Get to know the ETOX Department

Agenda Today

9 - 10 Overview ETOX – meet the PIs
Coffee/Tea with group leader

10:15 – 11:45 meet the WGs (M. Liess, W. Busch)

11:45 – 12:30 meet the WGs (J. Nyffeler) → Lab

12:30 – 13:30

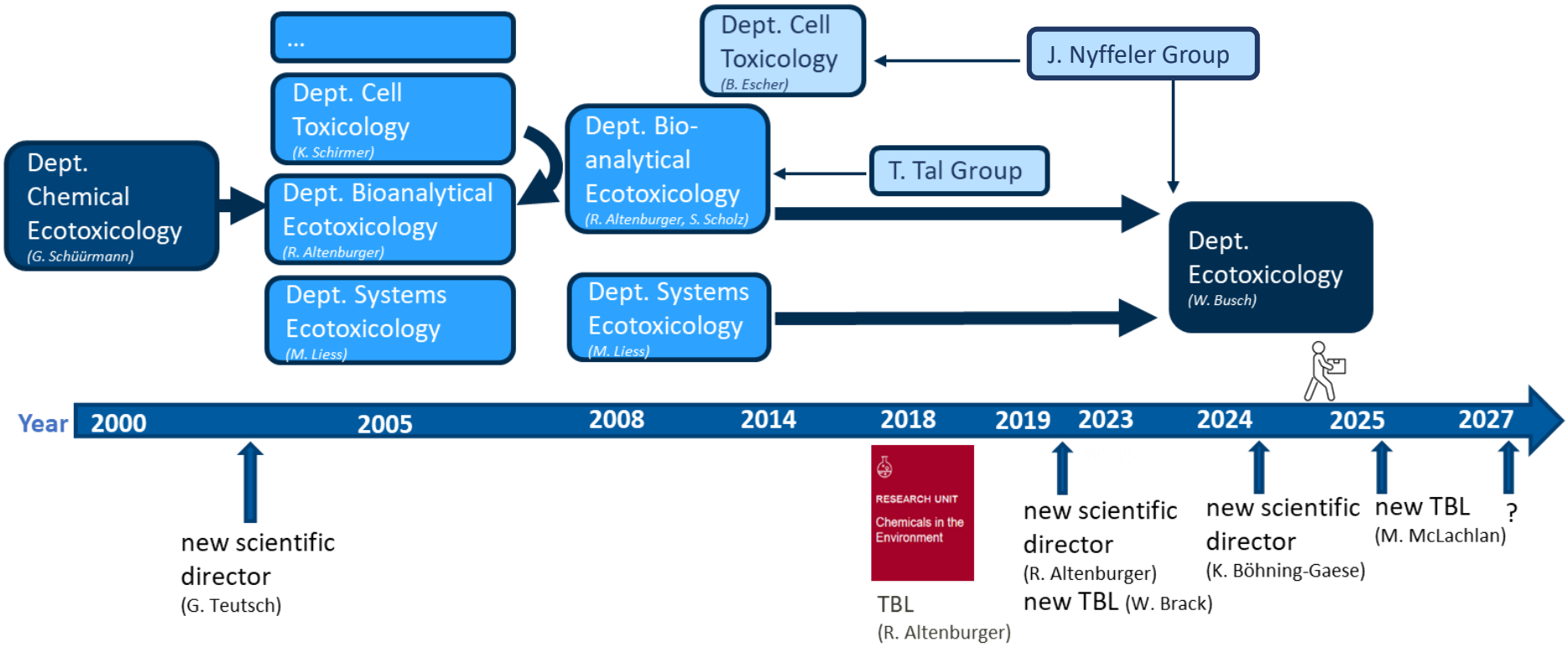
meet the PhDs, technicians & assistants

13:30 – 14:30 relaxed walk and lab tour zebrafish (S. Scholz)

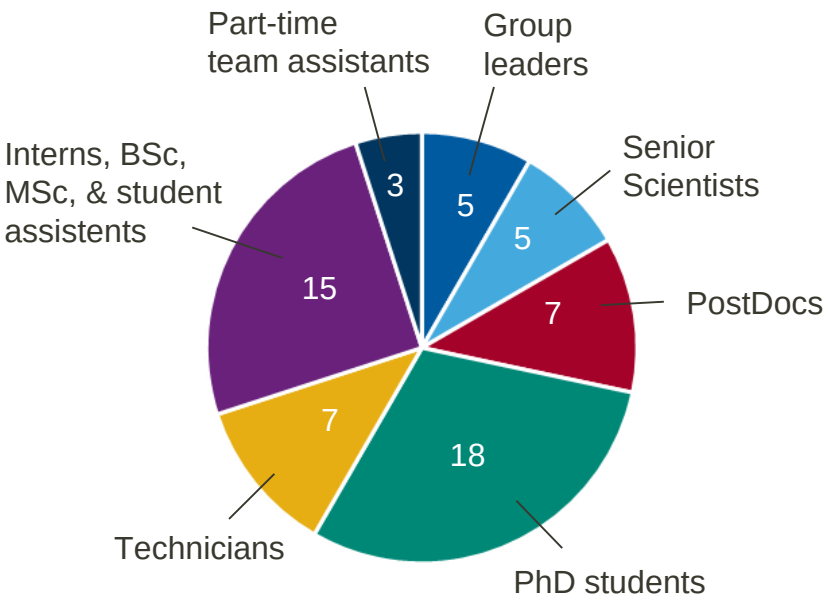
14:30 – 16:00 meet the WGs (M. Schmitt-Jansen, T. Tal)

