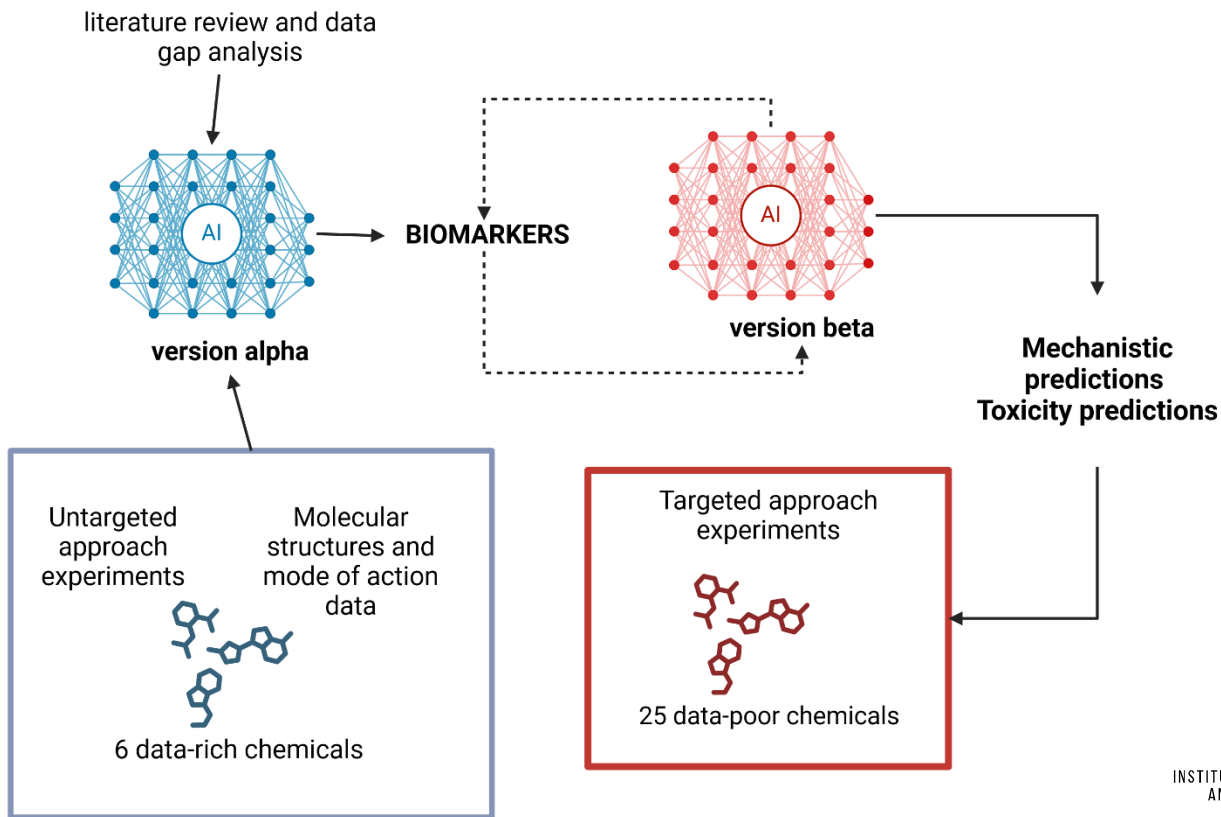Availability and data richness

Relevance for the endpoints of the project

Handling considerations

3 doses

2 time points (24h and 72h)

PREDICTING EFFECTS WITH AI

The overarching goal of TULI project: building an analytical bioinformatics pipeline

LIST's EH group
- Prof. Arno Gutleb

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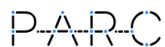WEBER Pamina

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Downstream Bioprocessing

SERGEANT Kjell

Biotechnologies &
Environmental Analytics
Platform

HORIZON 2020
EUROPEAN GREEN
DEAL CALL

HORIZON 2020

efsa
European Food Safety Authority

7 SEVENTH FRAMEWORK PROGRAMME

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AND TECHNOLOGY | LIST

DIAGONAL

Phoenix

TOLI

INSIGHT

CHIASMA

PINK

CompSafeNano

P-A-R-C

SUNRISE

HEU - BioPhenom

POTENTIAL

efsa
European Food Safety Authority
OC/EFSA/NIF/2022/01

efsa
European Food Safety Authority
NAMs4NANO

MACRAMÉ

ZEROF

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Thank you!

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PhD student | 3D Cell Culture Models |
Microphysiological systems | Developing ...