16:00 meet the PostDocs

ETOX Department
Evolution



ETOX Department
in numbers



- ~ 60 people
- 18 nationalities
- 5 working groups

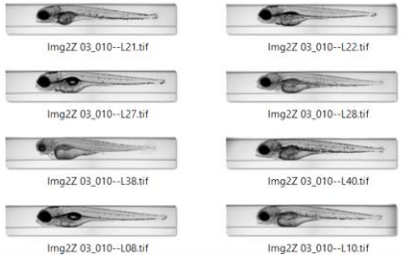
- 7.3 Mio € third-party funding (running projects)

- ~ 52 papers / year

- 18 labs
- 2 large facilities

ETOX infrastructures

a) Zebrafish facility



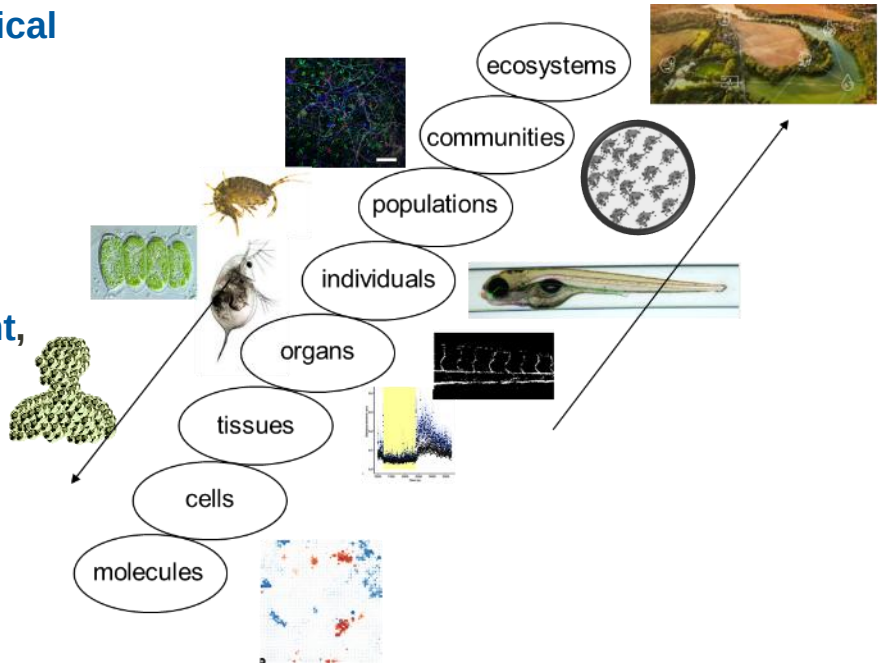
b) Mesocosms

c) CITEPro Instruments

ETOX Department

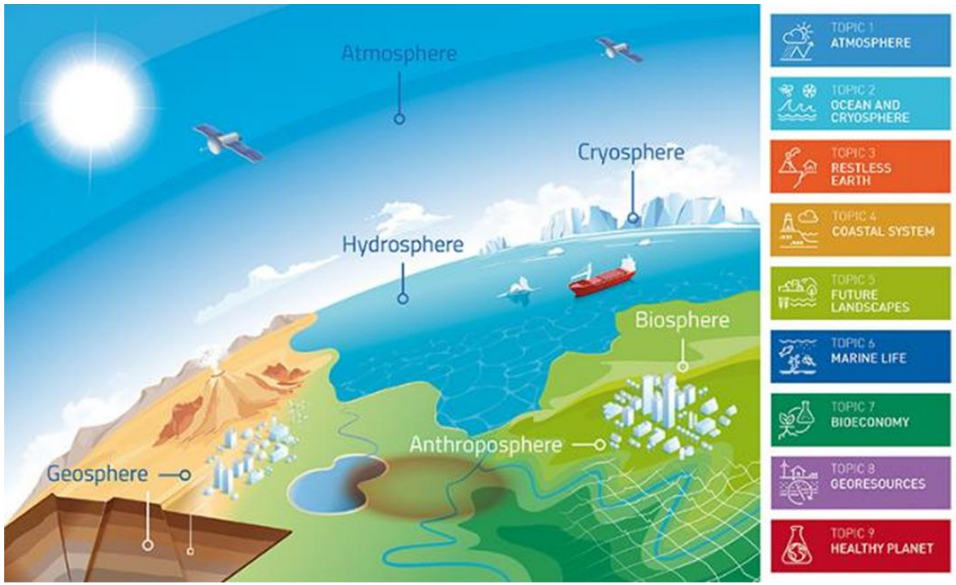
Toxicological effect assessement from the molecular to the ecosystem scale

- *Perform* medium to high-throughput **screening** for **chemical and mixture effects**
- *Capture* multiple, **complex interactions**
- *Enable* consideration of **species interactions**
- ***Bridge* environmental and human toxicity assessment,** (high translational power of the zebrafish model)
- *Develop* **NAMs and assessment strategies**
- *Investigate* **mechanisms of toxicity**
- *Provide* **computational tools** and **FAIR data**



ETOX Department
in POF IV

"Changing Earth - Sustaining our Future“ (1 program, 7 centers, 9 topics)



← ETOX

Collaborations within UFZ:
- within CITE (with all CITE Depts.)
- with Topic 5, mainly RU Water & RDM

https://www.helmholtz.de/fileadmin/user_upload/04_mediathek/epaper-POF_IV_Changing_Earth_Pro/epaper/ausgabe.pdf

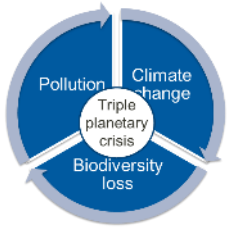
ETOX Department
Joint goals

Challenge: ***Toxicology within a transforming world of data, knowledge and AI***

Goal: Development of NAMs for High-Throughput and High-Content Testing to provide FAIR effect data for chemical assessment

Challenge: ***The triple planetary crisis - climate change, pollution, and biodiversity loss***

Goal: Development of novel assessment strategies for multiple-stressed environments



United Nations
Framework Convention on Climate Change

ETOX Department
in POF V – current status

Topic E: Functioning of the terrestrial Earth System, its ecosystems, and biodiversity (4 FTE)

Topic F: Landscape Management: Multifunctionality for Sustainable Land Use (2 FTE)

Topic H: Urban Transformation Toward Resilient Cities and their Surrounding Areas (1 FTE)

Topic I: Closing the Circle: Bio-based Solutions (0 FTE)

ETOX Engagement

Dissemination and Science communication

- Head of Scientific Advisory Board NAP (M. Liess)
- Human-Biomonitoring Kommision (W. Busch)
- ModHaz, Stakeholder Workshops, Policy Brief (S.Scholz)
- Stakeholder Dialogs
  - Mixtures and Regulation (W. Busch)
  - P-Leach (M. Schmitt-Jansen, D. Kühnel, S. Lips)
  - Round Table for Expert Stakeholders - Transferring Research on Micro and Nanoplastics into Policy and Regulation (D. Kühnel)
- Film talk documentary „Plastics People“ @ Silbersalz Festival, Halle/Saale (D. Kühnel)
- SynCom Project SPHERE Synthesizing Plastics – Helmholtz Expertise on Plastics Research and Policy Engagement (D. Kühnel)

NAP Nationaler Aktionsplan Pflanzenschutz

SynCom HELMHOLTZ Policy Brief

Mehr Stoffe schneller testen
Potenziale für eine bessere Chemikalienregulierung

PARC und Stakeholder im Dialog – Die Mischung macht's!
2. Deutscher PARC-Stakeholder-Dialog: Die Risikobewertung von Chemikaliengemischen

Umwelt Bundesamt BfR

CUSP

Policy brief 2

MICRO- AND NANOPLASTICS AND PUBLIC HEALTH: A REASONABLE CONCERN

MANTRA
https://materialneutral.info/

ETOX Engagement in PARC

Stefan Scholz (PI WP5.2b, WP5.2.1e):
- Zebrafish, Bisphenols, and DNT

Tamara Tal (Project Lead, WP 5.2.1e):
- NAMs for human DNT and ANT

Wibke Busch (Project Lead WP 6.4.1)
- Chemical mixture risk assessment

Matthias Liess (Project Lead WP6.4.4)
- Streamlining pesticide risk assessment

For the benefit of human health and the environment

Partnership for the Assessment of Risk from Chemicals (PARC) is a public-public partnership working for the benefit of human health and the environment by developing better chemical risk assessment and supporting the implementation of research and innovation for societal benefit.

The knowledge gained on the potential toxicity of chemicals has increased considerably over the last century, and the policies and legislation implemented in the EU are considered effective. Still, there are some gaps that should be addressed:

- How can we know the extent of the EU population's exposure to currently used, new chemicals and legacy chemicals?
- How can we assess the safety of emerging chemicals?
- How can we assess the risk of exposure to combinations of chemical mixtures?

PARC was established in 2022 to help policy-makers and authorities find the best answers for such questions. The knowledge and methods provided by PARC will support regulators in making informed decisions on how to protect human health and nature.

The PARC community

More than 200 partners from 29 countries join efforts in PARC. The partners are universities, public health organisations, research institutions, national health authorities, health care institutes and three EU agencies.

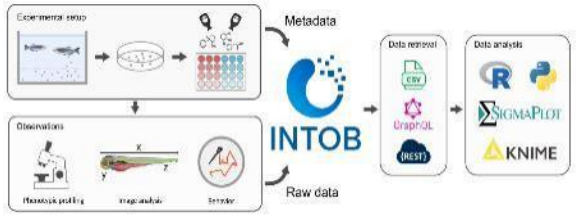
The total budget of the seven-year partnership is 400 million euros. Half is funded by the European Union under the Horizon Europe framework programme supporting scientific research initiatives. The other half is funded by the participating countries.

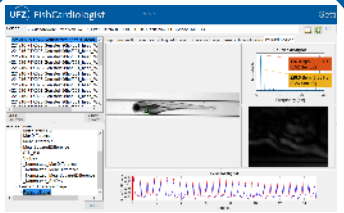
For a full overview of the PARC community visit eu-parc.eu.

ETOX Engagement - Digitalization

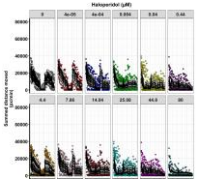
Software & Workflow Development

Findable
Accessible
Interoperable
Reusable

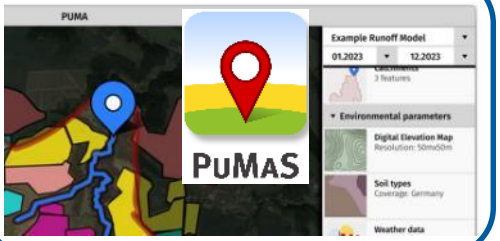


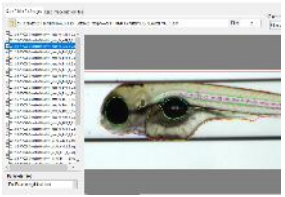


FishCardiologist



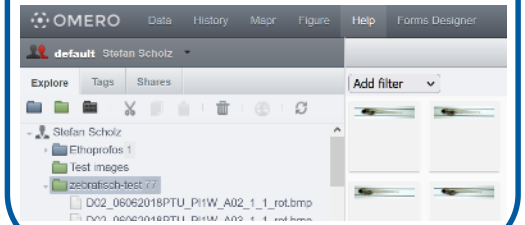
Neurobeat





FishInspector

Image storage and metadata



DRomics

Dose-response modelling

Galaxy PROJECT

Indicate
- SPEAR (Pesticide Indicator)
- SAM (Multiple Stress Effects)

transfun
inspiring ideas | accelerating application

RDM
Research Data Management

InfAI
Institut für Angewandte Informatik

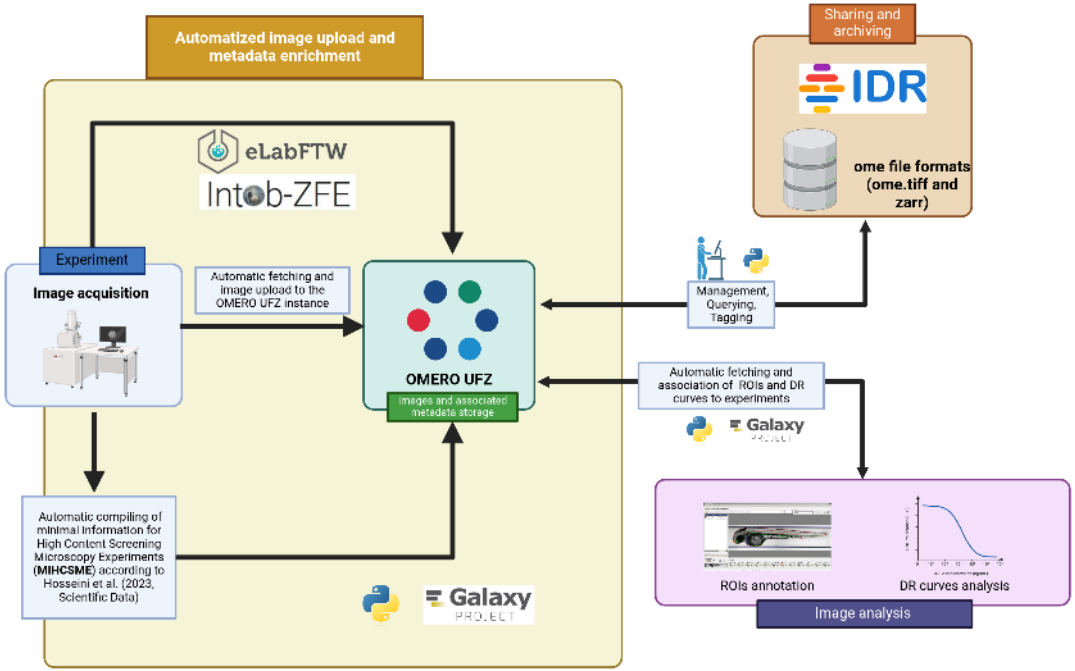
NFDI4 BIOIMAGE

OME
HELMHOLTZ IMAGING

Open for Innovation
KNIME

ETOX Engagement - Digitalization

Software & Workflow Development



Example - HCS bio-image analysis workflow

INTOB, ELN, OMERO and GALAXY for the FAIR management of HCS zebrafish image data

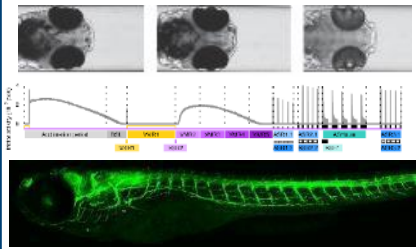
RDM
Research Data Management

NFDI4 BIOIMAGE

HMC HELMHOLTZ Metadata Collaboration

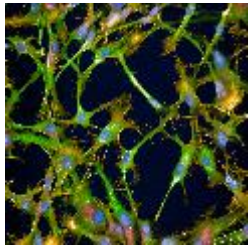
ETOX Department - Working groups

mTox



Build NAMs and analysis strategies

HITEC



High-throughput ecotoxicology

iTox

Data-driven risk assessment & digitalisation in toxicology

mStress

Combined assessment of chemical and non-chemical stressors

sysTox

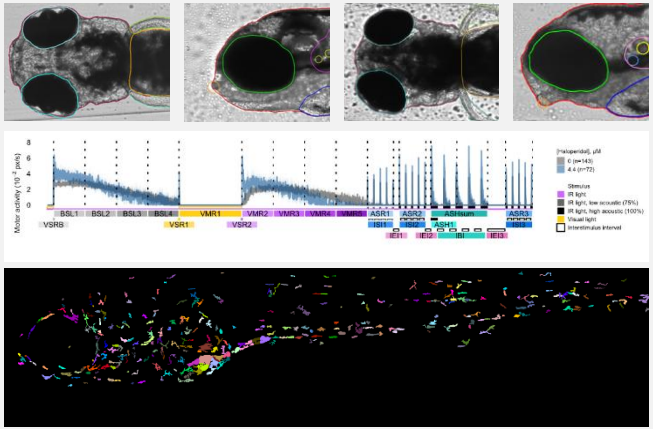
Indicator systems and combined effects

(mTOX) working group

Head:
Tamara Tal

1. Develop New Approach Methods

(DevTox, DNT, ANT, gut inflammation)



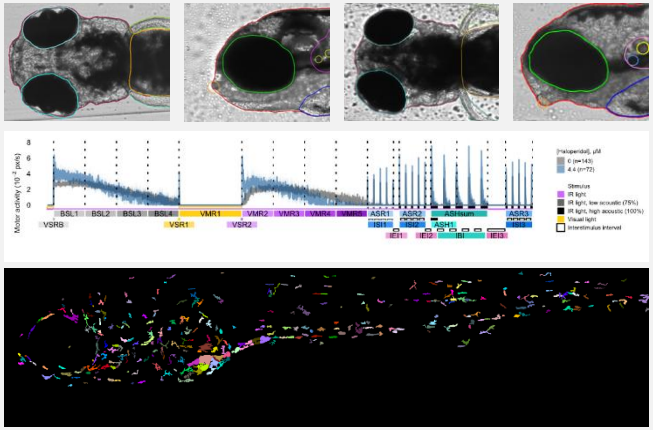
Identify toxic chemicals, mixtures & underlying mechanisms

(mTOX) working group

Head:
Tamara Tal

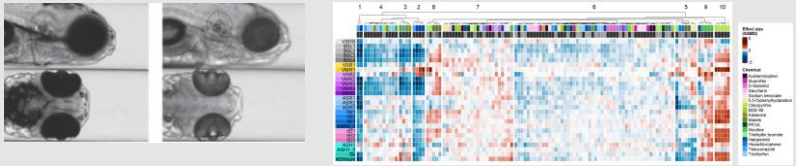
1. Develop New Approach Methods

(DevTox, DNT, ANT, gut inflammation)



Identify toxic chemicals, mixtures & underlying mechanisms

2. Discover mode of action



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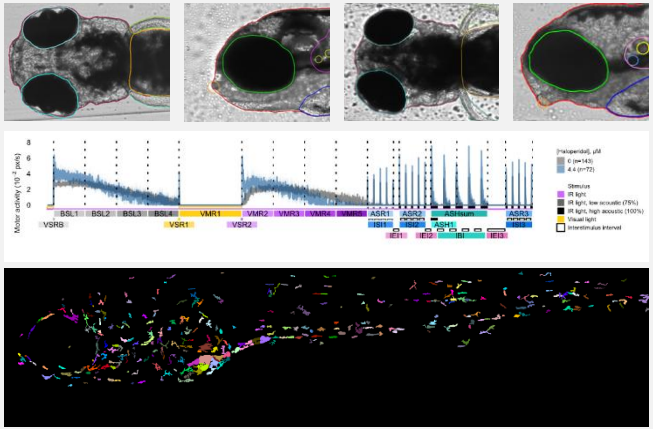
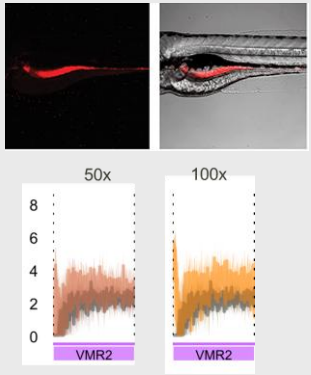


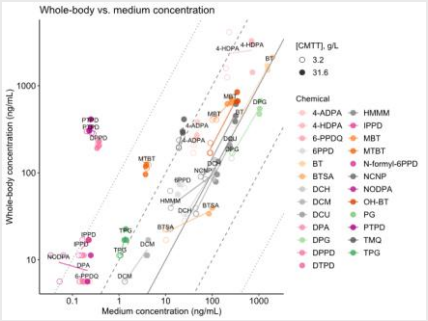
Identify toxic chemicals, mixtures & underlying mechanisms

3. Identify risk drivers and modifying factors

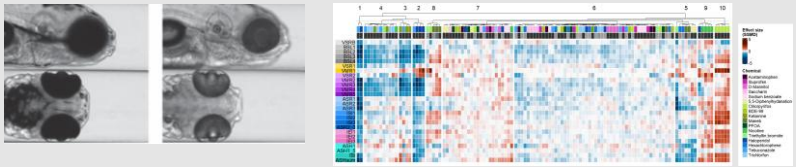
Microbiome



Complex mixtures



2. Discover mode of action

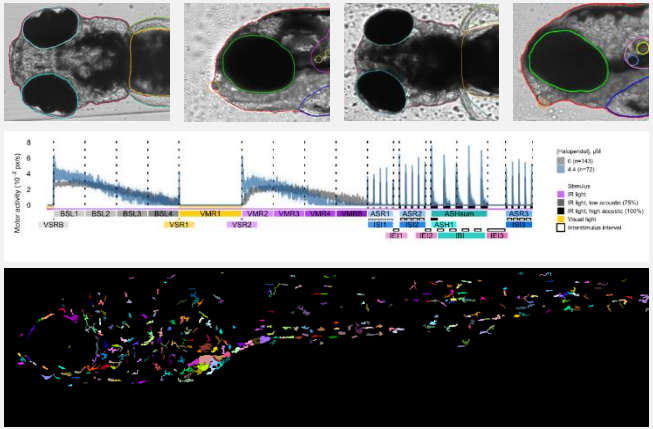


(mTOX) working group

Head:
Tamara Tal

1. Develop New Approach Methods

(DevTox, DNT, ANT, gut inflammation)



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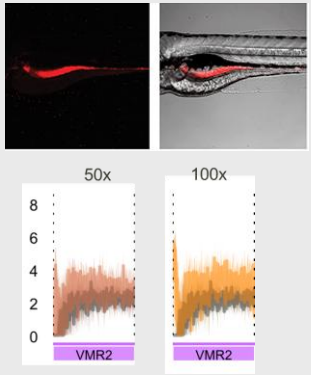
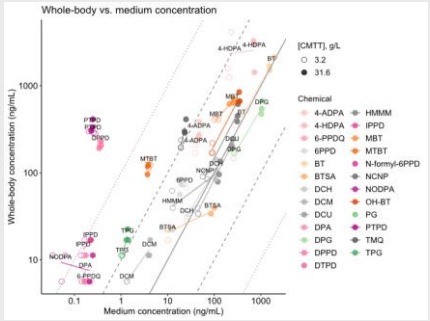
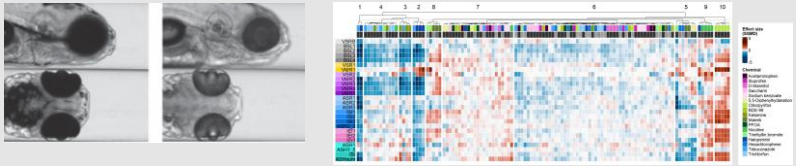


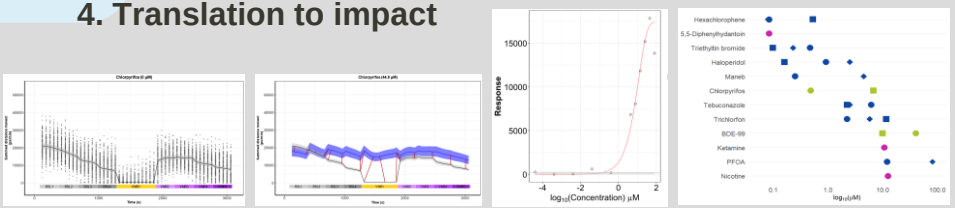
Complex mixtures



2. Discover mode of action



4. Translation to impact



(mTOX) working group

PIs

T. Tal

S. Scholz

PIs

Postdocs

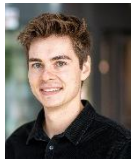
D. Leuthold

P. Opute

N. Herold

Postdocs

PhD students



S. Gutsfeld

C. Wray

R. Owen

E. Nicolay

V. Saalman

B. Chen

E. Chukwu

G. Ajugwo

PhD students

Master's, visiting PhD, technicians

J. Spath

J. Raab

T. Silvestrini

N. Schweiger

T. Jonat

Master's, visiting PhD, technicians

Integrative toxicology (iTOX) working group

Head:
Wibke Busch

Toxicogenomics and data-driven toxicology with zebrafish embryos

Mixture toxicology and environmental risk assessment

Integrative toxicology (iTOX) working group

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Toxicogenomics and data-driven toxicology with zebrafish embryos

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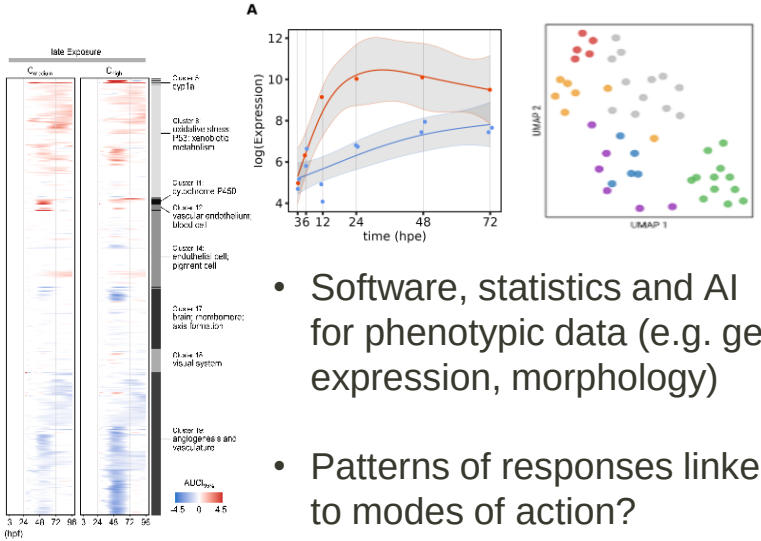
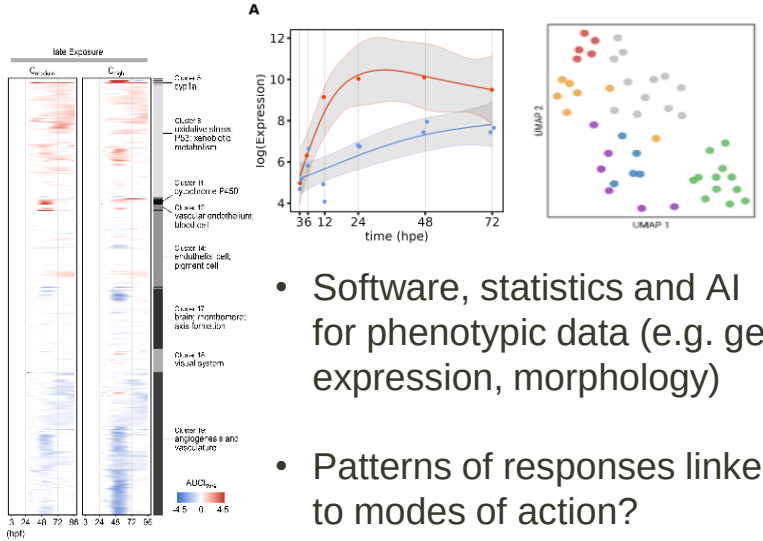


- Software, statistics and AI for phenotypic data (e.g. gene expression, morphology)
- Patterns of responses linked to modes of action?

Integrative toxicology (iTOX) working group

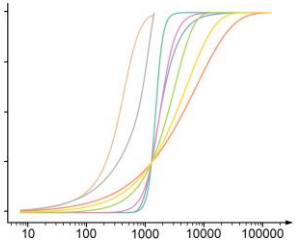
Head:
Wibke Busch

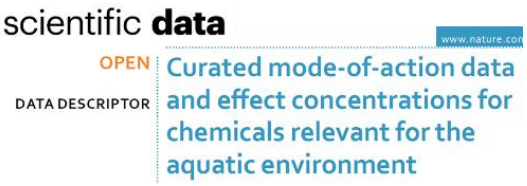
Toxicogenomics and data-driven toxicology with zebrafish embryos



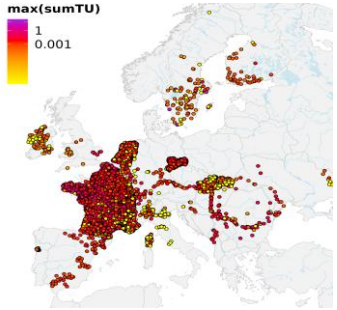
- Software, statistics and AI for phenotypic data (e.g. gene expression, morphology)
- Patterns of responses linked to modes of action?

Mixture toxicology and environmental risk assessment



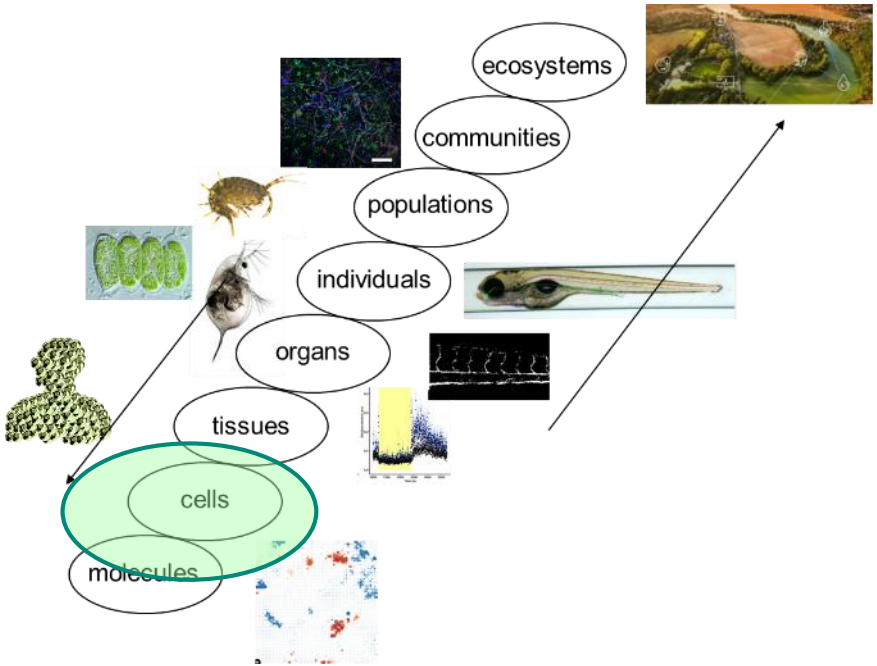


- Mixture toxicology in the lab at different scales
- Data curation and mixture risk assessment with regulatory impact



HITEC working group
High-throughput ecotoxicology

Head:
Jo Nyffeler



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High-throughput ecotoxicology

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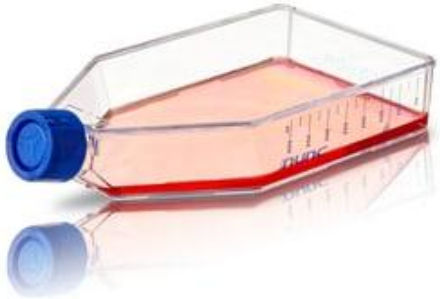
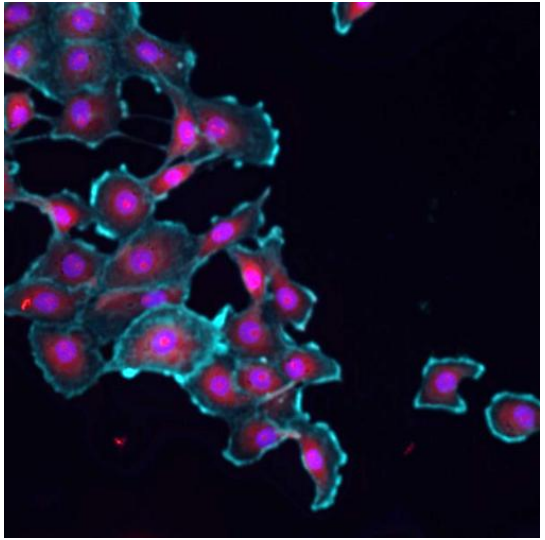
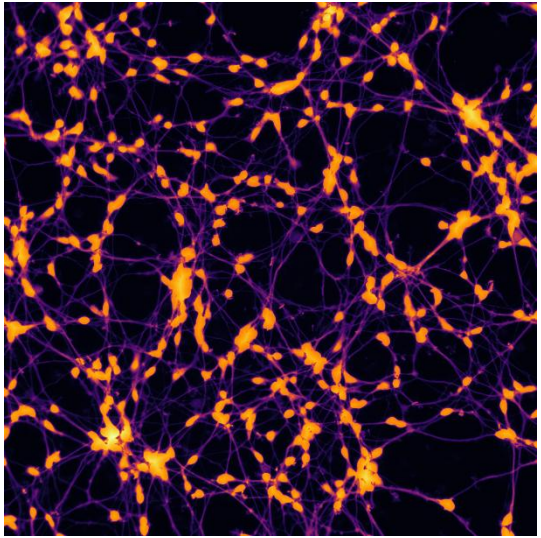


in vitro methods (cell lines)



amphibian cell line



human dopaminergic cell line

HITEC working group
High-throughput ecotoxicology

Head:
Jo Nyffeler

high-throughput

plate washer & dispenser

automated microscope

non-contact liquid dispenser for nanoliter volumes

HITEC working group
High-throughput ecotoxicology

Head:
Jo Nyffeler

Why?

- Chemicals can impact biodiversity

  Which chemicals are problematic?
  Which species are affected?

How?

- Develop high-throughput methods
- Develop cheaper methods

→ test many chemicals

- Develop NAMs for new taxa

→ test more taxa

- Describe & share methods
- High data quality
- FAIR data

→ usable data

mStress working group
multiple Stressor Ecology

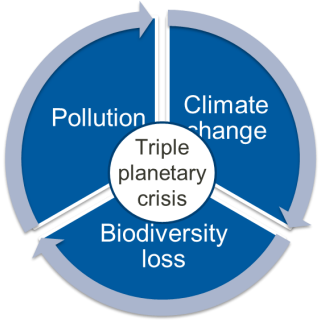
Head:
Mechthild Schmitt-Jansen

WHY

Ecosystem complexity

Vulnerability of organisms

- Multiple species
- Interacting communities
- Field situations



Multiple stressors

- Chemical mixtures
- (non-)chemical stressors
- Particles and chemicals

VISION

Protecting aquatic communities from chemical threats

MISSION

Multiple Lines of Evidence approach combining effect-based and community-level strategies

Bridge the lab to field gap

WHO

mStress working group
multiple Stressor Ecology

Head:
Mechthild Schmitt-Jansen

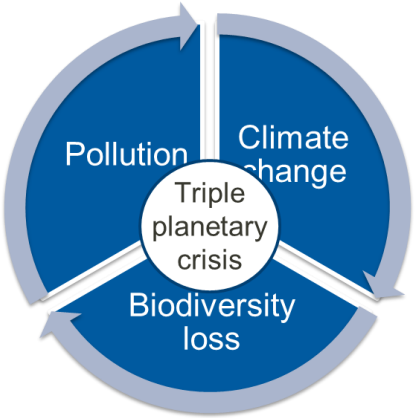
HOW

Effect-based monitoring

Assessment strategies

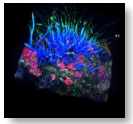
Multiple stressors (climate, particles)

Upscaling



Risk communication

Community ecotoxicology



Ecological relevance

Communication & outreach

DaNa 4.0

Matthias Liess

System-Ecotoxicology

Background

- Toxicants are a relevant drivers of biodiversity-loss
- Especially pesticides
  - applied directly into the ecosystem
  - desiged to kill
- Despite this, Risk Assessment suffers from fundamental deficits

Problems of PPP RA

- Inadequate recording of **exposure** in agricultural water bodies
  - Developed event-driven sampler in 1999 (Liess et al. 1999)
  - Applied in Germany, France, Finland
  - >>> Nationwide monitoring: RACs exceeded in 80% stream (Liess et al. 2021)

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- No knowledge of **effects** on the ecosystem
  - Tired approach in RA only involves ecosystem simulations
  - Relevant factors determening ecosystem effects of PPP are not considered.

Solutions

- Identifying effects on the ecosystem through **monitoring**
  - Developed monitoring system not confounded by environmental factors (Liess & v.d. Ohe 2005)
  - Applied in Argentina, Australia, Finland, France, Germany, Kenya, Switzerland, USA
  - >>> Nationwide monitoring: WFD goals are met in 20% stream (Liess et al. 2021)

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- **Predicting** combined effects of stressors
  - Developed Stressor Addition Model (SAM) (Liess et al. 2016)
  - Successfully applied with a multitude of toxicants, environmental stressors & organisms
  - >>> Combinations: Tox & Tox - Concentration addition / Environmental stressors & Tox - SAM

Future

- Implementation in Risk Assessment

- Improved understanding of effect propagation through All levels of biological organisation

Questions to Michael

- What do you consider as the main knowledge gap and/or future challenge in chemical risk assessment?
- How do you envision the role of ETOX in RU CITE?
- What is your perspective on POF? And POF V in particular?
  (Where do you see CITE and ETOX? How do we achieve transformation to fit into?)
- What do you want to achieve in the next two years and what comes after?
- How can unity be achieved within the RU?
- What do you consider as the main knowledge gap and/or future challenge in chemical risk assessment?

Wishlist or what concerns us

- Issues with the scientific infrastructure – new building
  - Long waiting times for repair or adaptation issues with BFM (BFM is understaffed)

  → flexibility is needed for quick adaptation as science and funding is very dynamic
  - if basics do not work, we cannot do rocket science (e.g. power on weekend)

- Global room concept at UFZ – Department is 2x larger than it was when the new building was planned, but no amendments were made for movement

  → still people in 6.0 and 6.1

- Long term infrastructure support ?

Dept. ETOX

… in collaboration with:

… funded by: