

MUNI | RECETOX

Stockholm Convention
Regional Centre

Thank you for having us!

Kateřina Šebková, Ph.D (Katka)
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the Stockholm Convention Regional Centre in the Czech Republic (SCRC)
RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

*Education course: Evaluation de riesgos químicos: Protegiendo la salud y el ambiente
18 November 2025 - Online*



SEMINARIO

Evaluación de riesgos químicos: Protegiendo la salud y el ambiente.

Programación

27 de octubre al 18 de noviembre

27 Octubre

Lunes

Conferencia:

An introduction to risk evaluation with focus on health

Helena Casabona
KEMI

Virtual en Zoom
8:00am - 10:00am

29 Octubre

Miércoles

Conferencia:

Experiences from the OECD with hazard assessment and its tools.

Ester Carregal Romero
OECD

Virtual en Zoom
8:00am - 10:00am

31 Octubre

Viernes

Conferencia:

Contexto de la evaluación de riesgos en la gestión de sustancias químicas de uso industrial en Colombia

Juan Carlos Sánchez
Ministerio de Ambiente y Desarrollo Sostenible

Virtual en Zoom
8:00am - 10:00am

4 Noviembre

Martes

Conferencia:

Evaluación de riesgos a la salud en procesos de sustitución.

David Combariza
Universidad Nacional de Colombia

Virtual en Zoom
8:00am - 10:00am

6 Noviembre

Jueves

Conferencia:

Evaluación de riesgos para la inclusión de sustancias químicas en la Convención de Estocolmo

Boris Ávila
Universidad de Antioquia

Virtual en Zoom
8:00am - 10:00am

10 Noviembre

Lunes

Conferencia:

Risk assessment within the context of managing contaminated sites

André Silva Oliveira
CETESB

Virtual en Zoom
8:00am - 10:00am

12 Noviembre

Miércoles

Conferencia:

Databases and information sources for chemical risk assessment.

Déborah Pellecer, Miriam Plana, Carolina Belalcazar
CAS

Virtual en Zoom
8:00am - 10:00am

14 Noviembre

Viernes

Conferencia:

Evaluación de riesgos de productos químicos: experiencias desde la región de América Latina

Alejandra Acosta
LARCF

Virtual en Zoom
8:00am - 10:00am

18 Noviembre

Martes

Conferencia:

Assessment and international cooperation on risks from chemicals: experiences from RECETOX, PARC and EIRENE.

Pavla Lakdawala - Kateřina Šebková
Pavla Lakdawala - Kateřina Šebková

Virtual en Zoom
8:00am - 10:00am

Opportunities and collaboration in the Chemical Risk Assessment: the RECETOX, PARC and EIRENE experience

Kateřina Šebková, Ph.D
katerina.sebkova@recetox.muni.cz

the Stockholm Convention Regional Centre in the Czech Republic (SCRC)
RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

Objectives

- to meet you!
- to provide capacity building for regulatory risk assessment in sharing our story with you
- to inform about ongoing activities and tools (PARC) - opportunities to join community of practice
- to establish new cooperations and build on existing ones - biobank facility, human bio monitoring, open access research infrastructure

Mecanics

- 2 parts: “story of growing, new approaches and opportunities” (Katka) and biocides “learning by doing” crash-course (Pavla)
- questions and comments welcome!
- presentations will be shared, many slides in KaSe presentation - for inspiration and further reading

MEET THE RECETOX



HOST OF THE STOCKHOLM CONVENTION
REGIONAL CENTRE IN THE CZECH REPUBLIC

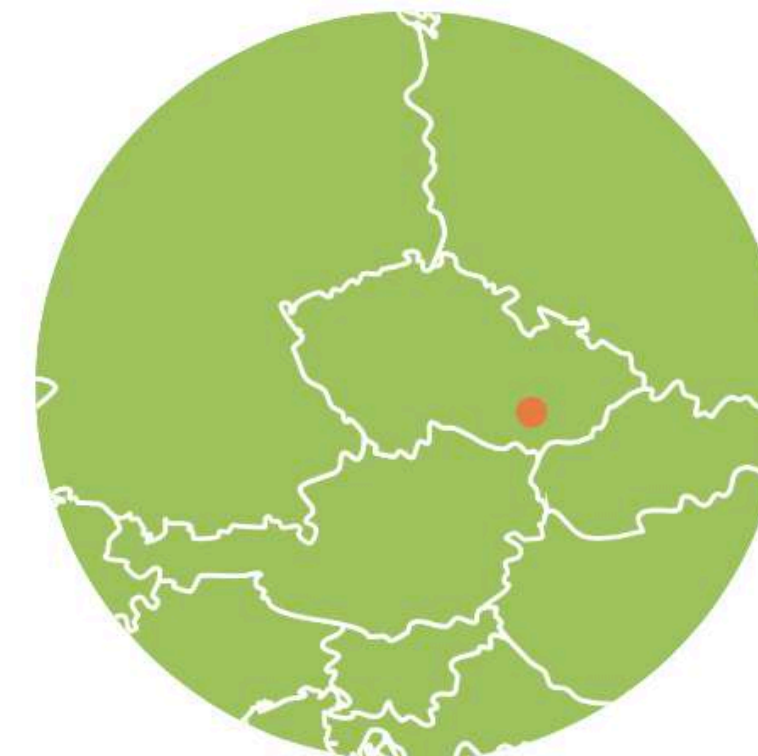
RECETOX in Brief

The RECETOX is a leading Czech research institute covering a broad range of basic and applied research on toxic compounds in the environment and their effect on human health.

Functions of RECETOX:

- **Research** activities
- **Education** programmes
- Open-Access Research Infrastructure
- **Science to Policy and Society** platforms (National Centre for Toxic Compounds, **Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology**)
- Application of research results

RECETOX
Faculty of Science
Masaryk University
Brno, Czech Republic



BRNO - BOHUNICE CAMPUS



history



culture



architecture



science

BRNO
city for life

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RECETOX in a glimpse - keywords and selected numbers

40 years - on the way to a healthy future

studying the relationship between humans and the environment, with a particular focus on the environmental and health risks associated with toxic substances.

175

Research staff

22

Research groups

60

PhD students

2

Study programmes

3

RI Core facilities

3

Science to Policy Platforms

1983 – 1993: POLLUTION

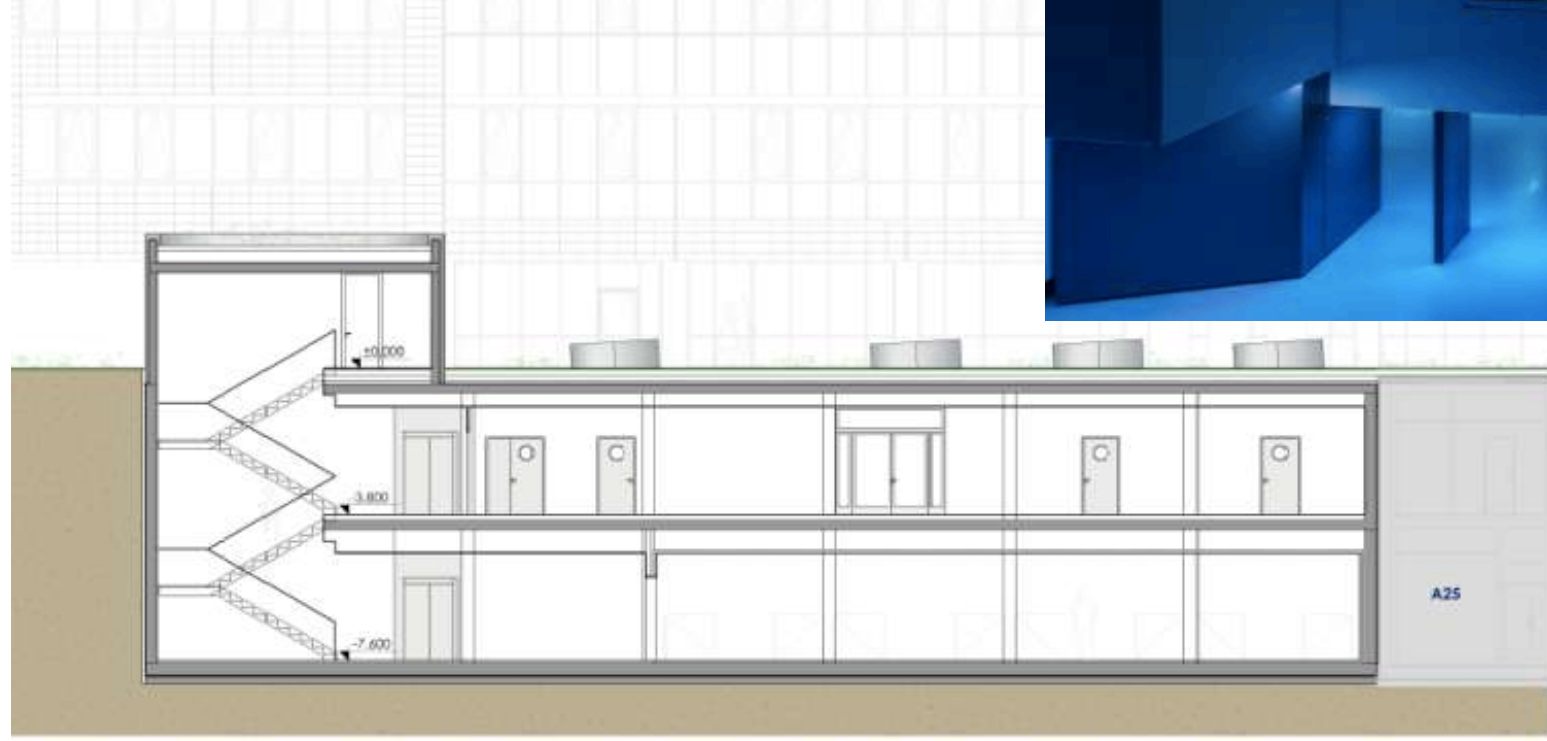
1993 – 2003: EXPOSURE, HAZARD, RISK

2003 – 2013: SAFETY and SCIENCE-to-POLICY

2013 – 2022: HUMAN HEALTH

2023 – : EXPOSOME, partnerships and networks

Modern campus and state of the art facilities in Brno Bohunice, CZ



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ABOUT

Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology in the Czech Republic

- Hosted by the RECETOX + uses its capacity
- established in 2007
- endorsed in 2009 + successfully evaluated in 2013, 2015, 2019 and 2023 (mandates extended for additional 4 years)
- provides support to the Stockholm Convention on POPs contracting Parties (countries) in its geographical region of the Central and Eastern Europe and beyond*.
- chemicals management and management of wastes containing toxic chemicals by providing training, capacity building, expertise support in a number of fields

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Stockholm Convention
Regional Centre



Our mission is to provide technical assistance, build capacities to implement the Stockholm Convention on POPs and to protect the planet for future generations by combatting global environmental challenges and address triple planetary crises

* We cover issues related to chemicals management, exposome research, monitoring, legal and institutional arrangements and governance including synergies. We support the work under Basel, Rotterdam, Stockholm and Minamata Conventions, SAICM and new Global Chemical Framework and negotiations of the Science Policy Panel (UNEA resolution 5/8) and also partly the INC process for the plastics treaty (UNEA resolution 5/14).

Support in the wider European region (WHO region)

WHO Collaborating Centre for Chemical Exposure and Risks

- RECETOX officially endorsed in January 2023 for 4 years, working in WHO European region and also globally

Workplan and topics of collaboration with WHO:

- assistance and technical support on assessment of exposure to chemicals of public health concern with the main focus on human biomonitoring
- addressing emerging and other policy issues relating to chemical safety
- laboratory capacity building

Specific new requests for support:

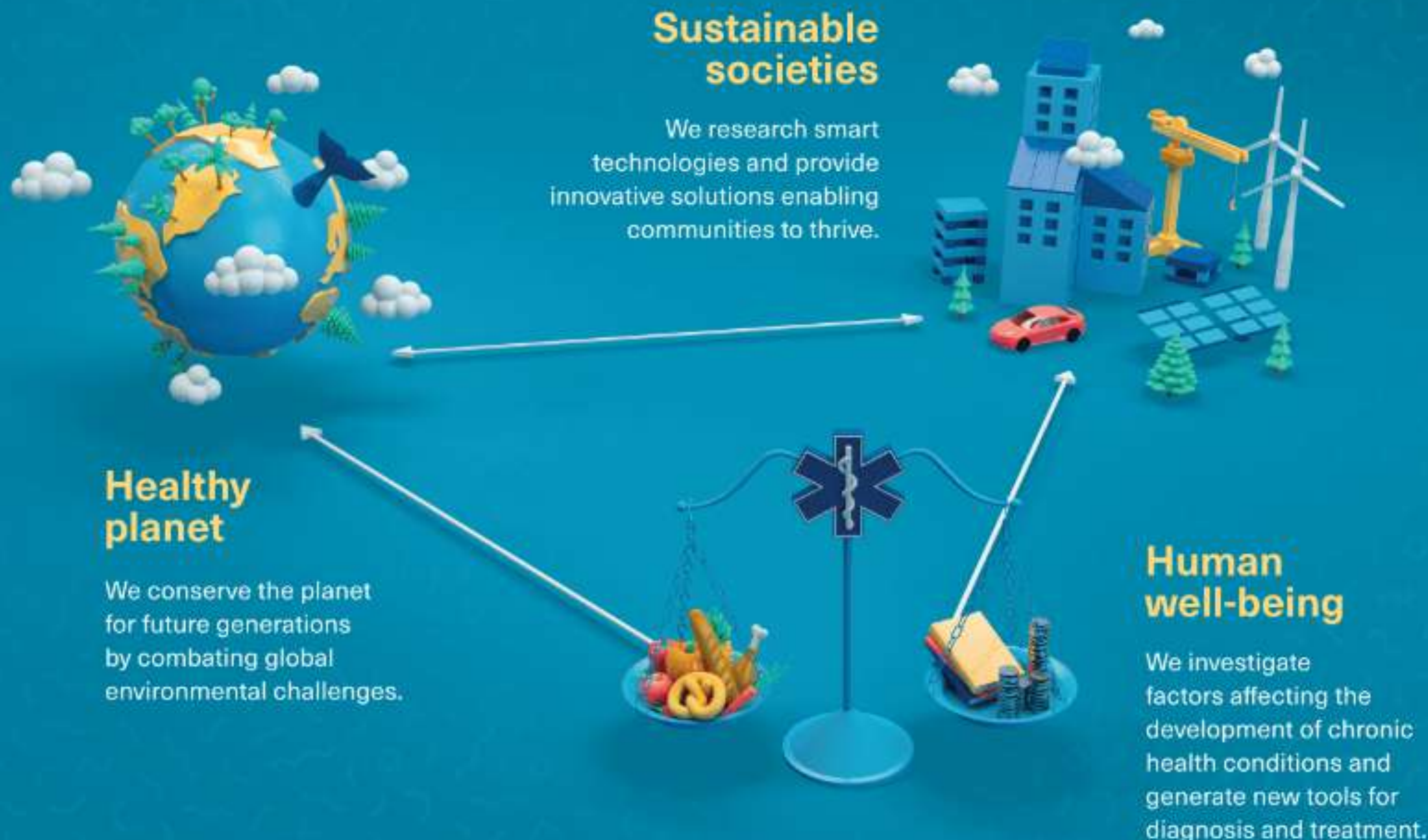
Minamata convention on Mercury - use RI - data warehouse for mercury HBM, lectures, trainings, governance case study, update of the National Action Plan - Czech Republic

C E T O X

Teaming for a healthy future

Mission

Building a healthy future with environmental, economic and social sustainability and improved well-being.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857560

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science

For many years we have studied the human impact on the environment & now we also assess environmental impacts on human health. Our research infrastructure supports the international research community.



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education

We train the future generation of professionals and provide them the multi-disciplinary skills across education, research, policy and practice needed to address environmental health challenges.



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application

We translate our research results to practical application and legislation. We transfer our knowledge to industry and government and inform regulatory decision-making processes to promote environmental, economic and social sustainability.



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society

We contribute to improving the quality of life. We generate data and provide new tools, technologies and solutions to benefit the community and secure a stable and prosperous future.



recetox.muni.cz



Brno Living Lab

MUNI

FAKULTNÍ
NEMOČNICE
BRNO

FNUSA
ICRC

B | R | N | O |

jiho­moravský kraj

Partnership for a healthy future

We collaborate to build a community that works together towards a healthy future. We form research partnerships with academic institutions and university hospitals and reach out to local businesses, regional and state authorities to share knowledge. We engage with citizens and welcome them to join our community to co-create positive change.



This project has received funding
from the European Union's Horizon 2020
research and innovation programme under
grant agreement No 857560

muni.recetox.cz

Research Programmes and Infrastructures

Research Programmes **Detailed information see slides 15 - 37**

Environmental exposure and modelling

Multiresidual assessment of toxic mixtures
Internal exposure of population to chemical mixtures
Environmental exposures in local, regional and global context
Linking internal and external exposures through modelling

Adverse Outcome Pathways: from exposure to health

Aquatic and soil toxicology
Biotechnology tools for mechanistic toxicology
Uncovering toxicological events beyond priority health outcomes
Building adverse outcome pathways and AOP-based models

Environmental Epidemiology

Development of the omics approaches
Systemic hallmarks of adverse health outcomes
Biomarkers of susceptibility and effect
Development of methods for integrative analysis of omics data

Chemical Tools for Diagnostics and Therapy

Phototriggers of signaling molecules
Photoactivatable compounds and fluorescent tags for biology
Nanocarriers

Protein Engineering

Assessment of the biomembrane composition
Development of microfluidic chips
Effects of pathogens
Development of diagnostic kits

Research Infrastructure

MONET monitoring networks
CELSPAC population studies
Biobanking facility

Trace Analytical Laboratory
Omics laboratories

Toxicology
Photochemistry
Microfluidics

IT platforms, databases and information systems
Bioinformatics and Biostatistics

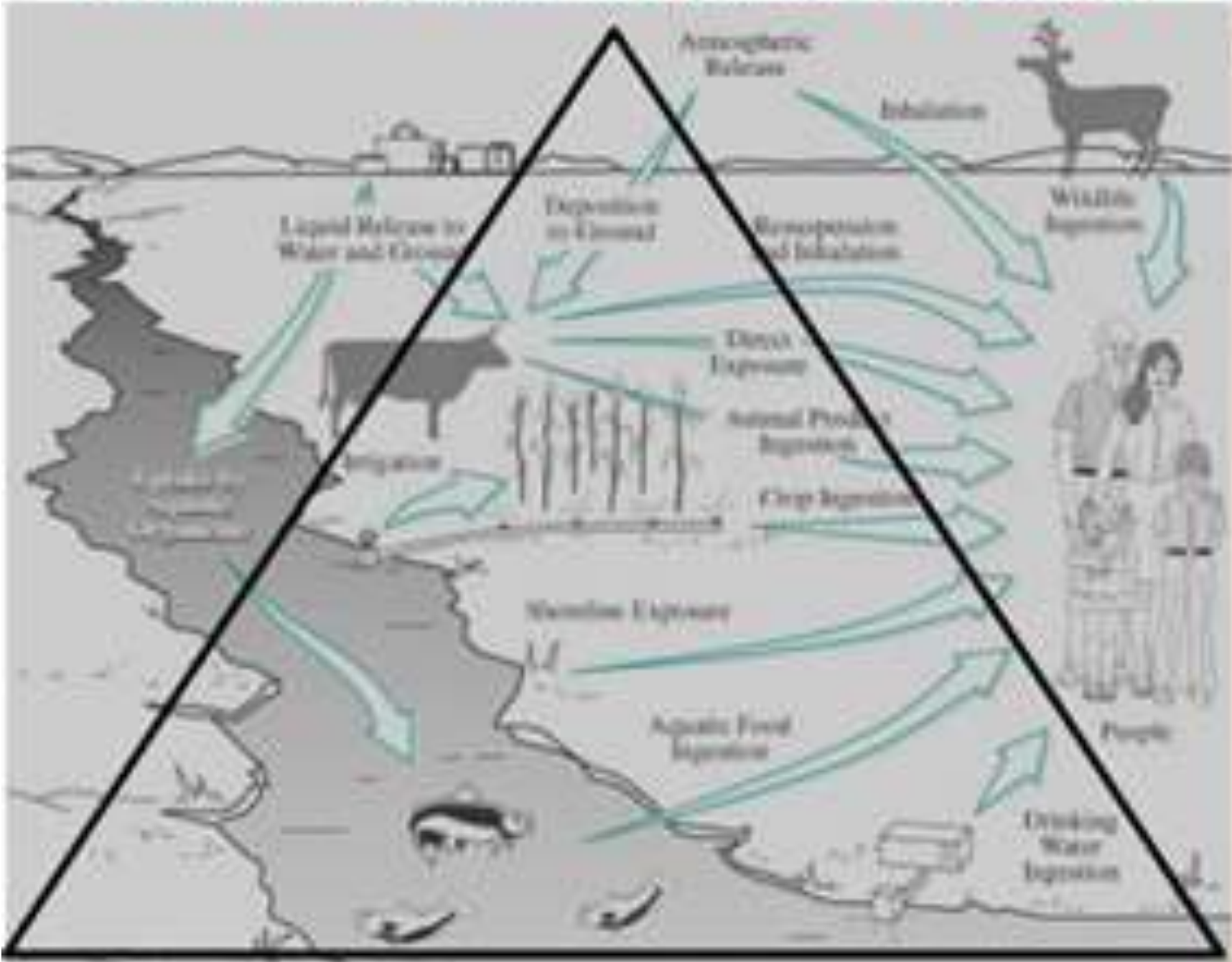
Detailed information see slides 15 - 37

Complimentary slides - Researchers (15-37)

Human exposome: Bottom-up vs. Top-down Exposomics

Bottom-up Exposomics

Identify important exogenous exposures



Measure chemicals in air, water & food

Top-down Exposomics

Measure chemicals in blood



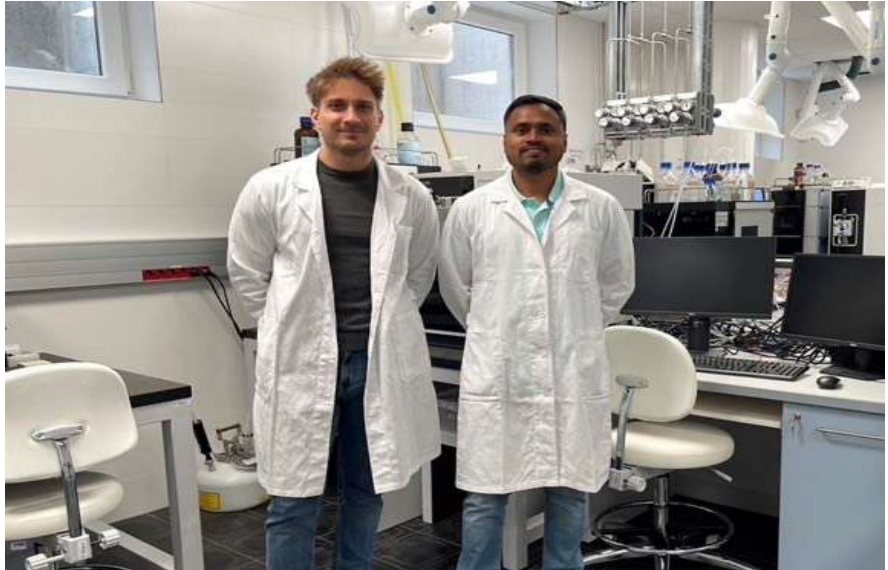
Identify all important exposures



Rappaport SM. *J Expo Sci Environ Epidemiol* 21:5–9 (2011).



2 MSCA grants
Joint PhD with University of Rennes



Human [chemical] exposome

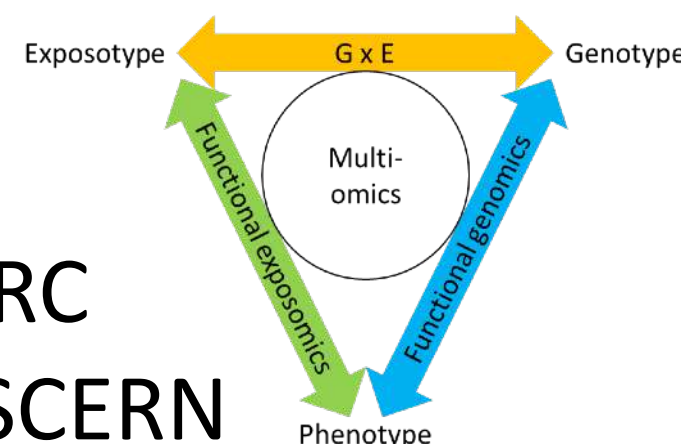
Research goal:

Development and application of the human exposome concept
Comprehensive & systematic identification of chemical exposure agents in human population & association with disease (e.g. fertility & metabolic disorders)



Major projects:

- H2020 ATHLETE
- H2020 EXPANSE
- Horizon Europe PARC
- Horizon Europe DISCERN
- Horizon Europe ENDOMIX
- ESIF SALVAGE



Science

Current Issue

HOME > SCIENCE > VOL. 388, NO. 6745 > INTEGRATING EXPOSOMICS INTO BIOMEDICINE

PERSPECTIVE | BIOMEDICINE

Integrating exposomics into biomedicine

Assessing a full range of environmental exposures will improve human health

GARY W. MILLER AND BANBURY EXPOSOMICS CONSORTIUM [Authors Info & Affiliations](#)

SCIENCE • 24 Apr 2025 • Vol 388, Issue 6745 • pp. 356-358 • DOI: 10.1126/science.adr0544

ARTICLES · Volume 54, 101314, July 2025 · Open Access

Download Full Issue

External exposome and incident asthma across the life course in 14 European cohorts: a prospective analysis within the EXPANSE project

Zhebin Yu^a · Sara Kress^b · Natalia Blay^{c,d} · Petr Gregor^e · Hanna-Maria Kukk^{f,g} · Miriam Leskien^{h,i} · et al. [Show more](#)

Articles

Worldwide trends in diabetes prevalence and treatment from 1990 to 2022: a pooled analysis of 1108 population-representative studies with 141 million participants

NCD Risk Factor Collaboration (NCD-RisC)*



bio-protocol

Open Access

Published: Mar 05, 2025

Automated Sequential Derivatization for Gas Chromatography- [Orbitrap] Mass Spectrometry-based Metabolite Profiling of Human Blood-based Samples

Akrem Jbebli^{1,*}, Kateřina Coufalíková^{1,2}, Moira Zanaboni³, Manuela Bergna³, Renzo Picononi⁴, Jana Klánová^{1,2} and Elliott J. Price^{1,2,*}

analytical chemistry

Open Access

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Article

[pubs.acs.org/ac](#)

Quantum Chemistry-Based Prediction of Electron Ionization Mass Spectra for Environmental Chemicals

Helge Hecht,* Wudmir Y. Rojas,* Zargham Ahmad,* Aleš Křenek,* Jana Klánová,* and Elliott J. Price*

JOEN
nce

Cite This: *Anal. Chem.* 2024, 96, 13652–13662

Read Online



Analytica Chimica Acta
Volume 1356, 22 June 2025, 343942



Dual LC column characterization for mass spectrometry-based small molecule profiling of human plasma and serum

Žiga Tkalec^{a,b}, Štěpán Koudelka^a, Jana Klánová^a, Elliott J. Price^a

External exposome

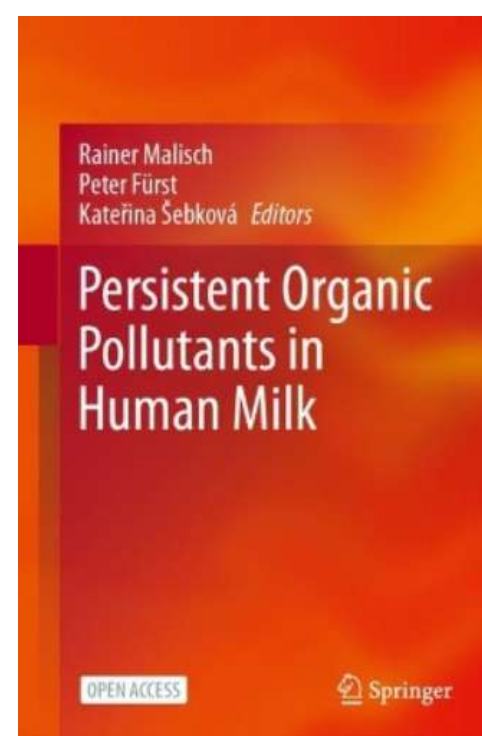
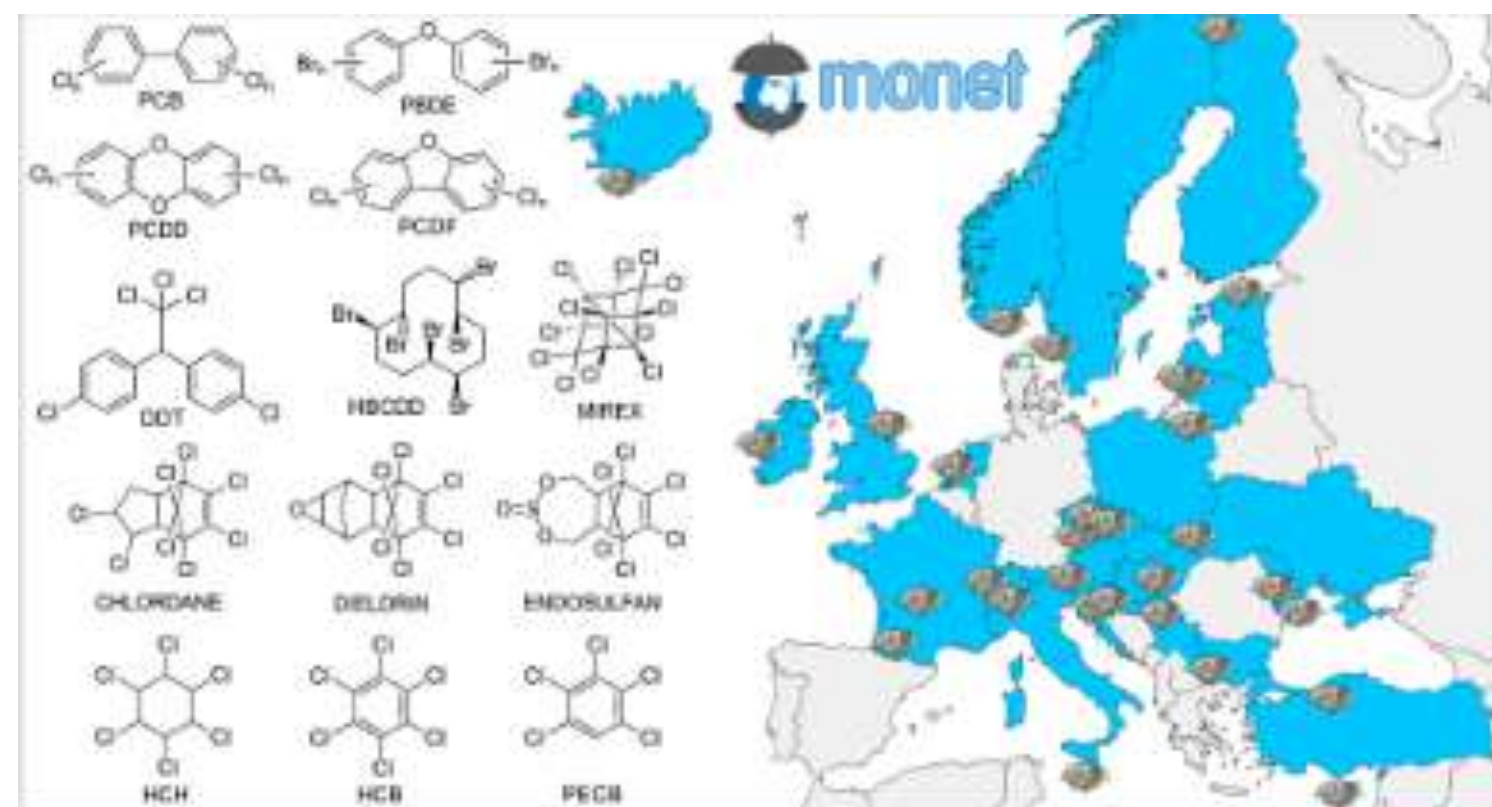
Research goal:

Assessment of spatial and temporal trends in chemical exposure of the environment and human population – shift to human data

PARC WPs 7 and 8

Large-scale data collection and interpretation, uncertainty assessment

Science-to-policy



Guidance on the Global Monitoring Plan for Persistent Organic Pollutants

January 2025





Environmental Pollution

Volume 345, 15 March 2024, 123445



Cross sectional study on exposure to BPA and its analogues and semen parameters in Czech men ☆

Michal Jeseta^{a,b}  , Jiri Kalina^c, Katerina Franzova^a, Sandra Fialkova^c, Jan Hosek^{d,i}, Lenka Mekinova^a, Igor Crha^{a,e}, Bartosz Kempisty^{f,g,h}, Pavel Ventruba^a, Jana Navratilova^c

Chemical Pollutants and Human Exposure Routes

Research Focus -Tools and strategies to understand human exposure to chemical compounds

- Link chemical policy with chemical use and exposures to better understand the influence of policy actions on chemical exposures
- Link chemical use and exposure modeling with toxicity to prioritize chemicals for further study, regulation
- Improve our understanding of the behavioural variables in our human exposure – how do individual consumer choices impact our exposures/what is the balance between regulation, external environment and lifestyle in chemical exposures

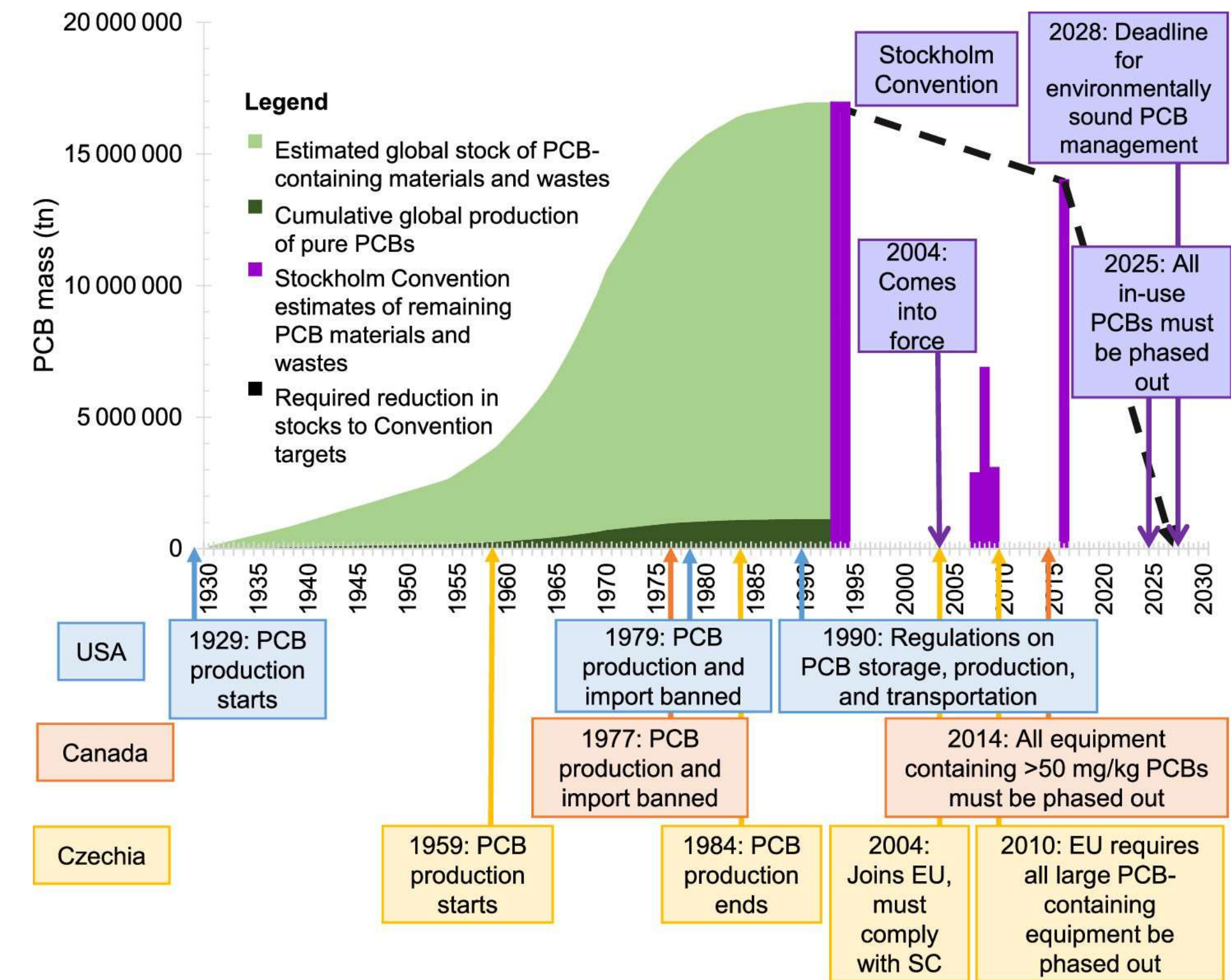
Current projects

INQUIRE – Improving indoor air quality and health: identification of chemical and biological determinants, their sources, and strategies to promote healthier homes in Europe – Horizon Europe (2022-2027) – WP leader

PARC – WP6 T6.4.3 - Developing databases and analytical testing methodology for chemicals in materials and articles (with Martin Scheringer)

MSCA Fellowship (Veronica van der Schyff)

Lisa Melymuk



Timeline of major policy actions on PCBs in the USA, Canada, and Czechia and in the Stockholm Convention.

Chemical Pollutants and Human Exposure Routes



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Letter

Occurrence of Pharmaceuticals and Other Anthropogenic Compounds in the Wastewater Effluent of Arctic Expedition Cruise Ships

Published as part of *Environmental Science & Technology Letters* special issue "Ocean Health".

Veronica van der Schyff,* Marek Stiborek, Zdeněk Šimek, Branislav Vrana, Verena Meraldi, Andrew Luke King, and Lisa Melymuk

Environ Monit Assess (2025) 197:396
<https://doi.org/10.1007/s10661-025-13822-z>

RESEARCH



High levels of flame retardants in vehicle dust indicate ongoing use of brominated and organophosphate flame retardants in vehicle interiors

Petra Svobodová · Simona Rozárka Jílková · Jiří Kohoutek · Ondřej Audy · Petr Šenk · Lisa Melymuk



pubs.acs.org/est

Editors' Choice

Open Access

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Policy Analysis

Toward Product Safety and Circularity: Understanding the Information Structure of Global Databases on Chemicals in Products and Articles

Chijioko Olisah, Lisa Melymuk,* Robin Vestergren, Karin Rumar, Tonie Wickman, Nina Melander, Petteri Talasniemi, Sicco Brandsma, Urban Boije af Gennäs, and Martin Scheringer

Environmental Science Processes & Impacts



PAPER

View Article Online
View Journal | View Issue



Cite this: *Environ. Sci.: Processes Impacts*, 2025, 27, 1054

Characterizing the distribution of aromatic amines between polyester, cotton, and wool textiles and air†

Özge Edebali,^a Anna Goellner,^b Marek Stiborek,^a Zdeněk Šimek,^a Melis Muz,^b Branislav Vrana,^a and Lisa Melymuk^{*a}



Chemodynamics of environmental pollution

Cooperations with: Actris RI, Max Planck Institute for Chemistry (DE), Aristotle U Thessaloniki (GR), Czech Hydromet I (CZ), NILU Oslo (NO) (and others)

Gerhard Lammel



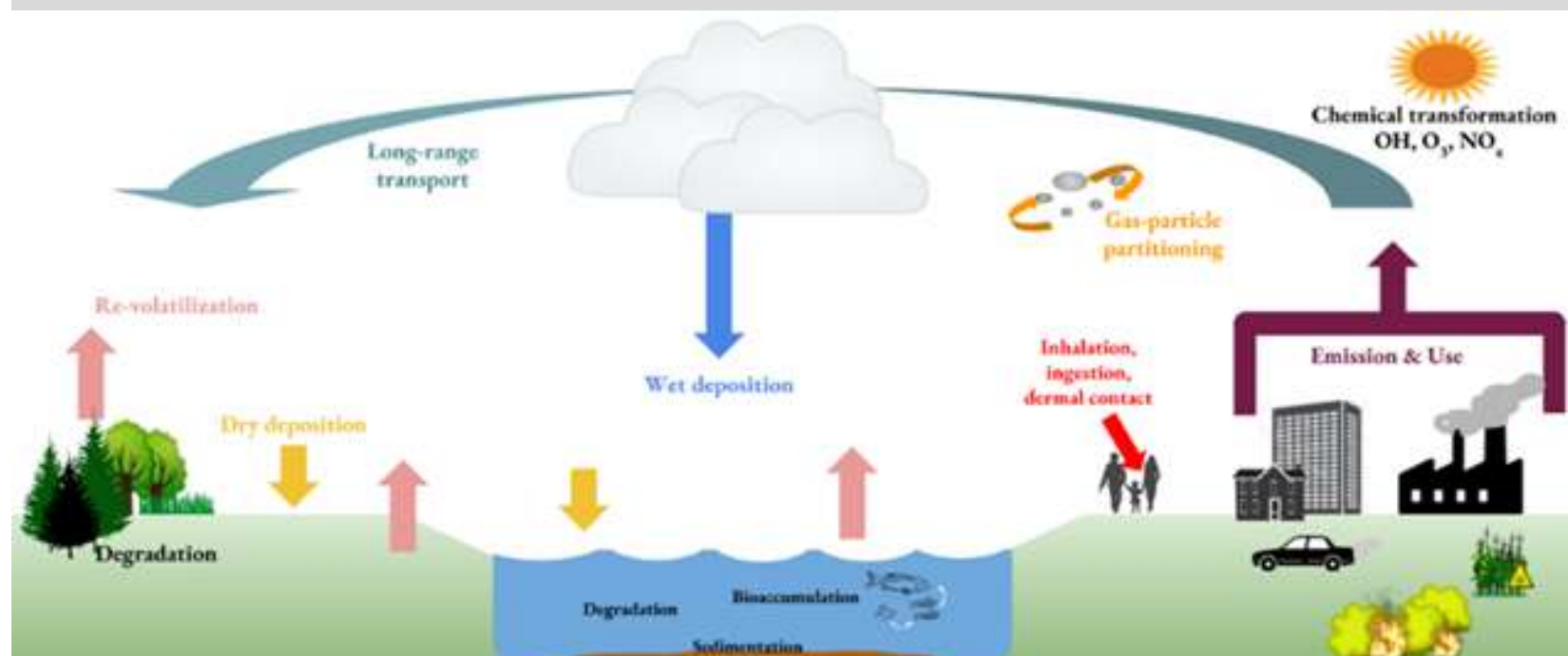
Aims:

- Characterization of distributions, long-range transport potential and paths of organic pollutants (i.e., polycyclic aromatic compounds, pesticides)
- Determination of inhalation bioaccessibility

Methodology: field measurements, chemical analysis, modelling

Achievements:

- PESPAT project: Simultaneous sampling at 29 rural, mountain and coastal sites across Europe and the European Arctic
- Studied formation of nitro-PAHs in regionally transported plumes (ca. 400 km, Eastern Mediterranean)



Short communication

Particle size distributions of current-use pesticides in three European atmospheric environments

Ludovic Mayer^a, Lisa Melymuk^a, Darius Ceburnis^b, Adela Holubová Šmejkalová^c, Petra Příbylová^a, Petr Šenk^a, Jakub Vinkler^a, Gerhard Lammel^{a,d,*}



Atmospheric Pollution Research

Volume 16, Issue 9, September 2025, 102606



Current-use pesticides in ambient air - evaluation of deposition sampling and soil fugacity techniques

Ludovic Mayer^a, Lisa Melymuk^a, Jakub Vinkler^a, Petr Šenk^a, Marek Šudoma^a, Petra Příbylová^a, Céline Degrendele^{a,1}, Gerhard Lammel^{a,b} ✉

Atmospheric Pollution Research 16 (2025) 102460

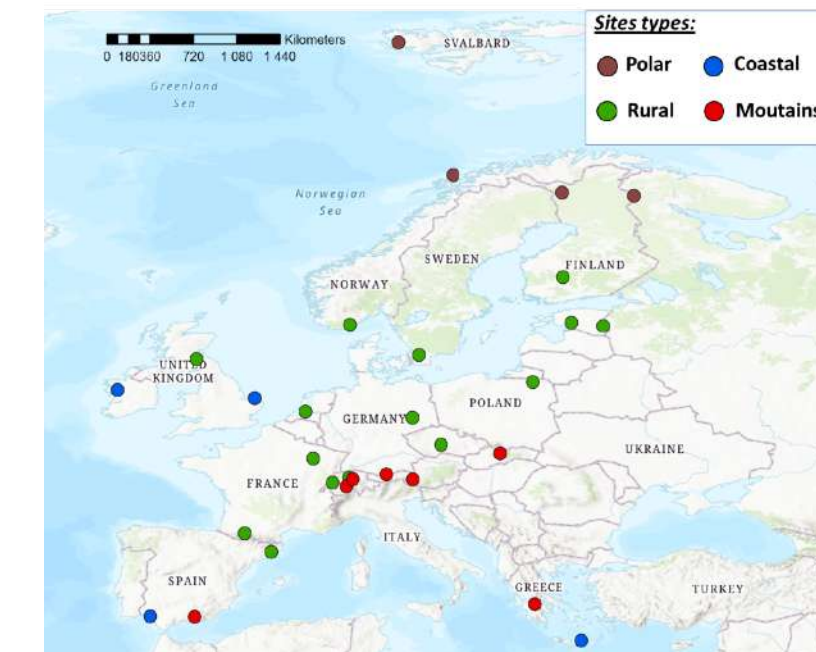


Atmospheric Pollution Research

journal homepage: www.elsevier.com/locate/apr

Field validation of a novel passive air sampler and monitoring of semivolatile organic pollutants in the remote marine and continental boundary layer

Gerhard Lammel^{a,b,*}, Björn Nillius^a, Frank Helleis^a, Adela Holubová Šmejkalová^c, Petr Kukučka^b, Jakub Martinič^b, Petra Příbylová^b, Roman Prokeš^{b,d}, Pourya Shahpoury^{a,c}, Daniel Štěpánek^d, Jakub Vinkler^b



Chemodynamics of environmental pollution

Cooperations with: University of South Bohemia in České Budějovice, NORMAN association, International Commission for the Protection of the Danube River (ICPDR), NIVA (Norway) and others

Aim: Setting up the AQUA-MONET Network for global monitoring

Methodology: field measurements, passive sampling in water, target and suspect screening chemical analysis

Achievement: Setting up the baseline for representative monitoring of trace organic pollutants in large water bodies.

Aim: Analytical and bioanalytical assessments of organic micropollutants in the Danube River using a combination of passive sampling, bioassays and non-target screening

Methodology: field measurements, passive sampling in water, target and suspect screening chemical analysis, bioanalytical tools

Achievement: Identification of toxicity drivers in complex mixtures.

Aim: Investigation of the relationship between concentrations of hydrophobic organic contaminants (HOCs) in freshwater fish at different trophic levels and in water using passive sampling

Methodology: field measurements, passive sampling in water and fish, chemical analysis

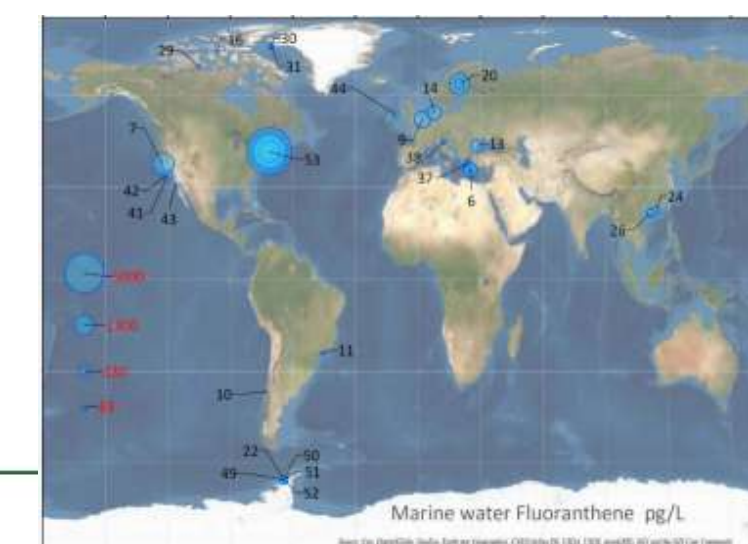
Achievement: The trophic magnification in freshwater food chains rarely amplifies levels of persistent HOCs in fish above those in the surrounding environment.

Branislav Vrana



ENVIRONMENTAL
Science & Technology

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Article

AQUA-GAPS/MONET-Derived Concentrations and Trends of PAHs and Polycyclic Musks across Global Waters

Rainer Lohmann,* Branislav Vrana, Derek Muir, Foppe Smedes, Jaromir Sobotka, Eddy Y. Zeng, Lian-Jun Bao, Ian J Allan, Peleg Astrahan, Terry Bidleman, Denis Crowley, Evgen Dykyi, Nicolas Estoppey, Gilberto Fillmann, Liisa Jantunen, Sarit Kaserzon, Keith A. Maruya, Brendan McHugh, Brent Newman, Raimon M. Prats, Manolis Tsapakis, Mats Tysklind, Barend L. van Drooge, and Charles S. Wong

ACS
ES&T | Water

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Perspective

Achievements and Challenges with Equilibrium and Kinetic Passive Sampling of Hydrophobic and Hydrophilic Organic Compounds in Surface Waters

Kees Booij,* Rachel Mackie, Branislav Vrana, Rainer Lohmann, and Sarit L. Kaserzon*



ELSEVIER

Contents lists available at ScienceDirect

Journal of Hazardous Materials

journal homepage: www.elsevier.com/locate/jhazmat



Biomarker responses in wild brown trout from a headwater stream and their causal link to water pollution assessed through chemical analysis and *in vitro* reporter gene bioassays

Anna Koubová^{a,*}, Zuzana Toušová^b, Pavel Šauer^a, Carolina de Sales-Ribeiro^c, Branislav Vrana^b, Marie Smutná^b, Hana Kocour Kroupová^a, Kateřina Grabicová^a, Heike Schmidt-Posthaus^c, Tomáš Randák^a, Roman Grabic^a, Klára Hilscherová^b, Vladimír Žlábek^a

Chemodynamics of environmental pollution

Aim:

Characterization of environmental levels of POPs, PAHs, flame retardants, microplastics

Air-sea and air-soil cycling of organic pollutants

Enhanced collaboration and capacity building in South America

Methodology: field measurements, chemical analysis and modelling

ENVIRONMENTAL POLLUTION 372 (2025) 126905



ELSEVIER

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol



Occurrence of current-use pesticides in sediment cores from lakes and peatlands in pristine mountain areas of Brazilian national parks[☆]

Patrícia C.G. Pereira^{a,b}, Cláudio E.T. Parente^{a,*}, Yago Guida^{a,b}, Raquel Capella^a, Gabriel O. Carvalho^{a,c}, Pavlína Karásková^b, Jiří Kohoutek^b, Karla Pozo^{b,c}, Petra Příbylová^b, Jana Klánová^b, João P.M. Torres^d, Paulo R. Dorneles^{a,b}, Rodrigo O. Meire^{a,b}



Environmental Pollution

Volume 374, 1 June 2025, 126196



Land-ocean export of microplastic in central Chile: The contribution of the Biobío River using a particle tracking model approach [☆]

Tatiana Recabarren^a, Mariett Torres^a, Camila Jacobsen^a, Katerine Pozo^b, Lautaro Girones^{c,d}, Andrés Arias^{c,d}, Roberto Urrutia^e, Guozhu Ye^f, Petra Příbylová^g, Jana Klánová^g, Ramón Ahumada^h, Karla Pozo^{a,g}

Marine Pollution Bulletin 205 (2024) 116575



ELSEVIER

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul



Baseline

Occurrence of marine plastic litter and plasticizers from touristic beaches of Arauco Gulf in Central Chile

Tatiana Recabarren^a, Mariett Torres^a, Victoria Gómez^{b,c}, Camila Jacobsen^a, Mathias Villablanca^a, Camila Ahrendt^e, Caroline da Silva Montes^d, Cristóbal Galbán-Malagón^{b,c,f}, Norma Tombesi^g, Karla Pozo^{a,h,*}

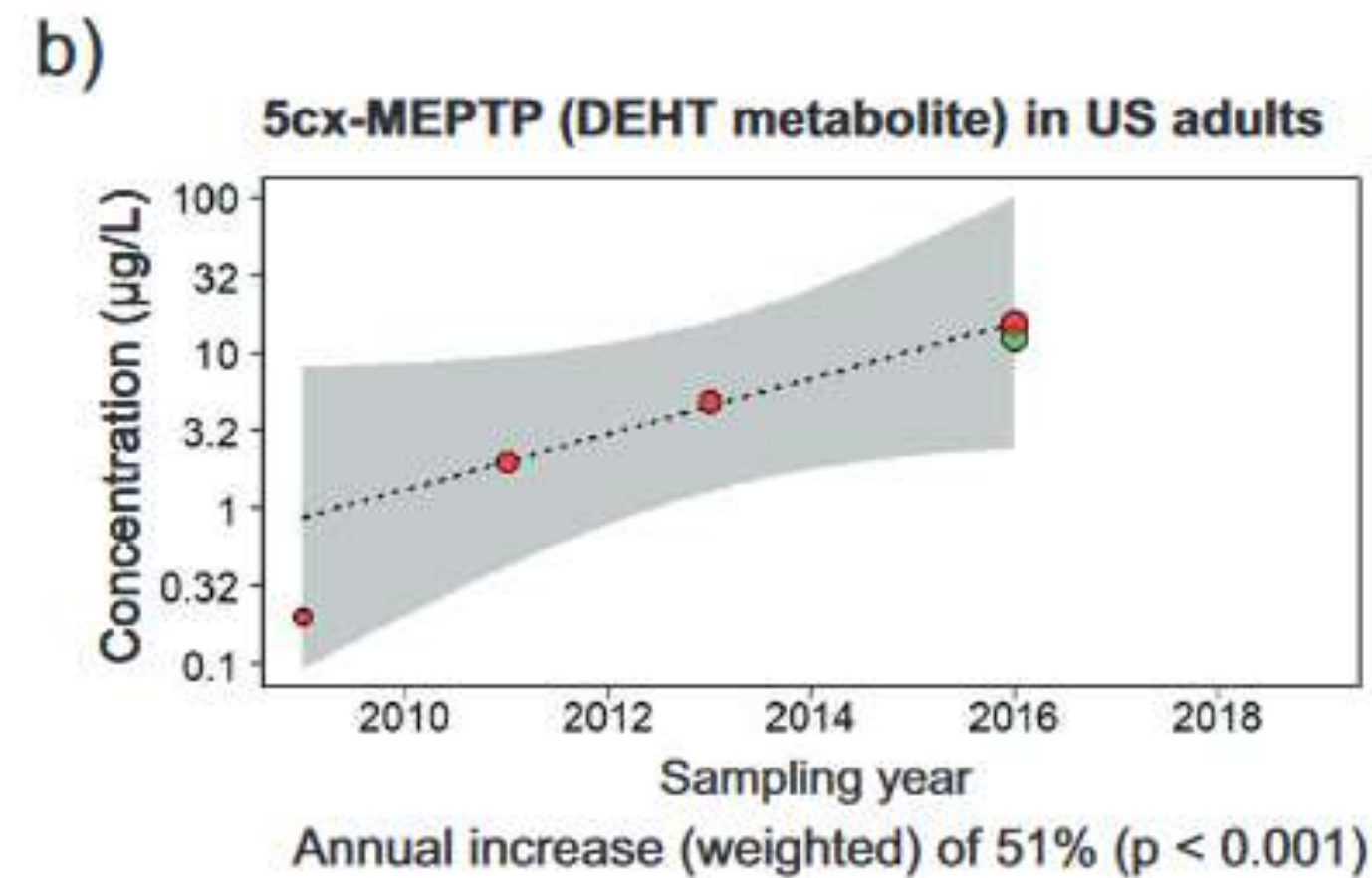
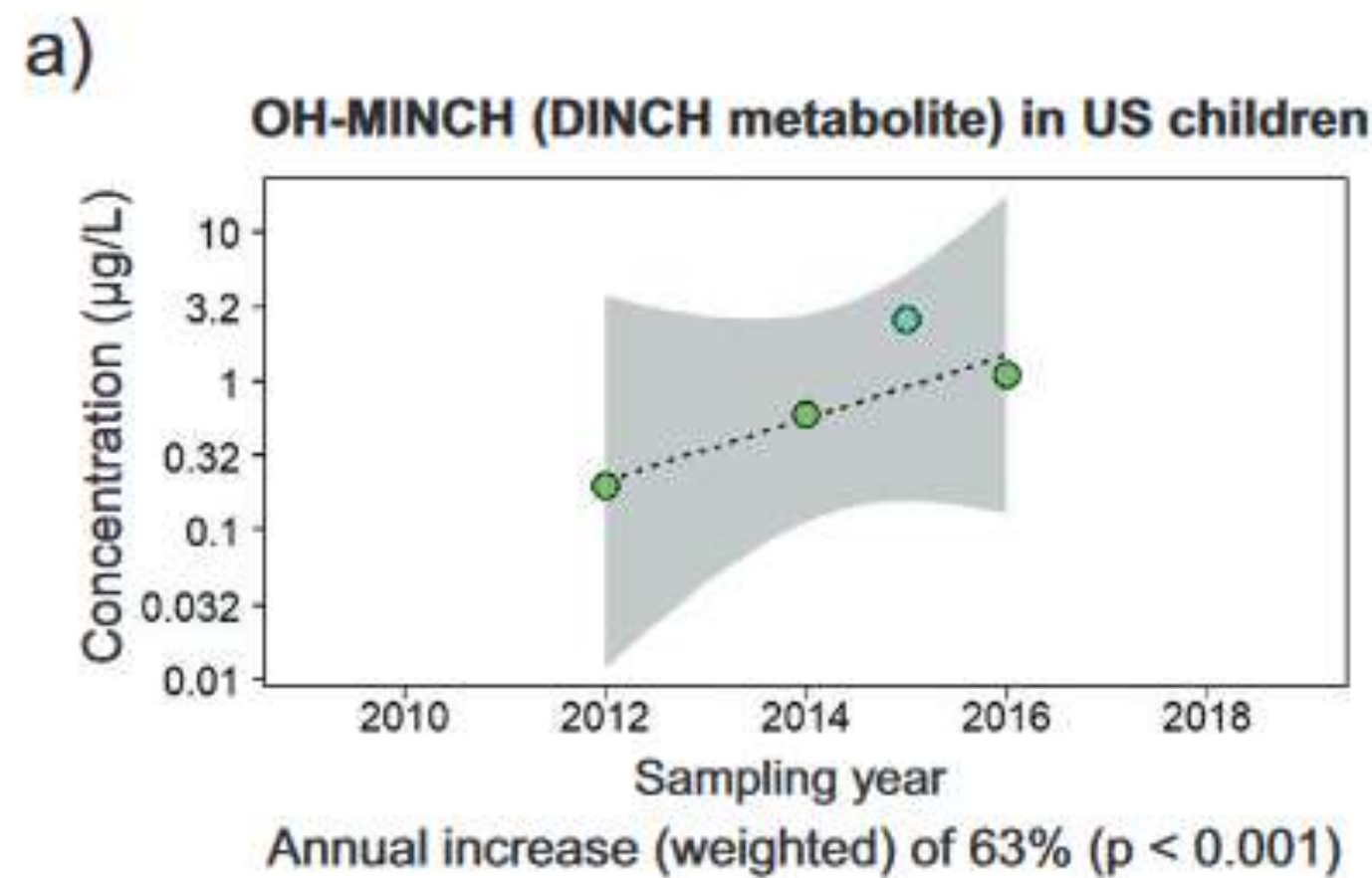
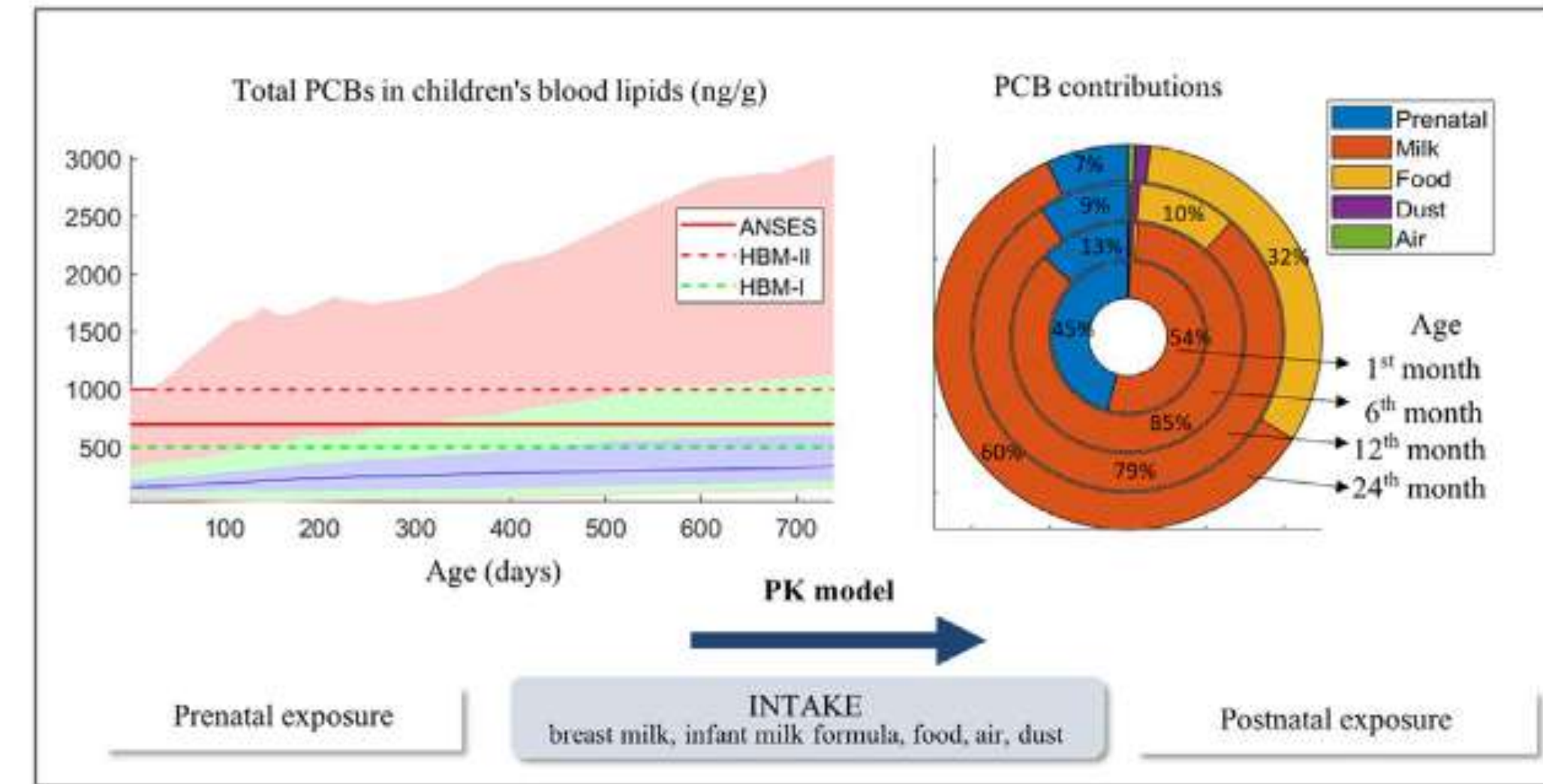


Pharmacokinetic modeling research group – RECETOX – ETH collaboration



Main research goals

- Modelling of human exposure using pharmacokinetic models
 - estimation of distribution of pollutants and their time trends in human tissue
 - identification of dominant sources of exposure
 - intake calculation, identification of exposed population groups
- Statistical analyses of human biomonitoring data



Projects

- HBM4EU
- PARC
- MSCA Global Fellowship (Brij Sharma at ETH)

Pharmacokinetic modeling research group

Achievements

- Characterization of exposure to PCBs of Czech and Slovak children
- Characterization of time trends of human exposure to phthalates and phthalate replacements
- Review of all globally available data on human exposure to mercury, quantification of levels and trends of human exposure to mercury globally
- Focus on Unlocking India's potential



www.nature.com/jes

Journal of Exposure Science & Environmental Epidemiology

Journal of Exposure Science & Environmental Epidemiology

www.nature.com/jes

ARTICLE

Check for updates

Human biomonitoring of essential and toxic trace elements (heavy metals and metalloids) in urine of children, teenagers, and young adults from a Central European Cohort in the Czech Republic

Brij Mohan Sharma^{1,2}, Klára Komprdová¹, Katarína Lörinczová¹, Jan Kuta¹, Petra Příbylová¹, Martin Scheringer^{1,2}, Ludmila Šebejová¹, Pavel Piler¹, Martin Zvonar^{1,3} and Jana Klánová¹



Available online at www.sciencedirect.com

ScienceDirect

Current Opinion in
Environmental Science & Health

An overview of the occurrence and remediation of perfluorooctanoic acid (PFOA) in wastewater-recommendations for cost-effective removal techniques in developing economies
K. Pavithra¹, Brij Mohan Sharma^{2,3} and Paromita Chakraborty⁴

ARTICLE OPEN

Check for updates

Changing pattern of exposure to polycyclic aromatic hydrocarbons over time in the Central European population

Soňa Smetanová^{1,5}, Akrem Jbebli^{1,5}, Jiří Kohoutek¹, Vladimíra Puklová², Milena Černá^{2,3}, Andrea Krsková², Martin Zvonar^{1,4}, Zdenko Reguli⁴, Lenka Andrášková¹, Pavel Piler¹, Petra Příbylová¹, Jana Klánová¹, Elliott J. Price¹ and Klára Komprdová¹

iScience

CellPress
OPEN ACCESS

Perspective

Complementing global chemicals management through shaping consumer behavior

Brij Mohan Sharma^{1,2,*}, Jane Muncke³, Justin M. Boucher³, Lisa Zimmermann³, Thomas A. Brunner⁴, Poonam Arora⁵ and Martin Scheringer^{1,2}

¹RECETOX, Faculty of Science, Masaryk University, Kotlarska 2, Brno, Czech Republic

²Institute of Biogeochemistry and Pollutant Dynamics (IBP), ETH Zürich, 8092 Zürich, Switzerland

³Food Packaging Forum (FPF) Foundation, 8045 Zürich, Switzerland

⁴Food Science and Management, School of Agricultural, Forest and Food Sciences (HAFL), Bern University of Applied Sciences (BFH), 3052 Zollikofen, Switzerland

⁵School of Business, Quinnipiac University, Hamden, CT 06518, USA

*Correspondence: brij.sharma@recetox.muni.cz

<https://doi.org/10.1016/j.isci.2025.112700>

Pharmacokinetic modeling research group

Science-to-policy interface

- Strategic panel on Chemical Pollution
- Numerous science-to-policy papers including tw Science editorials



ENVIRONMENTAL
Science & Technology

pubs.acs.org/est

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Perspective

From Ambition to Action: Navigating Obstacles and Opportunities of “Safe and Sustainable by Design”

Joanke van Dijk, Anežka Sharma, Bernd Nowack, Zhanyun Wang, and Martin Scheringer*

ENVIRONMENTAL
Science & Technology

pubs.acs.org/est

Open Access

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Correspondence/Rebuttal

Correspondence on “The Stockholm Convention at a Crossroads: Questionable Nominations and Inadequate Compliance Threaten Its Acceptance and Utility”

nature medicine

Review article

<https://doi.org/10.1038/s41591-025-03697-5>

Health impacts of exposure to synthetic chemicals in food

Received: 7 February 2025

Jane Muncke¹✉, Mathilde Touvier², Leonardo Trasande^{3,4} & Martin Scheringer⁵

Accepted: 4 April 2025

iScience

CellPress
OPEN ACCESS

Perspective

Complementing global chemicals management through shaping consumer behavior

Brij Mohan Sharma,^{1,2,*} Jane Muncke,³ Justin M. Boucher,³ Lisa Zimmermann,³ Thomas A. Brunner,⁴ Poonam Arora,⁵ and Martin Scheringer^{1,2}

¹RECETOX, Faculty of Science, Masaryk University, Kotlarska 2, Brno, Czech Republic

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⁴Food Science and Management, School of Agricultural, Forest and Food Sciences (HAFL), Bern University of Applied Sciences (BFH), 3052 Zollikofen, Switzerland

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*Correspondence: brij.sharma@recetox.muni.cz

<https://doi.org/10.1016/j.isci.2025.112700>

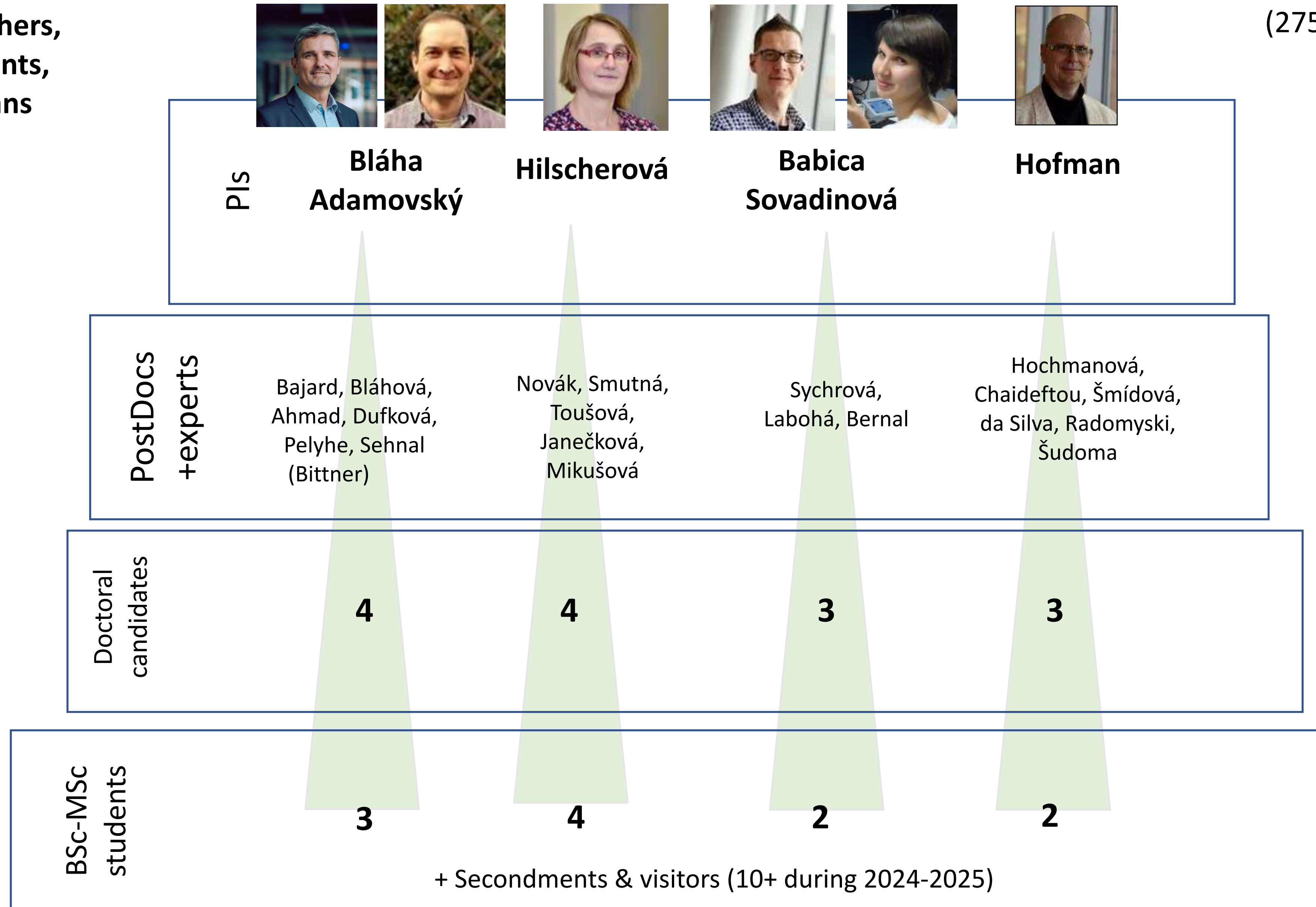
Environmental toxicology

4 Research groups

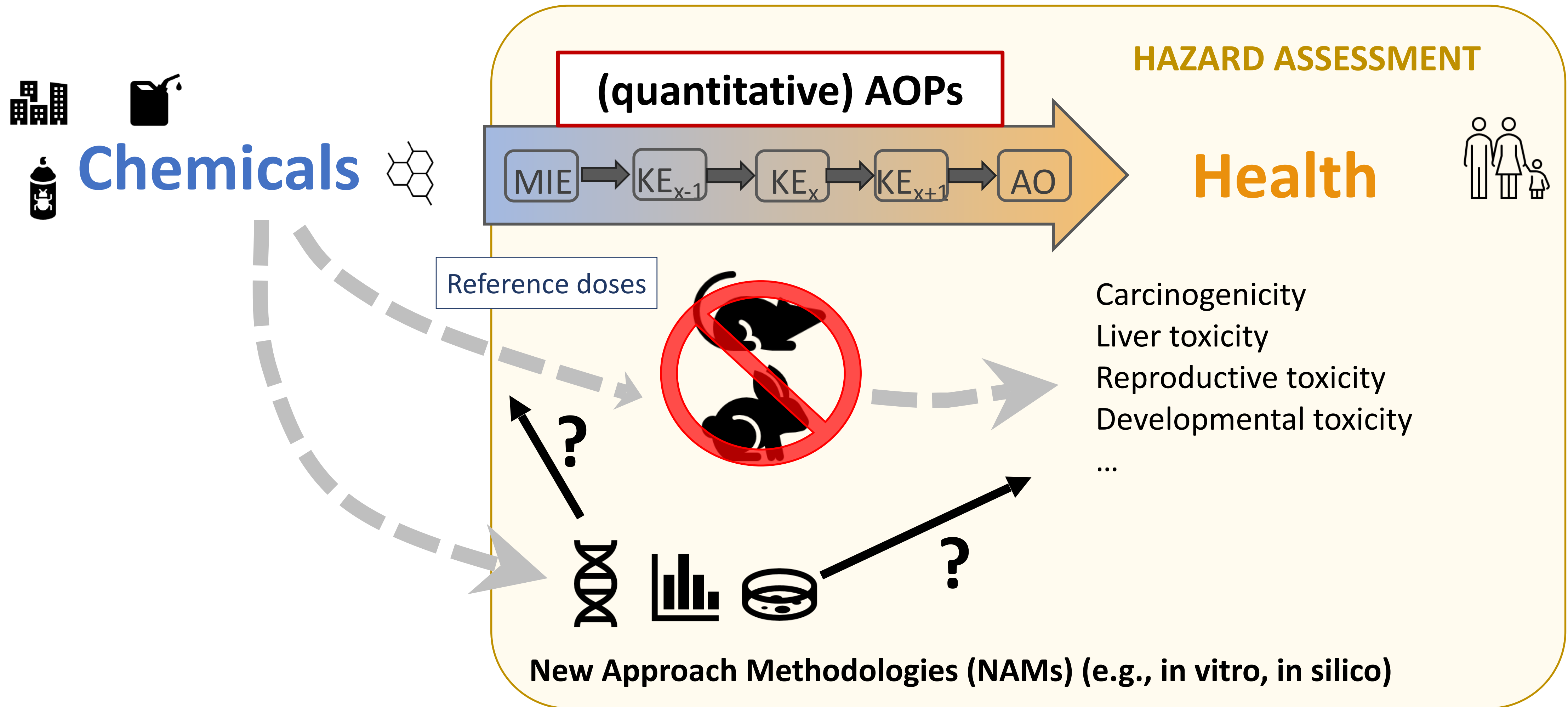
45 Researchers,
PhD students,
technicians

2024-2025

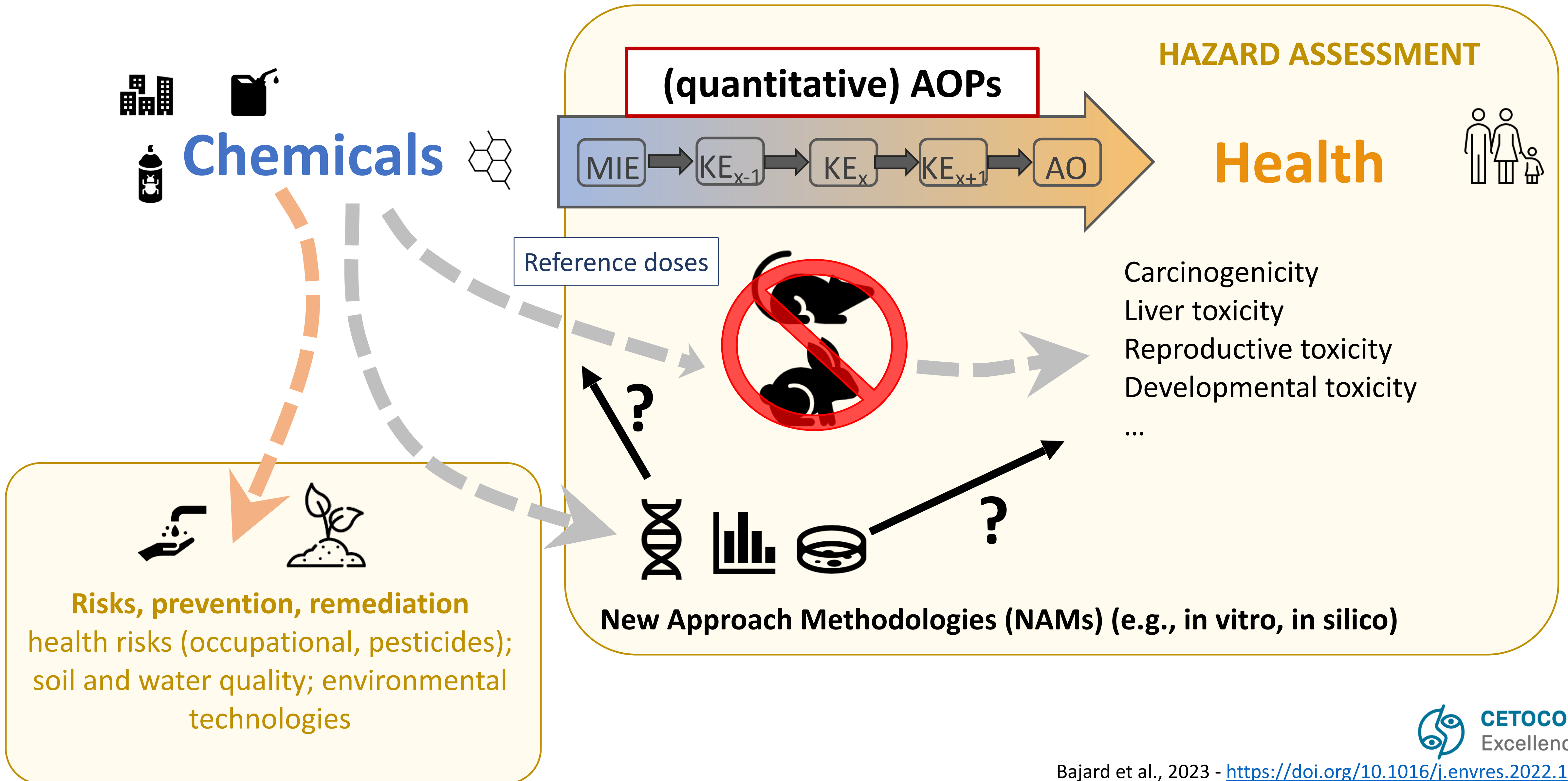
54 papers at WoS
(275 citations w/o self-cite)



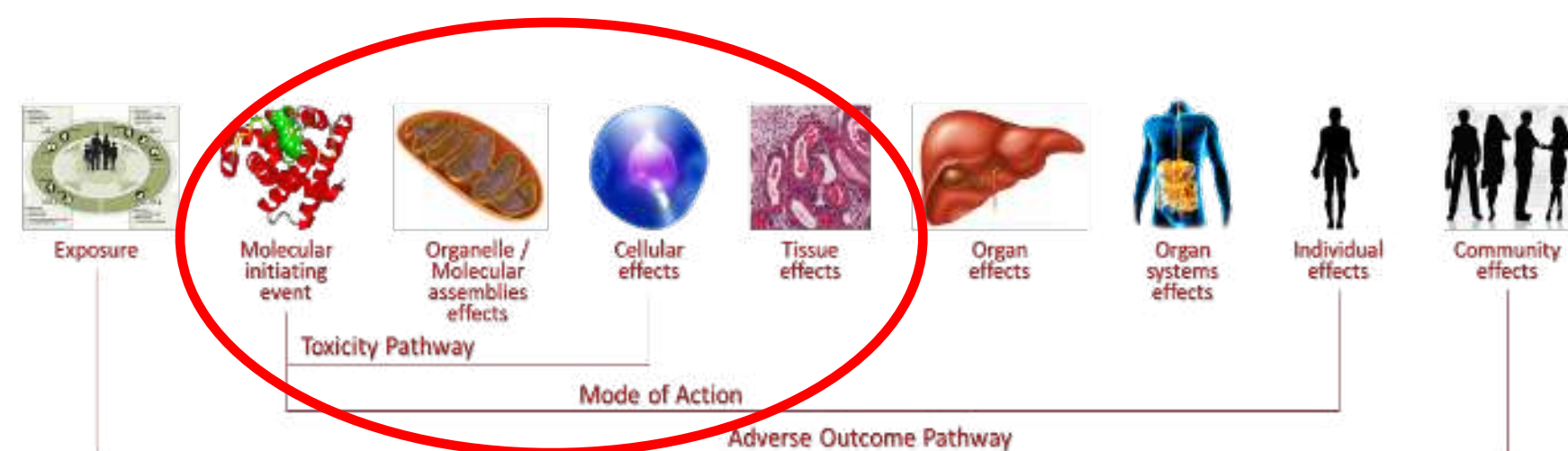
How to (quantitatively) predict toxic effects from NAMs data?



How to (quantitatively) predict toxic effects from NAMs data?



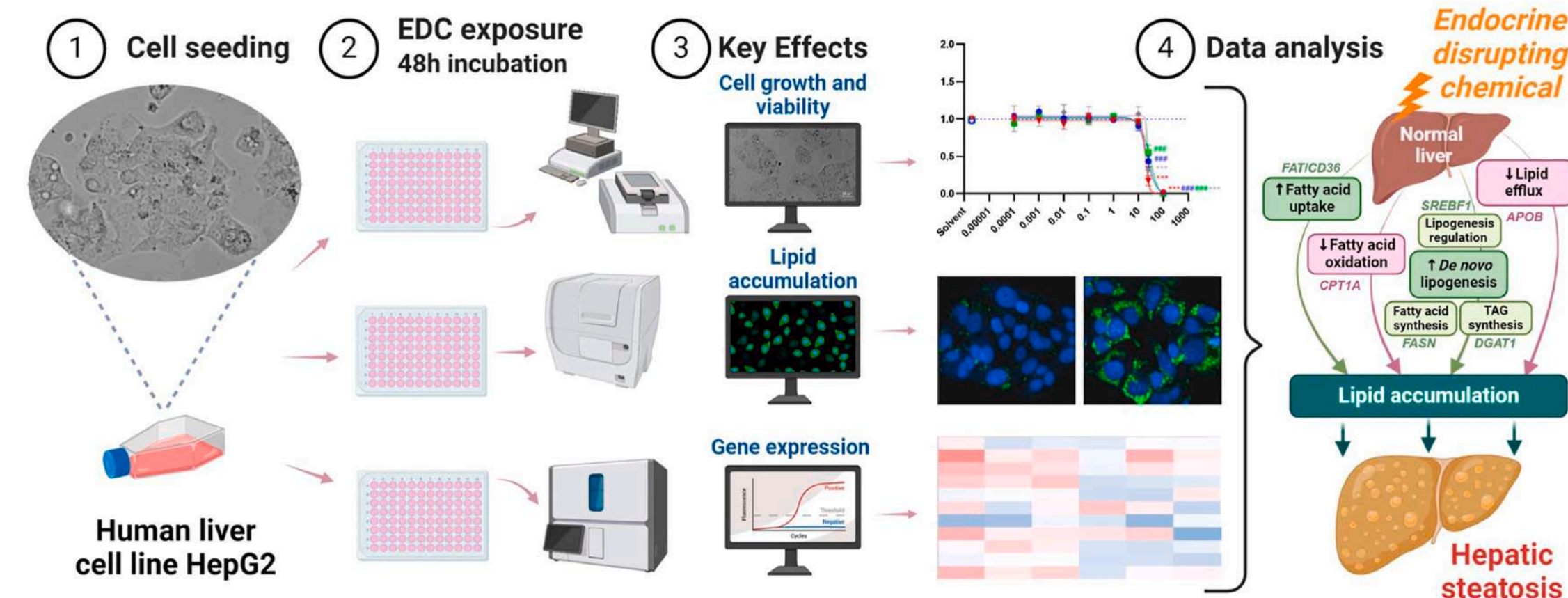
NAMs and toxicity mechanisms



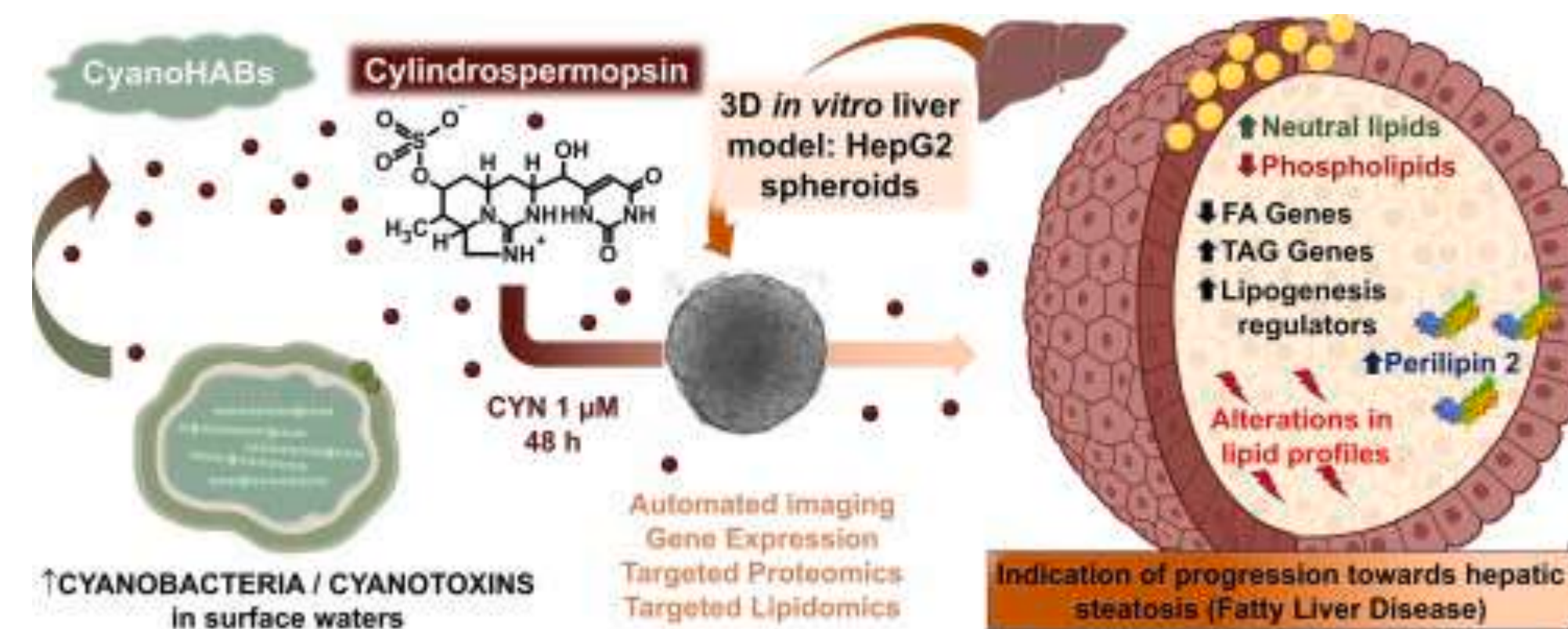
Pavel Babica and Iva Sovadinová

2025-2025

- 9 WoS papers (24 citations / excl. self-citations)
- Grants from GAČR (National Science Foundation), Viszegrad Fund (Cyanometa), IFER International Foundation for Ethical Research, HEU (PARC WP5+6)
- **International Stakeholder NETwork (ISTNET) on the road map for Developmental and Reproductive Toxicity (DART)**

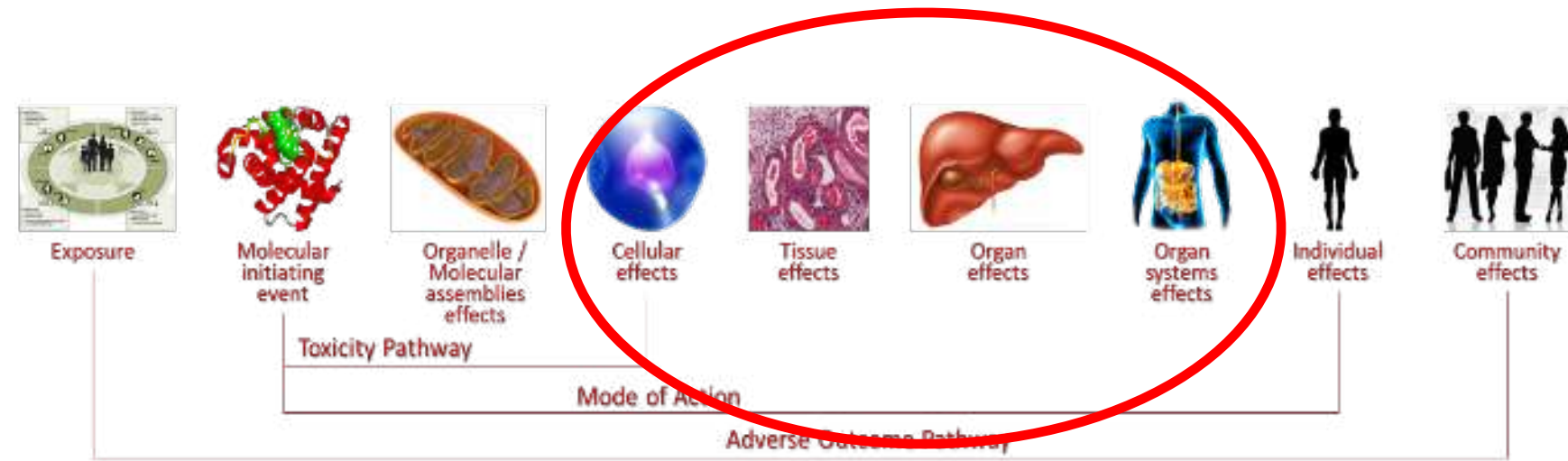


<https://doi.org/10.1016/j.fct.2025.115241>



<https://doi.org/10.1016/j.cbi.2024.111046>

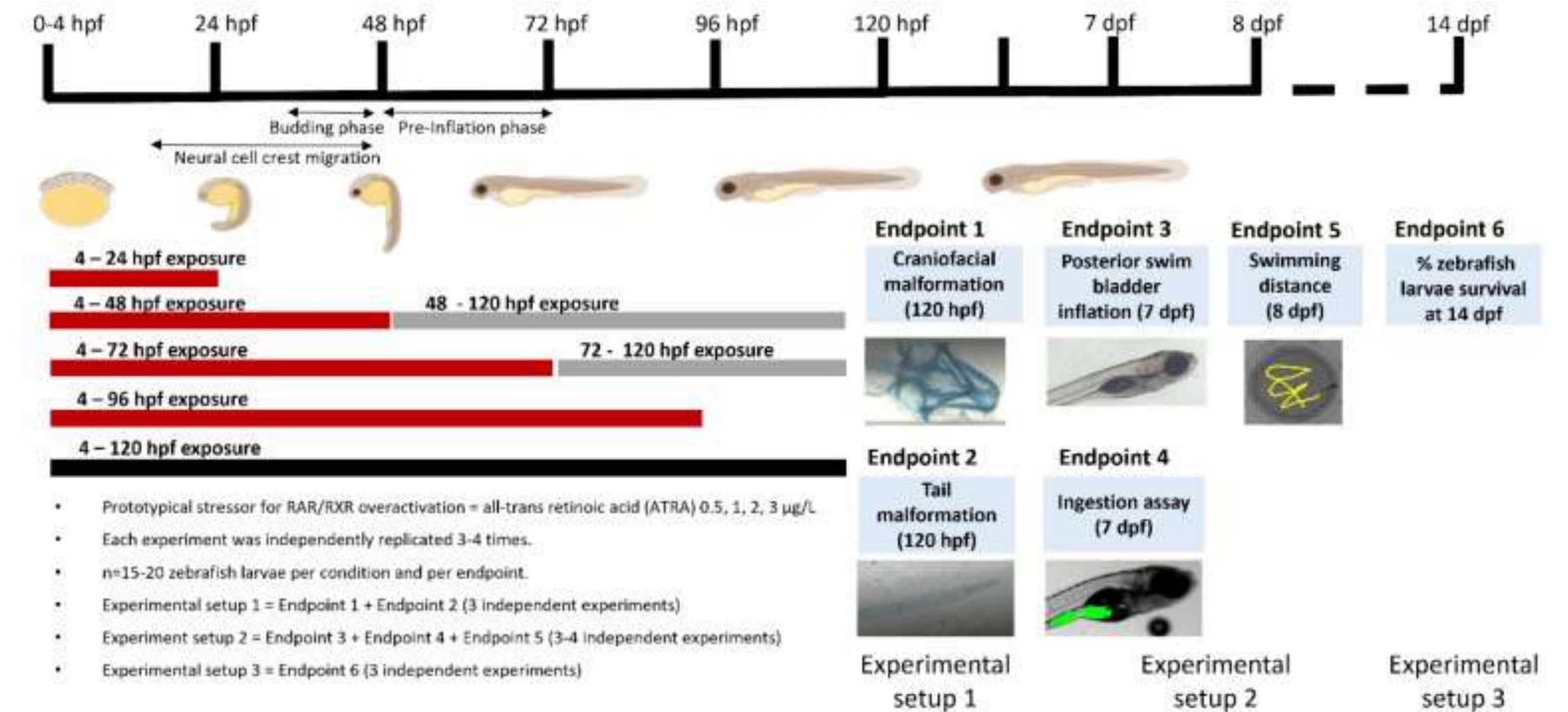
AOPs beyond priority outcomes: neurodevelopment



Klára Hilscherová

2024-2025

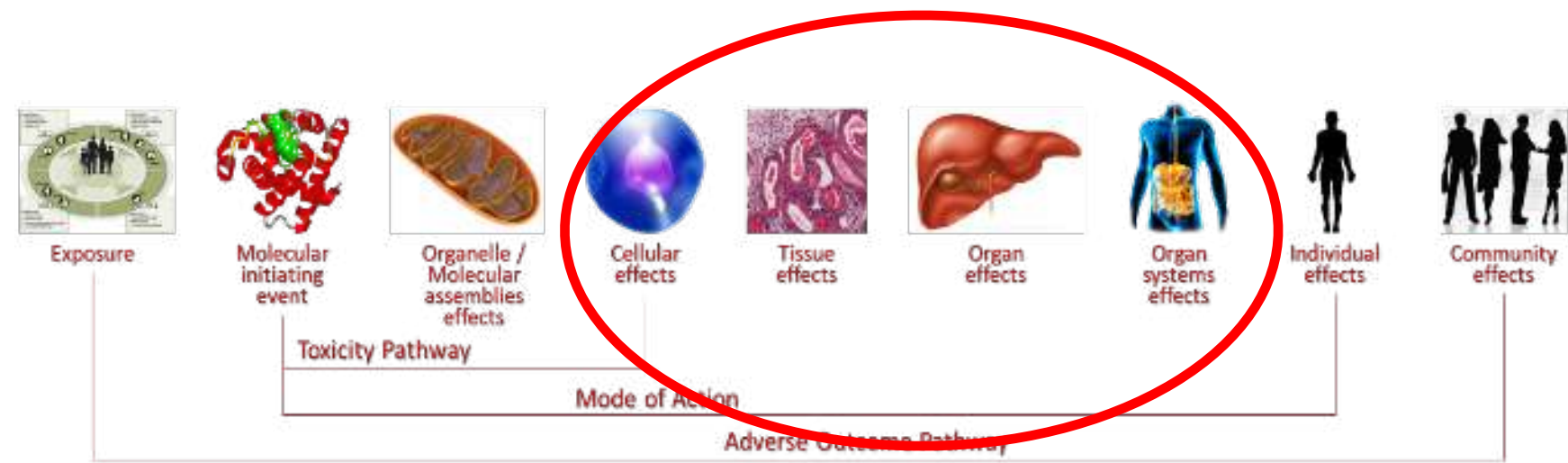
- 13 WoS papers
- Prestigious GAČR Expro grant (National Science Foundation), HEU (PARC, INQUIRE, ENDOMIX)
- **ThD assays for ECHA / EFSA use; the OECD Thyroid Disruption Expert Group**



<https://doi.org/10.1016/j.aquatox.2024.107143>

AOPs beyond priority outcomes: neurodevelopment

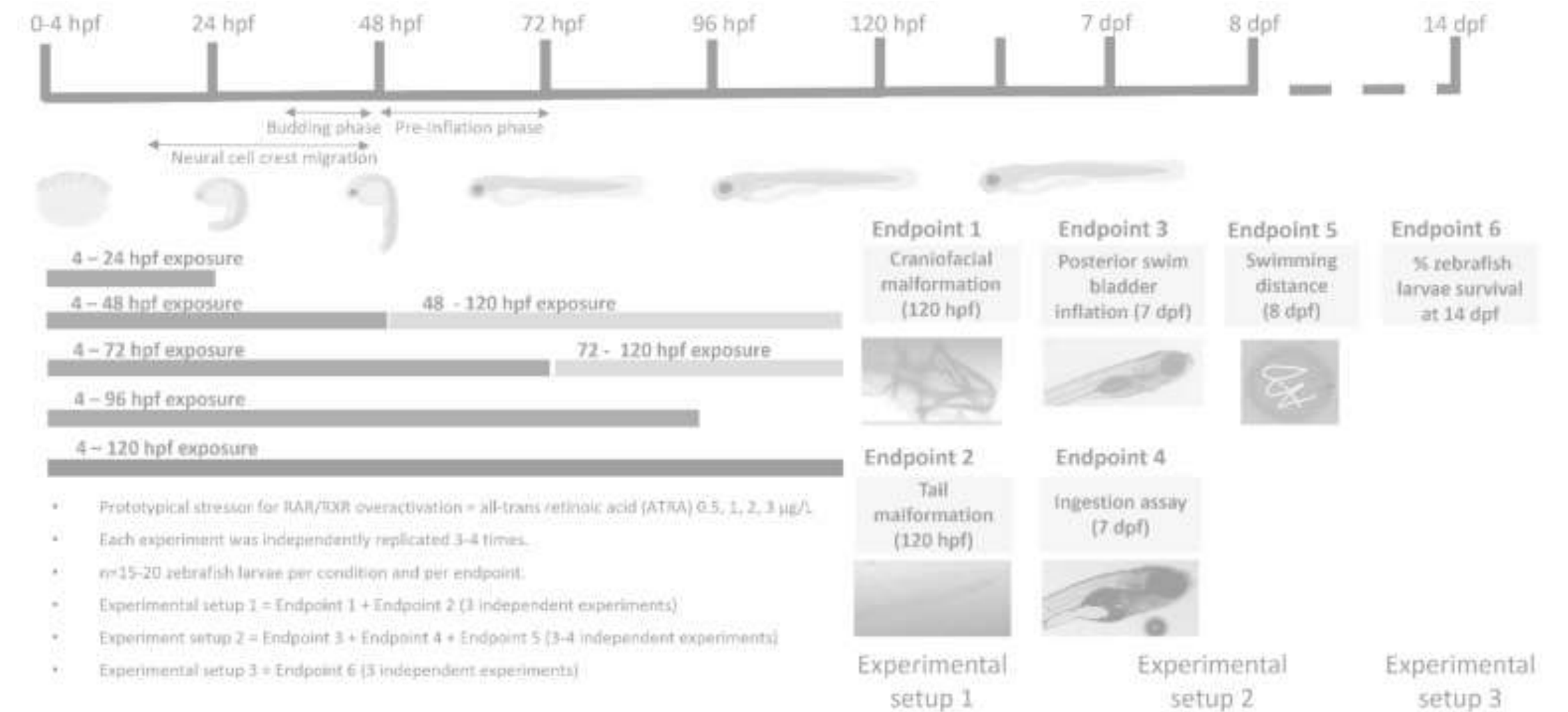
NAMs for effect-based environmental monitoring



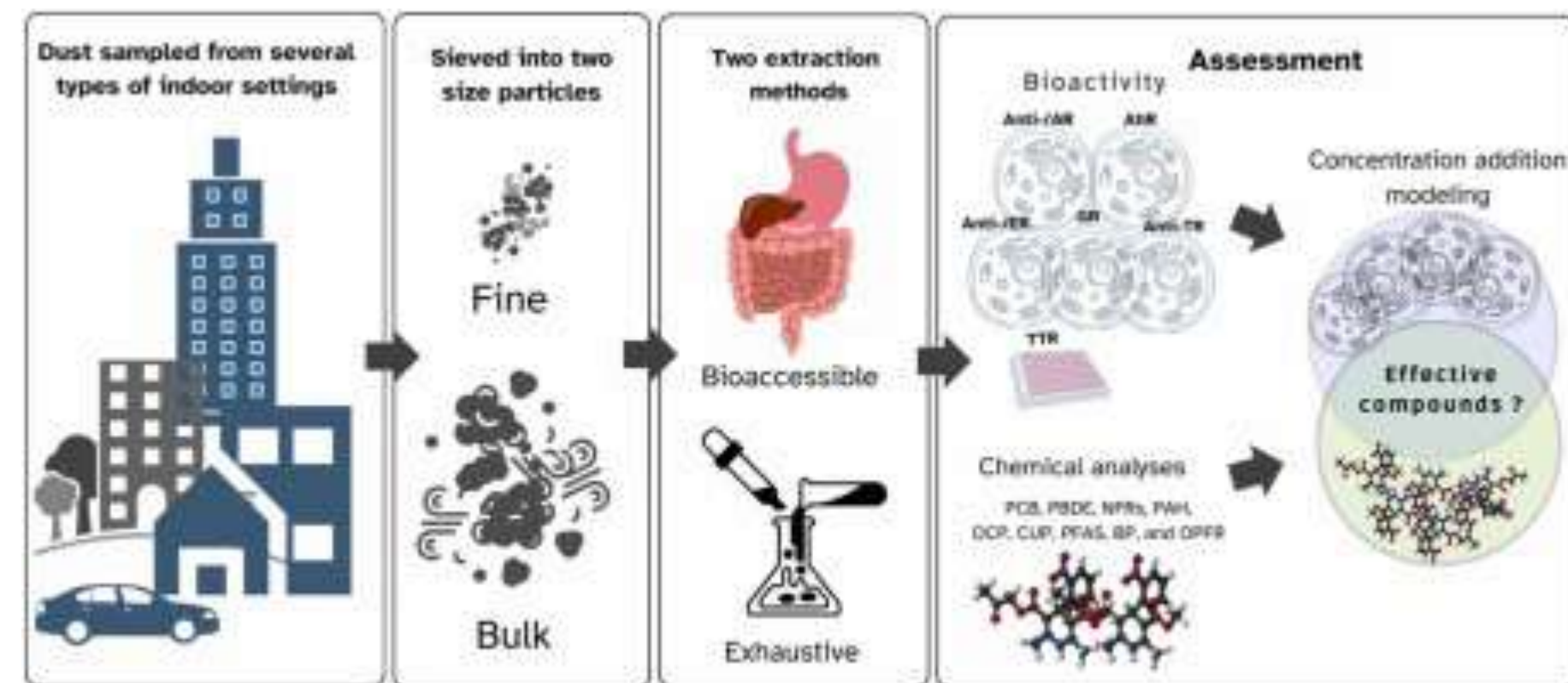
Klára Hilscherová

2024-2025

- 13 WoS papers
- Prestigious GAČR Expro grant (National Science Foundation), HEU (PARC, INQUIRE, ENDOMIX)
- ThD assays for ECHA / EFSA use; the OECD Thyroid Disruption Expert Group

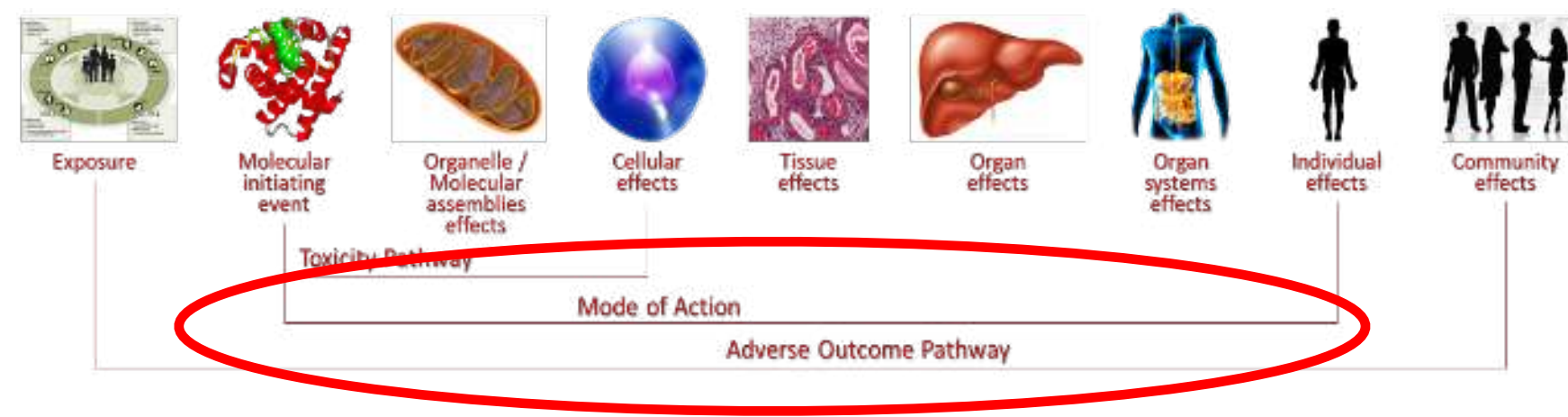


<https://doi.org/10.1016/j.aquatox.2024.107143>



<https://doi.org/10.1016/j.jhazmat.2024.133978>

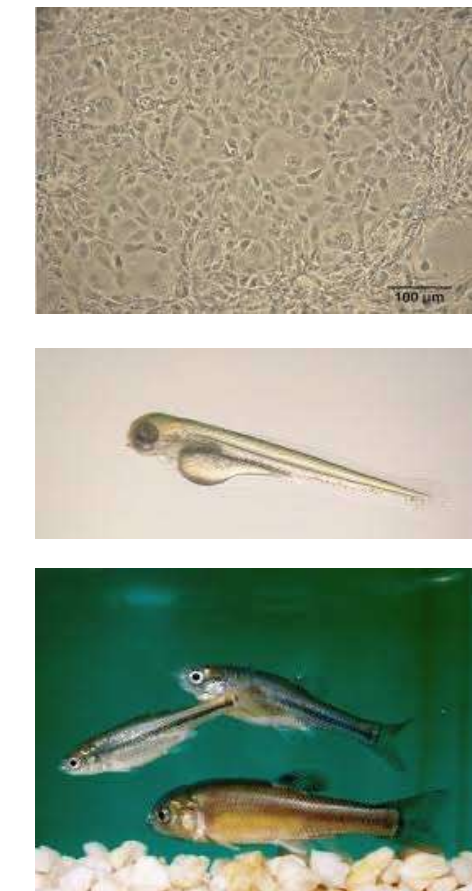
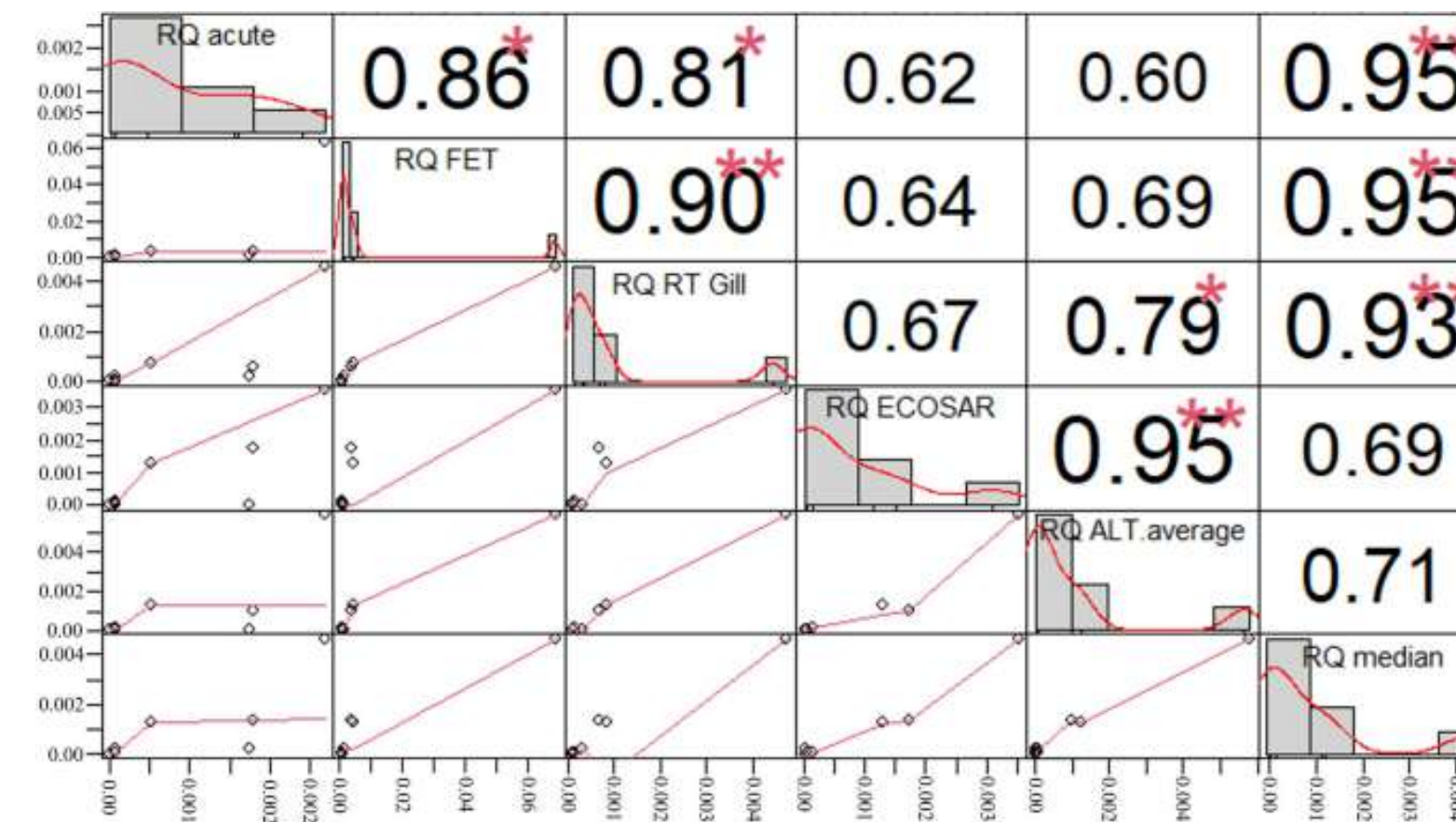
Advancing NAMs and AOPs for Risk Assessment



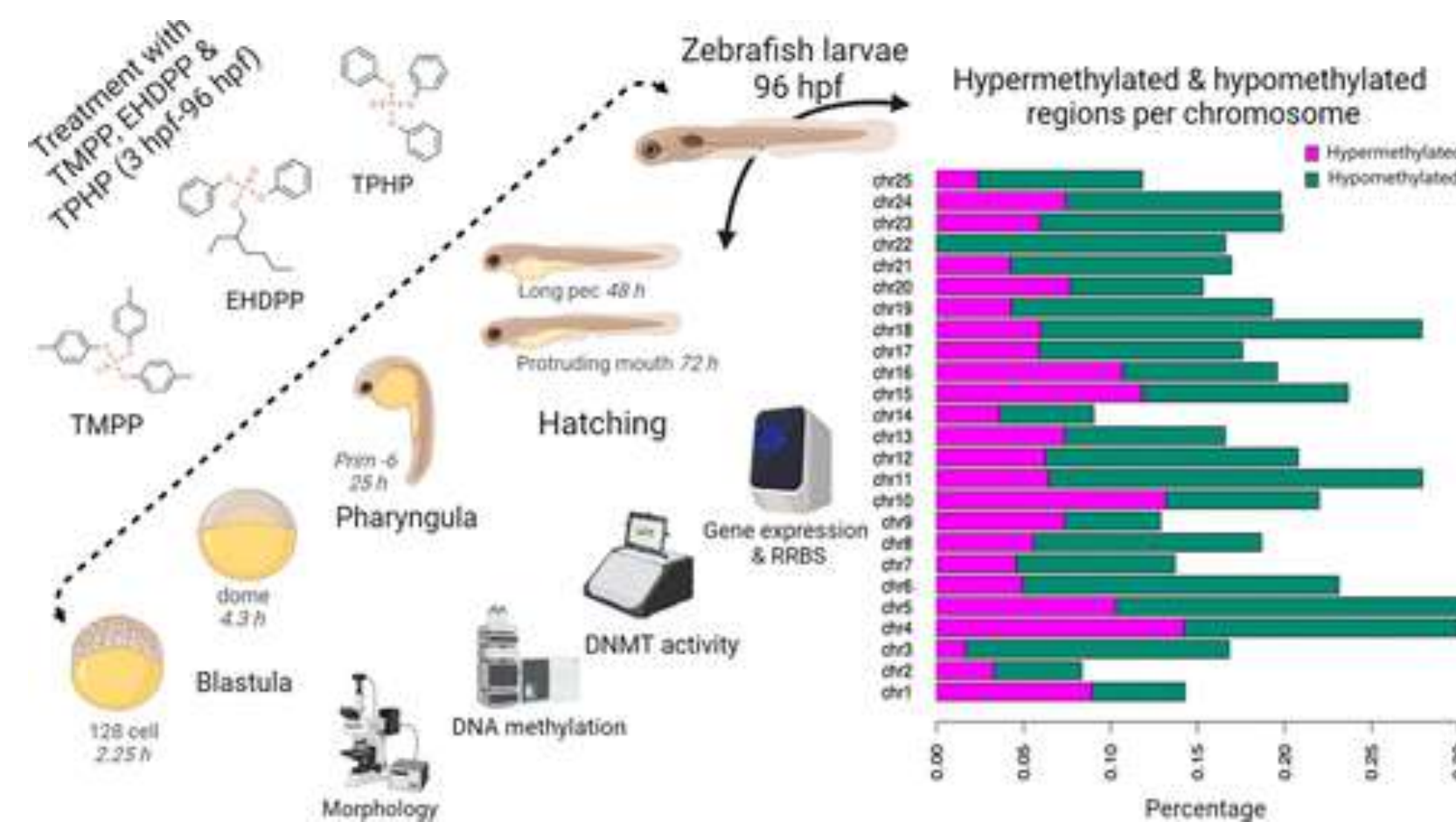
Luděk Bláha

2024-2025

- 10 WoS papers
- HEU (PARC), Applied grants (AZV, TAČR 3x, OP TAK), Japan CONCERT project (InLEDApp)
- **OECD AOPs group, PARC Toxicology**

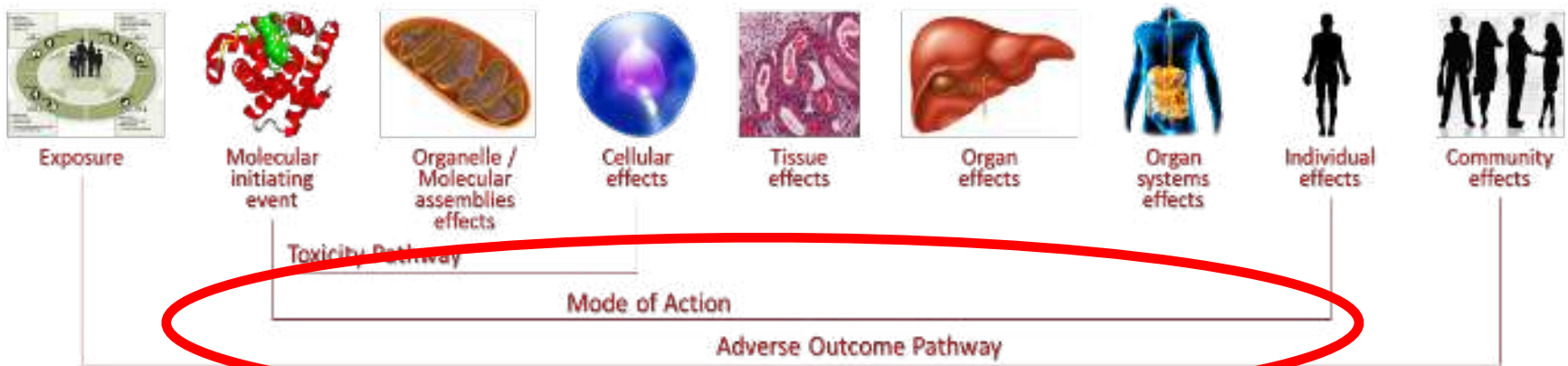


<https://enveurope.springeropen.com/articles/10.1186/s12302-024-01015-3>



<https://pubs.acs.org/doi/10.1021/acs.chemrestox.4c00223>

Gene – Environment – Health Interactions



Ondřej Adamovský

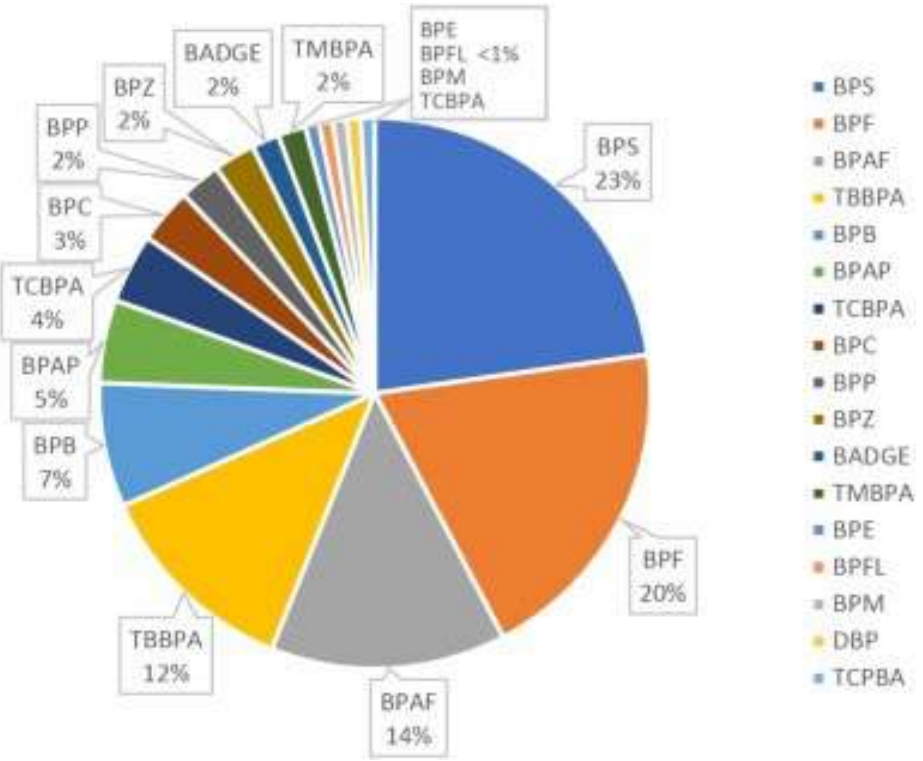
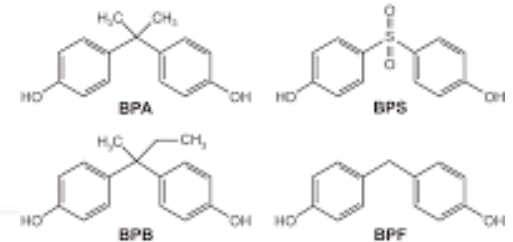
2024-2025

- 6 WoS papers (52 citations / excl. self-citations)
- Grants from GAČR (National Science Foundation), EU – PHERITALE, PARC, MSCA IF – EPIC
- **WP5 Task Leader – BPA Alternatives**

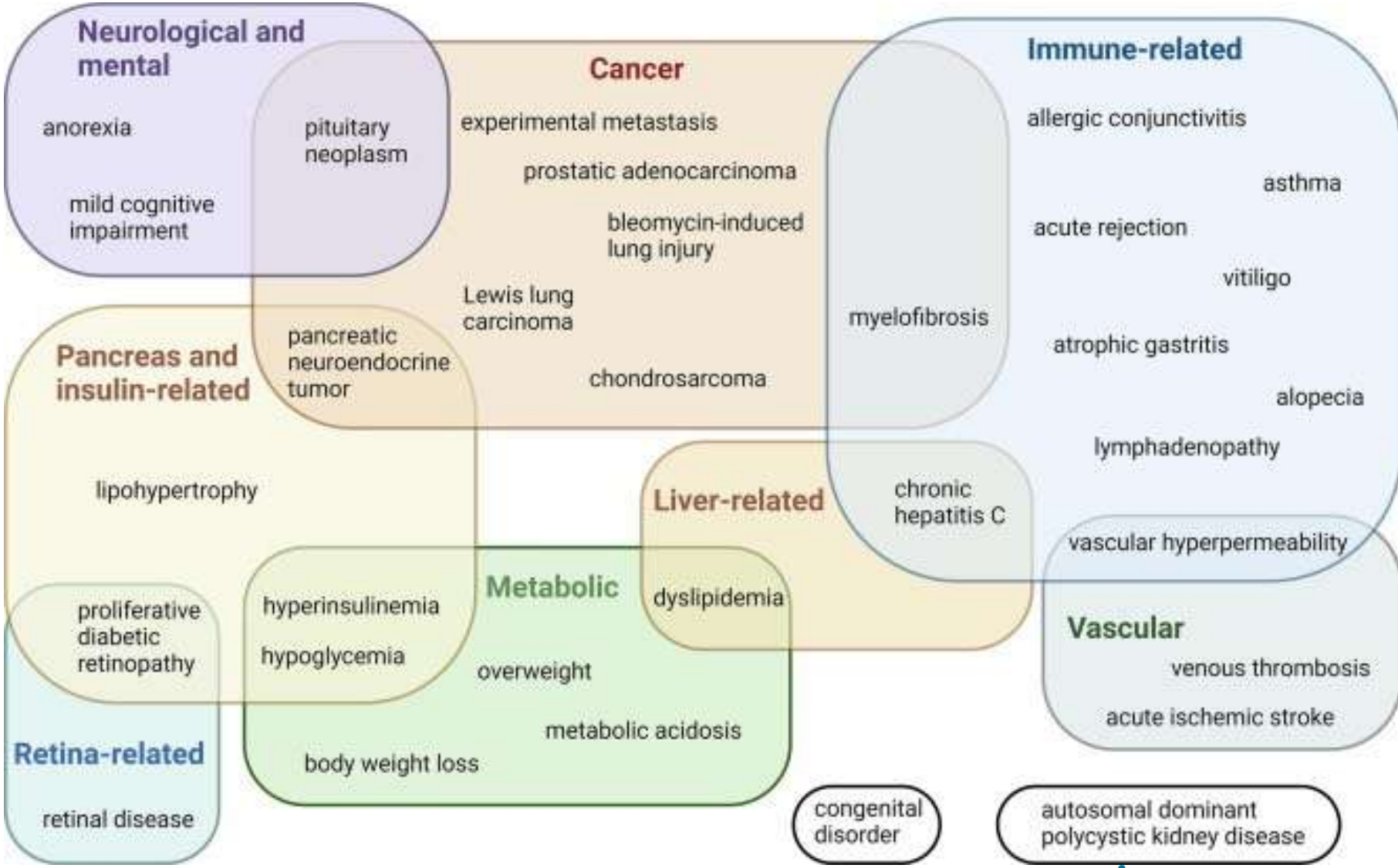
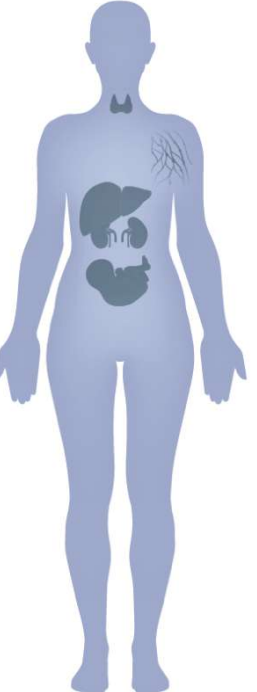
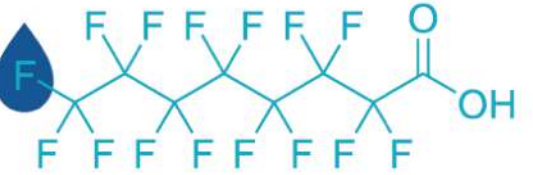
Environment International
Volume 189, July 2024, 108728

Review article
Exploring BPA alternatives – Environmental levels and toxicity review

Ondrej Adamovsky ^a, Ksenia J. Groh ^b, Anna Biatk-Bielińska ^c, Beate I. Escher ^d, R. Beaudouin ^e, Liadys Mora Lagares ^f, Knut Erik Tollefsen ^g, Martina Fenske ^h, Ewa Mulkiwicz ^c, Nicolas Creusot ⁱ, Anita Sosnowska ^j, Susana Loureiro ^k, Jonny Beyer ^g, Guillermo Repetto ^l, Alja Štern ^m, Isabel Lopes ^k, Marta Monteiro ^k, Andrea Zikova-Kloas ⁿ, Tina Eleršek ^m, Marjan Vračko ^f, Szymon Zdybel ^j, Tomasz Puzyn ^j, Weronika Koczur ^c, Jane Ebsen Morthorst ^p, Henrik Holbech ^p, Gunnar Carlsson ^q, Stefan Örn ^q, Óscar Herrero ^r, Ayesha Siddique ^s, Matthias Liess ^t, Georg Braun ^d, Vanessa Srebny ^d, Bojana Žegura ^m, Nathalie Hinfray ^u, François Brion ^v, Dries Knapen ^v, Ellen Vandeputte ^v, Evelyn Stinckens ^v, Lucia Vergauwen ^v, Lars Behrendt ^w, Maria João Silva ^x, Ludek Blaha ^a, Katerina Kyriakopoulou ^z



<https://doi.org/10.1016/j.envint.2024.108728>



<https://doi.org/10.1016/j.envint.2024.108879>



Soil Environmental Chemistry and Toxicology



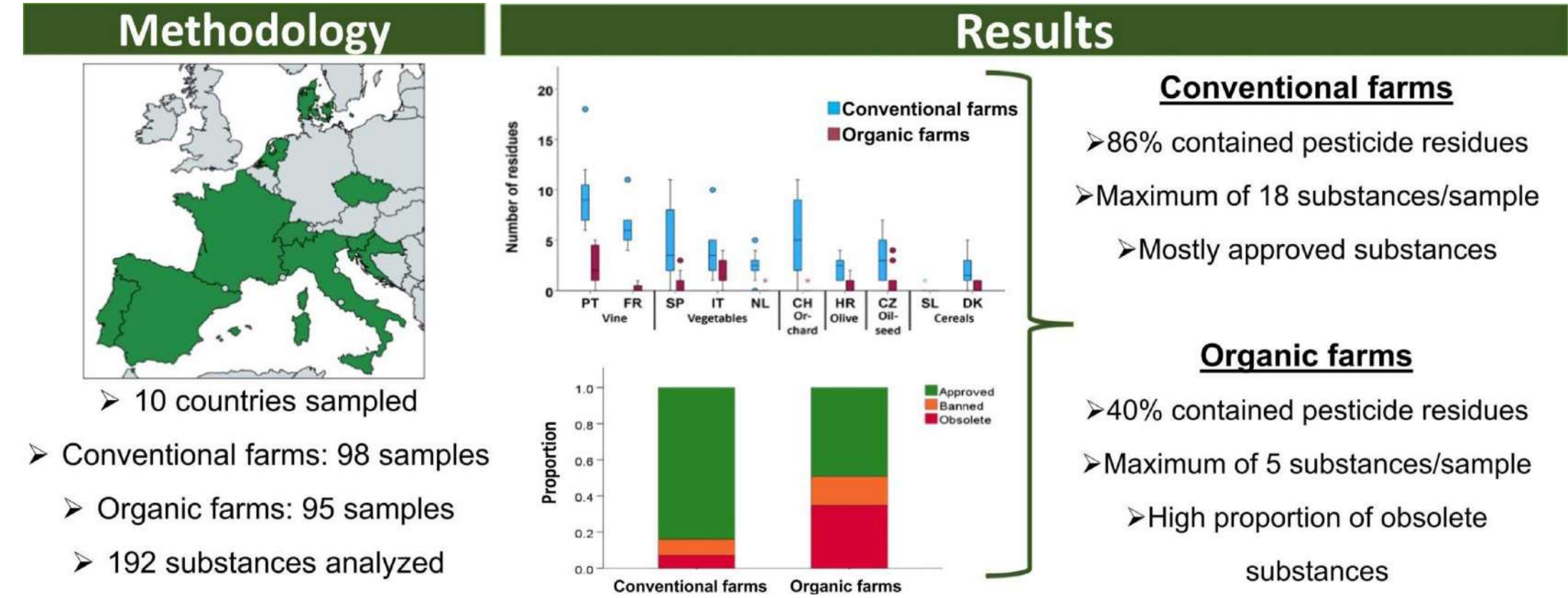
Jakub Hofman



Journal of Hazardous Materials
Volume 495, 5 September 2025, 139113

Occurrence of pesticide residues in harvested products of various crops from European conventional and organic farming systems

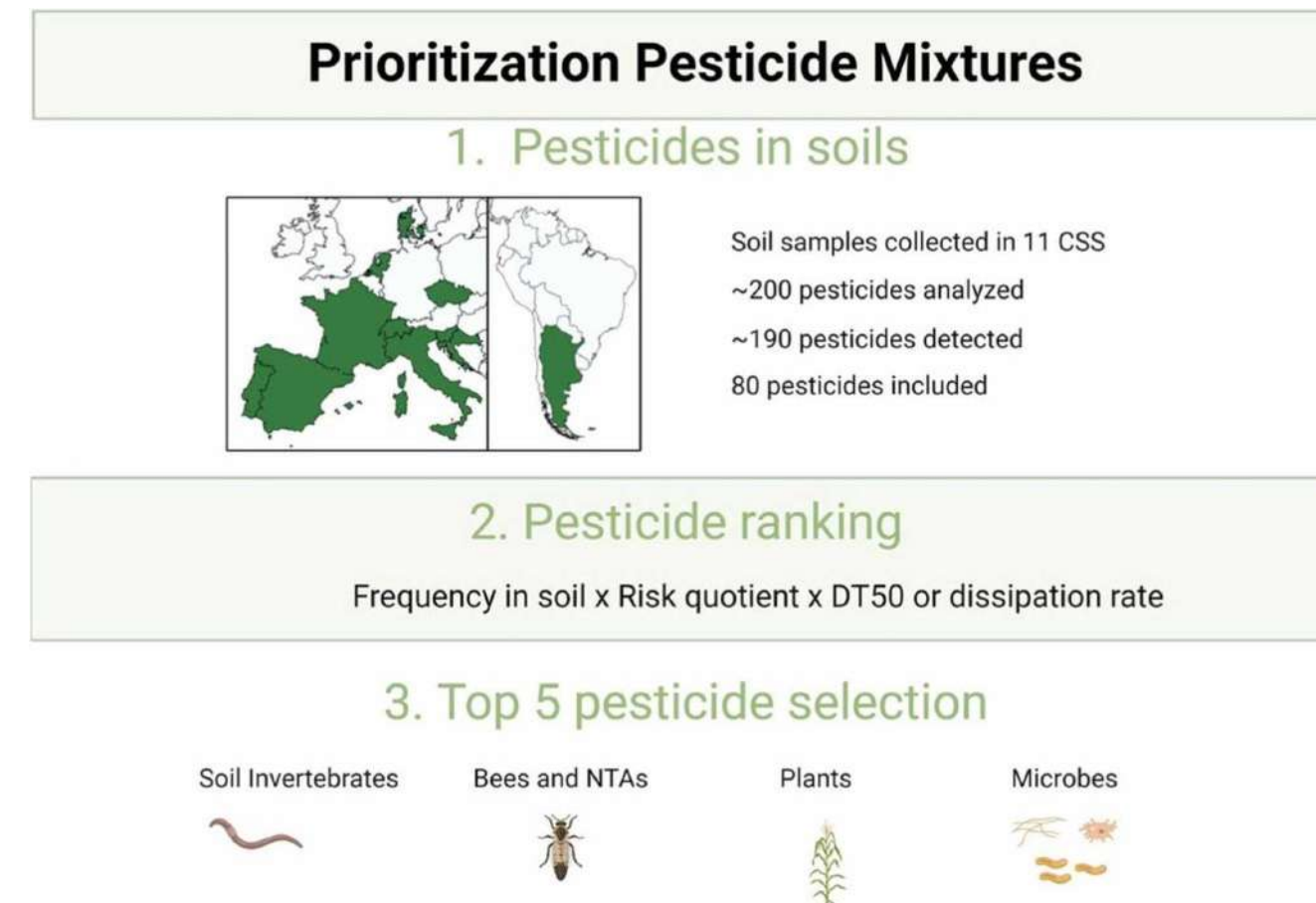
Paula S. Tourinho^a, Zuzana Hochmanová^a, Petr Kukučka^a, Martina Hronová^a, Marek Šudoma^a, Shiva Sabzevari^a, Francisco Alcón^b, Josefina Contreras^b, Nelson Abrantes^c, Isabel Campos^d, Isabelle Baldi^e, Mathilde Bureau^e, Abdallah Alaoui^f, Florian Christ^f, Daniele Mandrioli^g, Daria Sgargi^g, Igor Pasković^h, Marija Polić Pasković^h, Matjaž Glavanⁱ, Paula Harkes^j,...
Jakub Hofman^a ✉



<https://doi.org/10.1016/j.jhazmat.2025.139113>

2024-2025

- 18 WoS papers
- EU projects PAPHILLONS, BENCHMARKS, SPRINT, SOILPROM
- (Inter)national bodies on RA of plant protection products



<https://doi.org/10.1016/j.jhazmat.2025.138942>

Exposure and Health Risk Assessment Group (EHRA)

- **PI**

- Pavel Čupr

- **Post-docs**

- Ondřej Mikeš

- Tomáš Janoš

- Kateřina Snopková

- **PhD students**

- Soňa Skřídlová

- Petr Gregor

- Michal Maliszewski

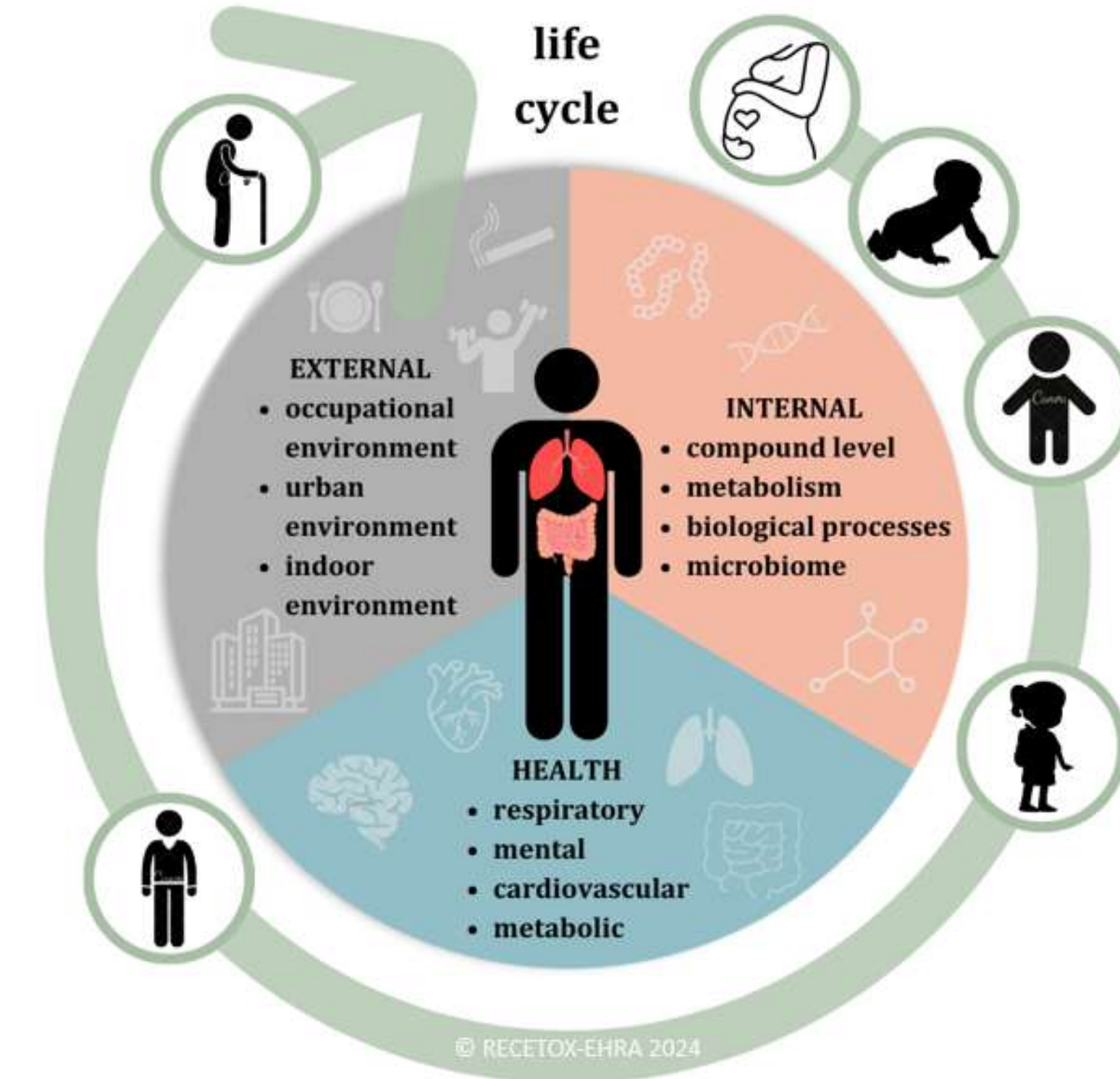
- Markéta Průšová

- Aneta Vrzalová



Exposure and Health Risk Assessment - Research

- Main aim: **EXPOSOME approach** as a tool for assessing the health outcomes
- **COHORTS/STUDIES:** Assessment of internal biomarkers of effect (DNA damages *in vivo*, DNA methylation, EPI markers, Thyroid and Liver Health effects, oxidative stress and related potential health risks)
- **New NEURO-degenerative cohort** – PD Parkinson diseases and dementia
- **Chemical mixture assessment + Modelling their toxicokinetic pathways** in the human body for exposure reconstruction
- Assessment of **External Exposome** – by geocoding and GIS spatial analysis
- Assessment of potential **relationship between external exposure and selected health outcomes** (pulmonary diseases - asthma, bronchitis).
- **Oncological research:** external exposome and cancer incidences



**RECETOX research infrastructure
see EIRENE slides 52-63 and 76-85**

Partnership for the Assessment of the Risks from Chemicals

SANDERS Pascal

PARC Coordinator

Geneva, 2025/04/30

PARC



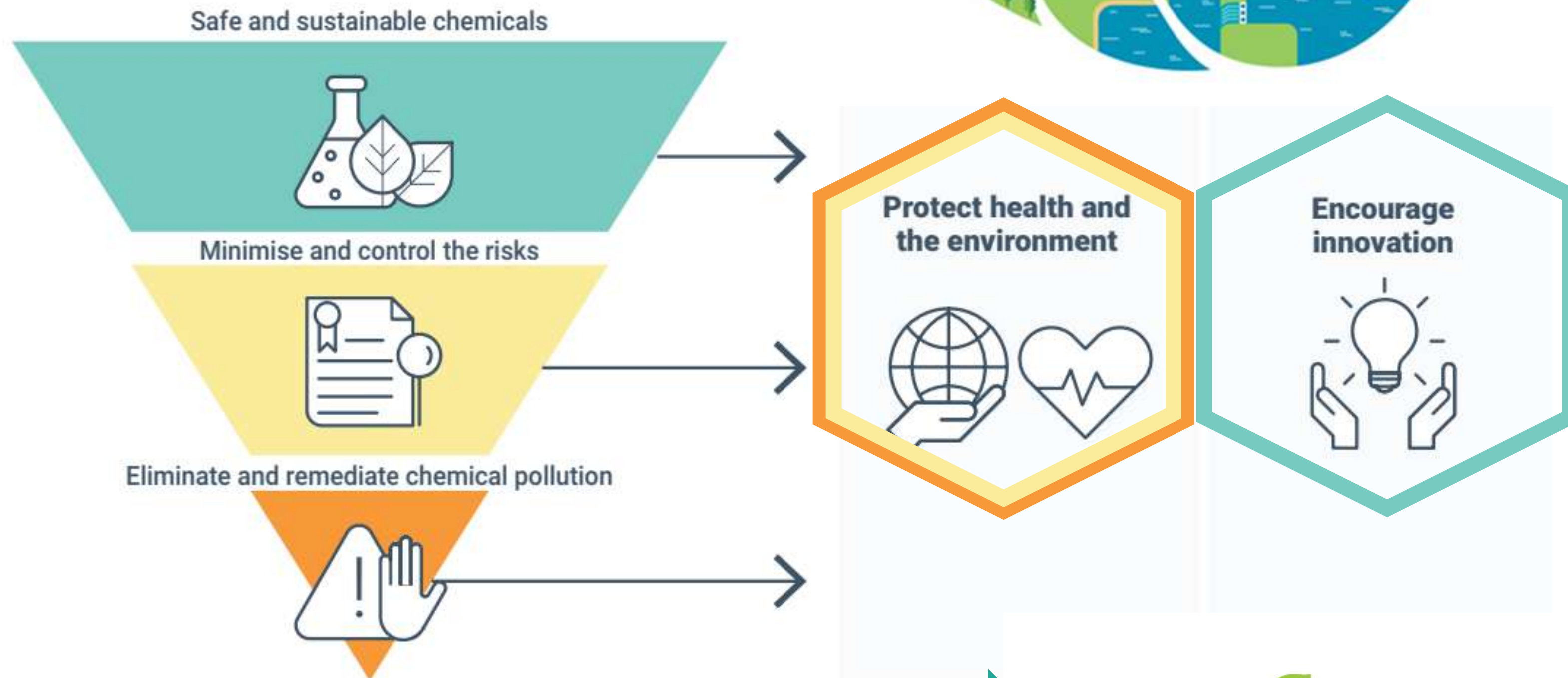
Co-funded by
the European Union

Chemicals Strategy for Sustainability towards toxic-free environment



2 Overarching Goals

- Preventing harm to people and the planet from hazardous chemicals and their toxic effects
- Supporting EU Industry in the production of safe and sustainable chemicals



Pollution Action Plan
Towards zero pollution for air, water and soil

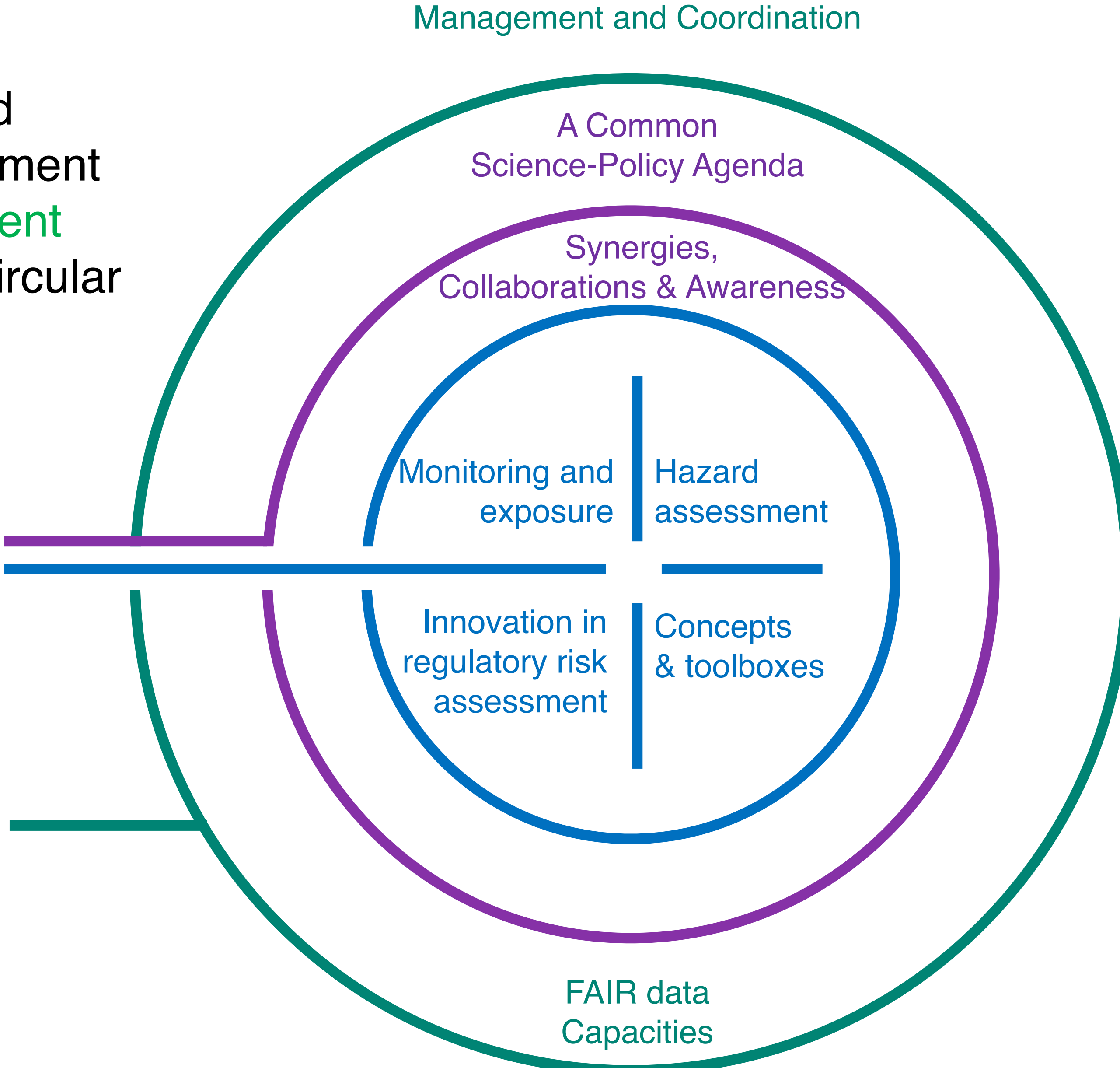


Global Objective

Consolidate and strengthen the EU's research and innovation (R&I) capacity for chemical risk assessment (CRA) to protect **Human Health** and the **Environment** and contribute to a non-toxic environment and a circular economy.

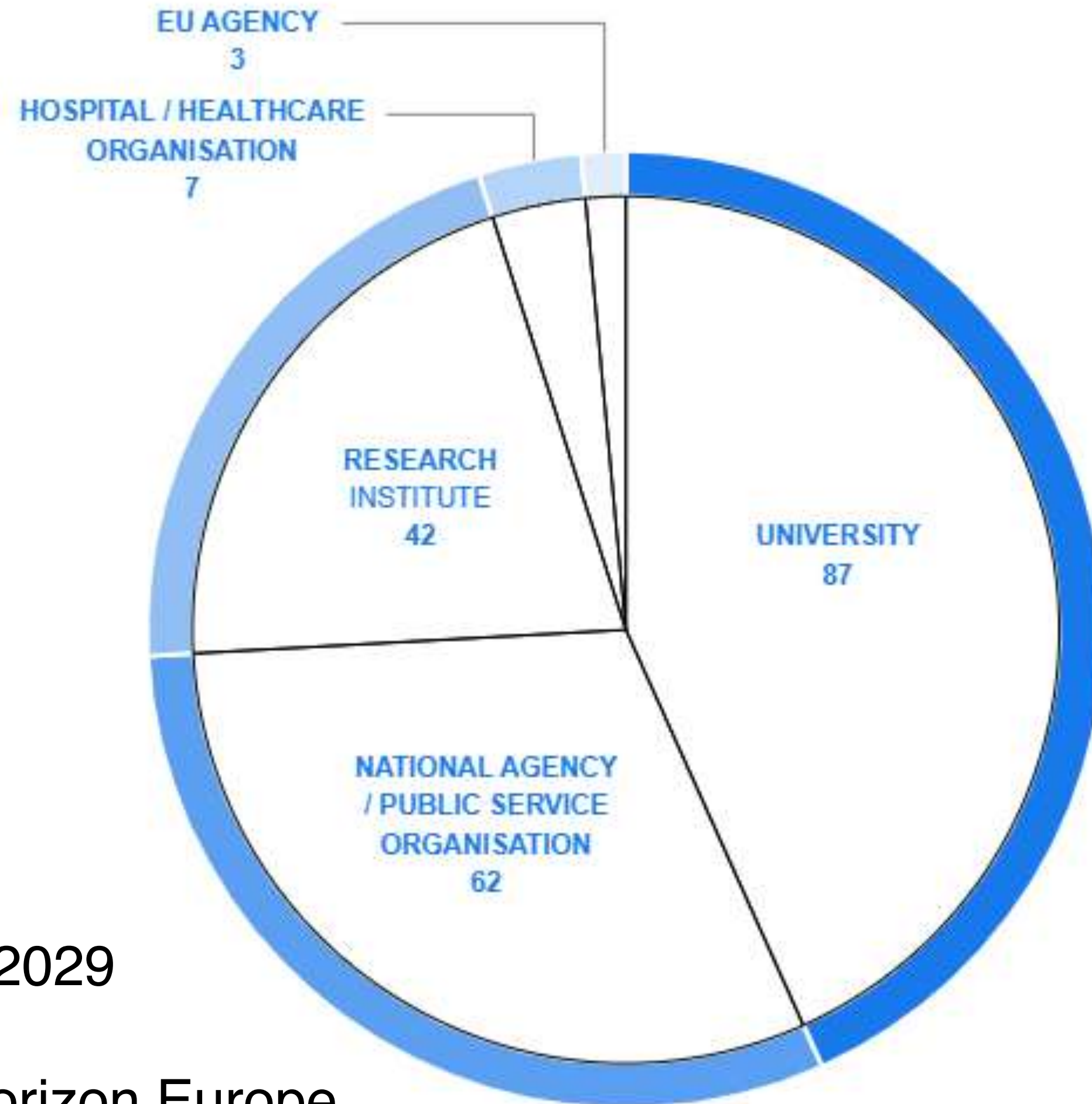
Specific Objectives

- To establish **a cross-disciplinary network** to set priorities for R&I in chemical risk assessment
- To carry out a **joint R&I programme** to respond to the agreed priorities in Chemical Risk assessment.
- To provide **access to the R&I capacities** required to implement innovative CRA

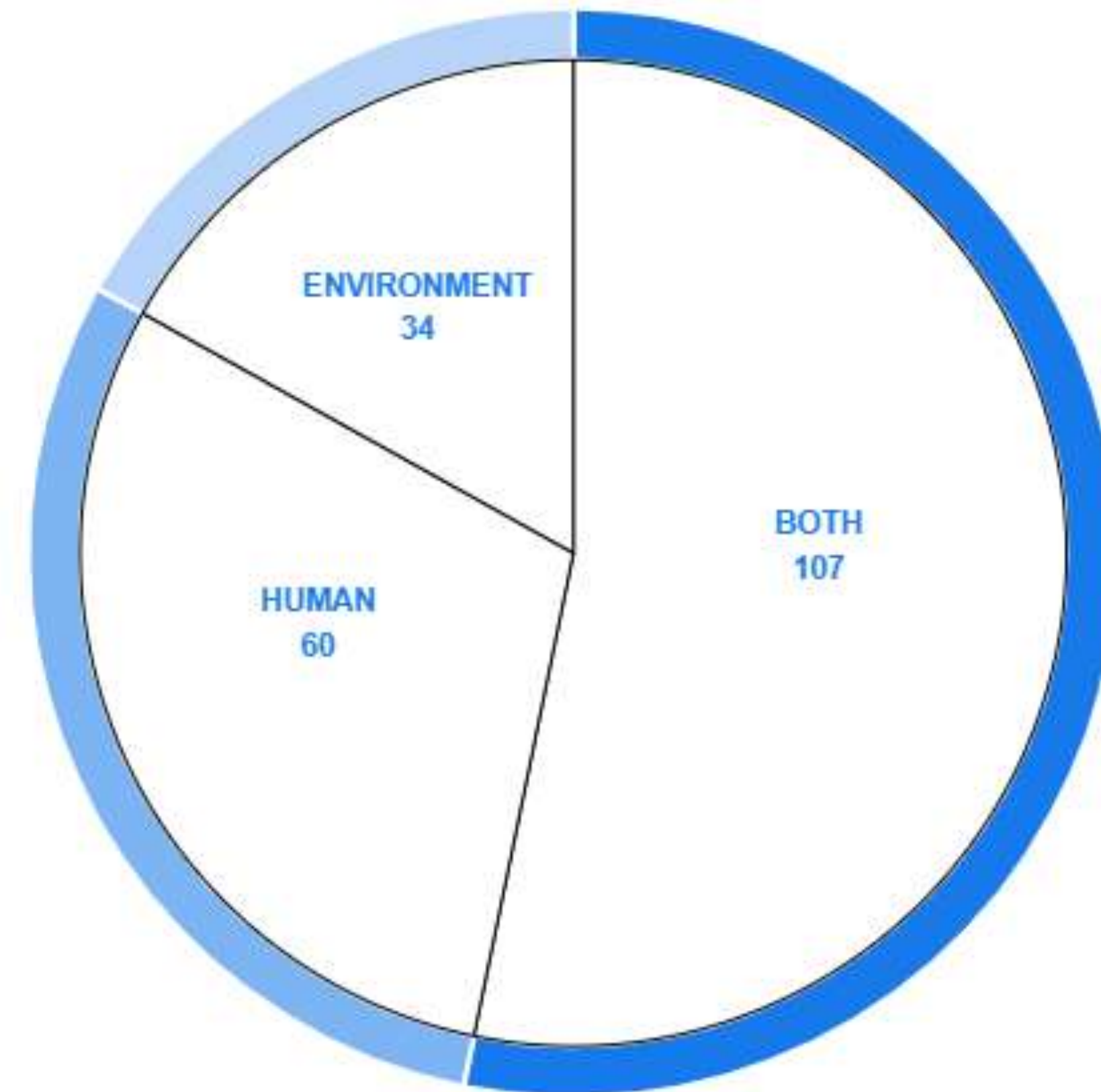


201 Partners

29 Countries

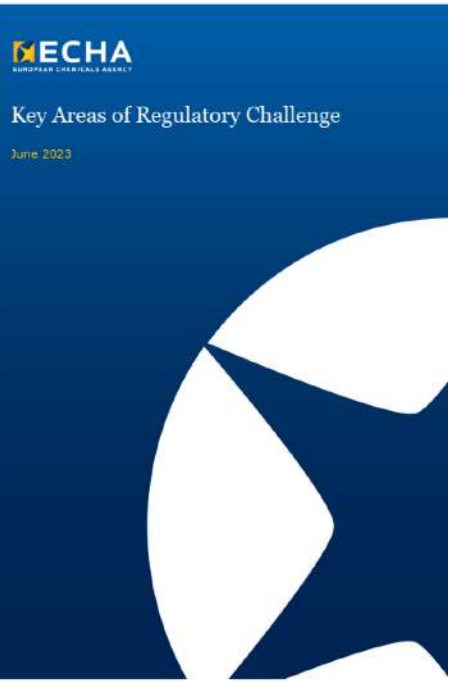


Domains



7 Years
05/2022-04/2029
400 M€
50/50 MS/Horizon Europe

PARC Governance and Impact



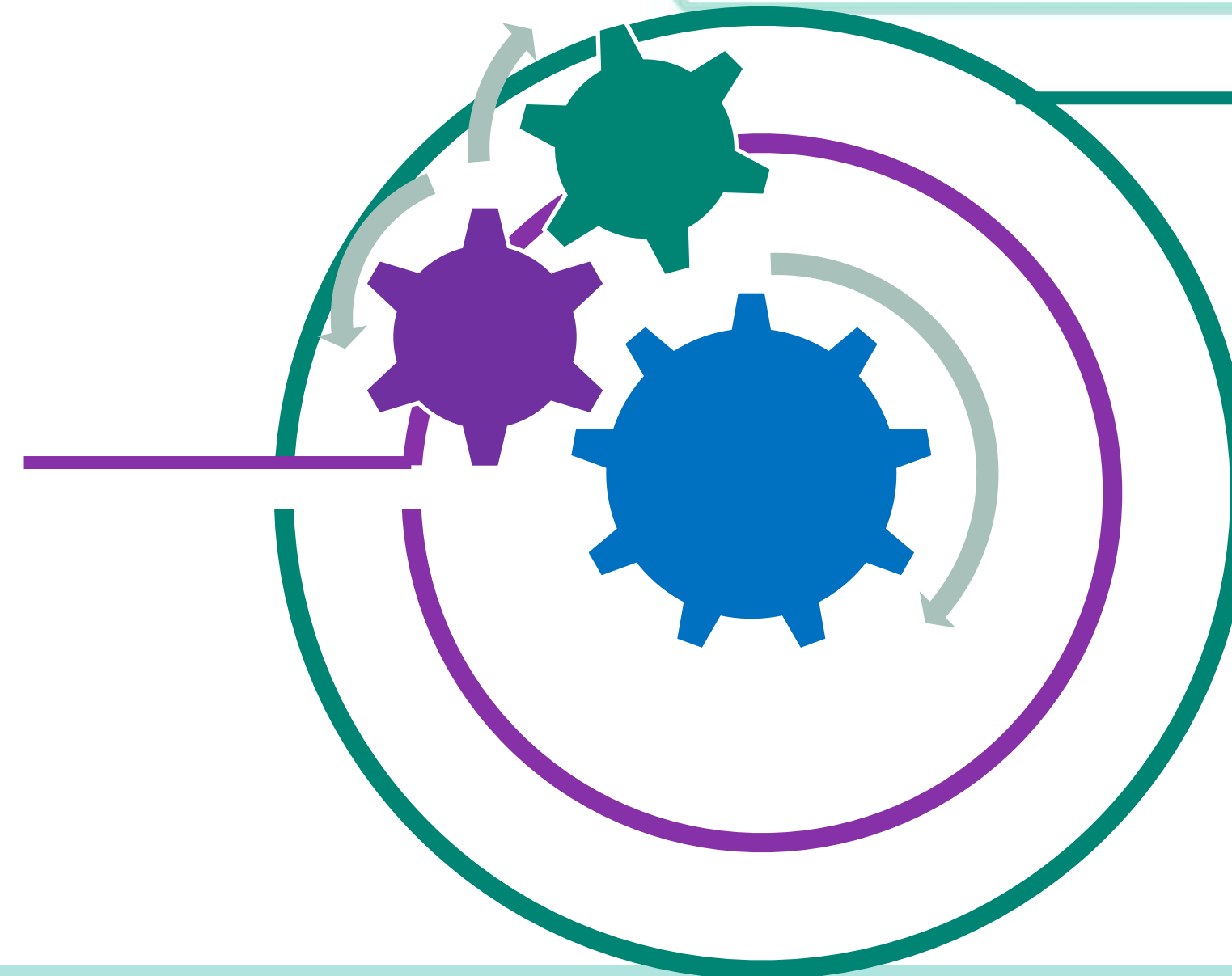
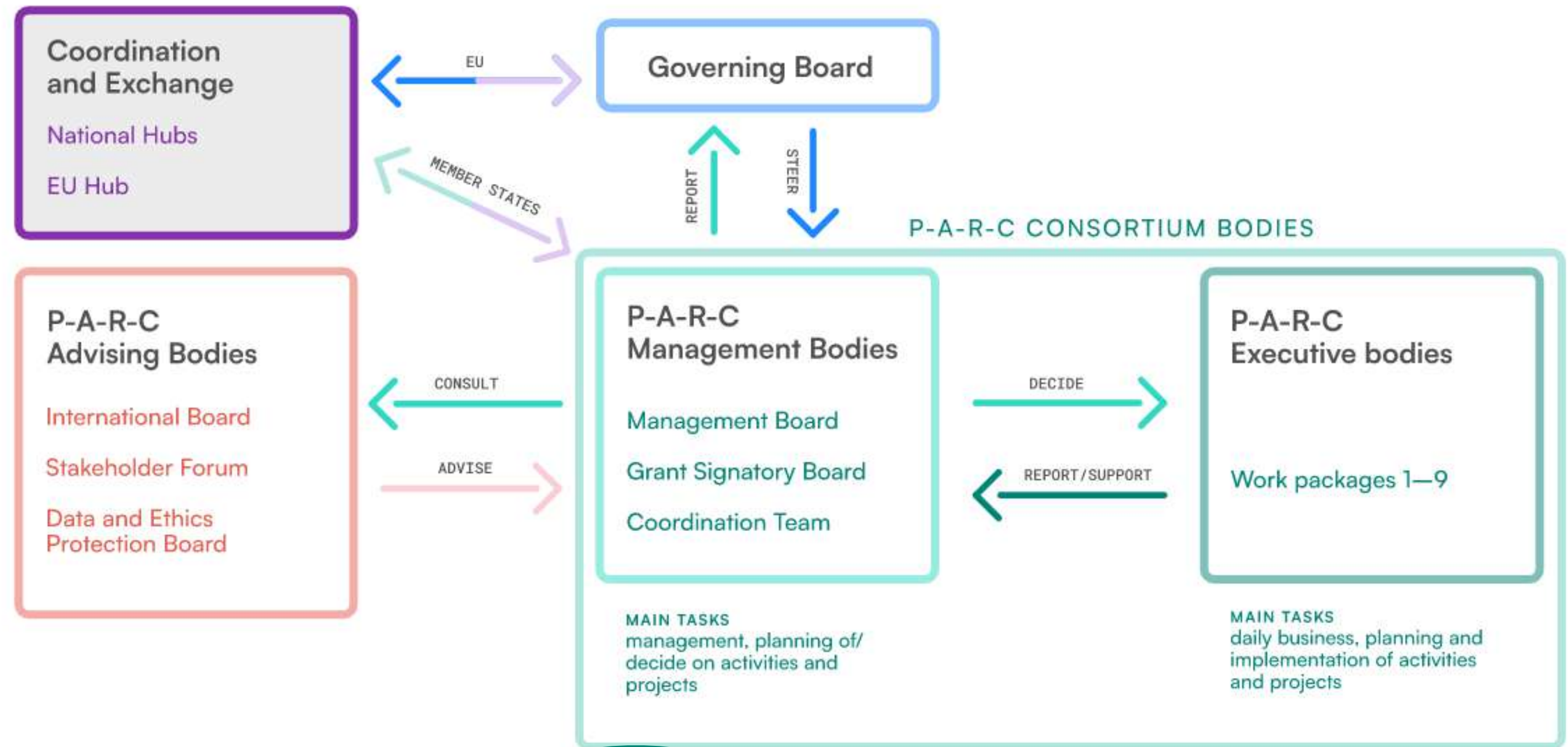
Strategic Research and Innovation Agenda

Mapping of needs



Rapid Response Mechanism

Next Generation Risk Assessment Route



- Annual Work Plan
- Annual Summary Reports
- Projects/Case Studies
- Tools
- Dashboards
- Scientific productions

WP2

Joana Lobo Vicente - EEA

Maria Uhl - EEA

Maria Uhl - EEA

Maria Uhl - EEA

WP4



Sebastien Denys - SpF



Marike Kolossa - UBA



Human Biomonitoring

- General Population
- Workers

Environmental Monitoring

Innovative methods for sampling and analysis



Stijn Baken- VITO



Iseult Lynch - UOB



WP7



Philip Marx-Stoelting - BfR



Gilles Rivière - ANSES



WP5

Toxicity testing addressing data gaps of concern

Innovative methods and tools for toxicity testing and modelling
Quantitative systems toxicology and development of new AOPs

WP6



Lina Wendt-Rasch - KEMI



Mirjam Luijten - RIVM



Integrated Approaches for Testing and Assessment

Integrative exposure and risk assessment

Review of risk assessment methodologies

Transposing results to regulatory risk assessment methodologies

Jakob Van Klaveren

Monitoring and exposure

Hazard assessment

Innovation in regulatory risk assessment

Concepts & toolboxes

Capacities



Denis Sarigiannis - AUTH



Veruska Leso - UNINA

WP8

Safe and Sustainable by Design

Early Warning System
Integrative models



Ana Cañas - ISCIII



Jana Klánová - MU



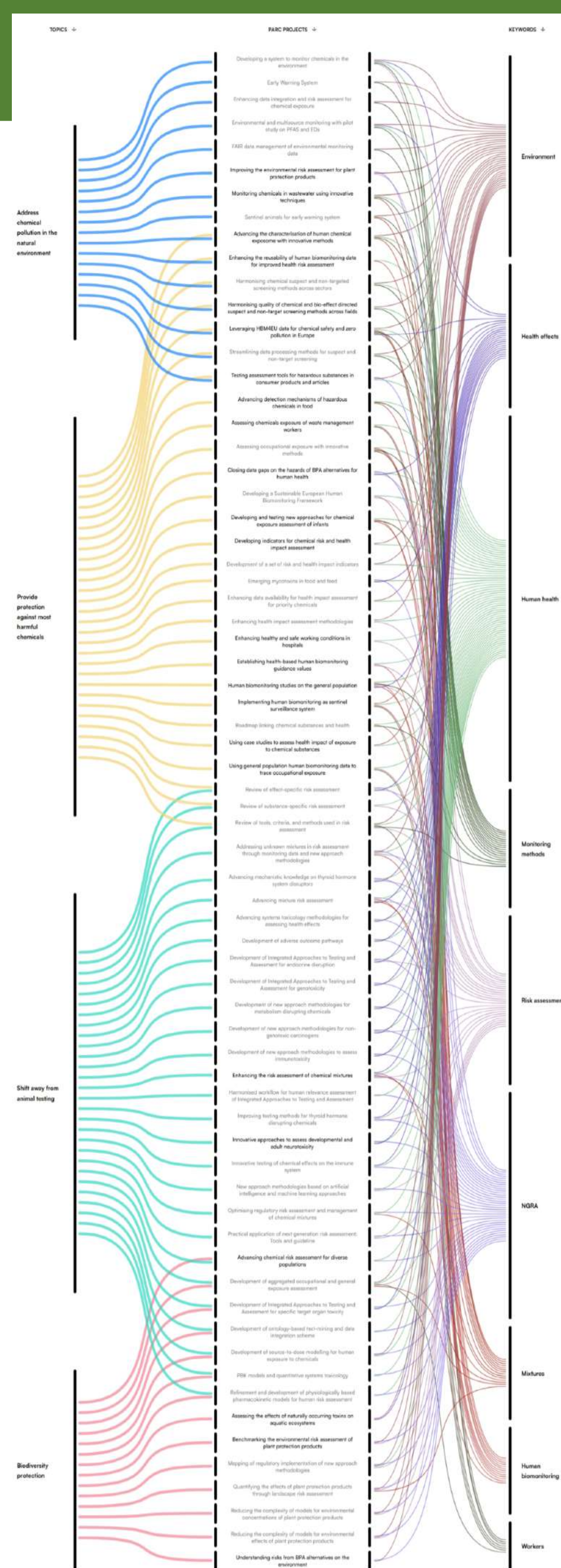
WP9

Address chemical pollution in the natural environment

Provide protection against most harmful chemicals

Shift away from animal testing

Biodiversity protection



Environment

Health effect

Human health

Monitoring methods

Risk assessment

Next Generation Risk Assessment

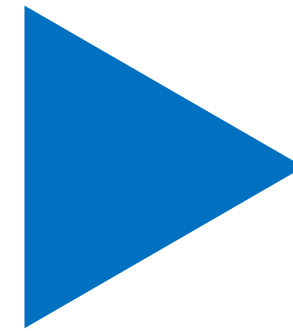
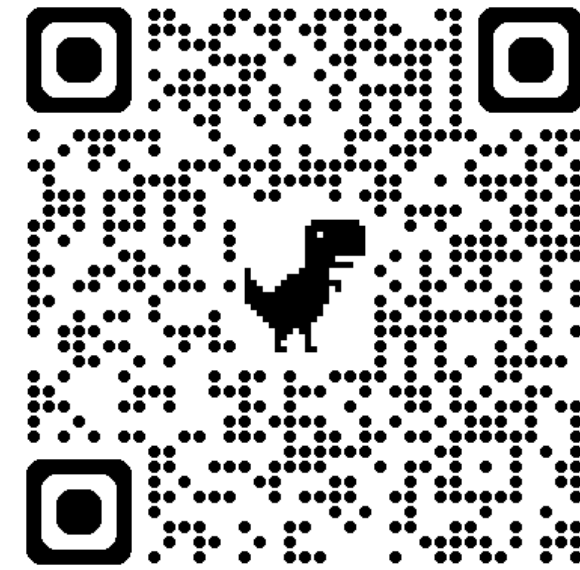
Mixtures

Human biomonitoring

Workers

PARC activities on Mercury

HBM Activities relay



Aligned studies Human Biomonitoring in General Population (on going)

- Protocols
- Laboratory network (QA/QC)

EXPOSURE | TIME PATTERNS | HEALTH RISK

PARC EUROPEAN HUMAN BIOMONITORING DASHBOARD
Population distribution of internal exposure levels

SELECT BIOMARKERS | PROJECT: All | STUDY: (Tout) | STRATIFICATION: No stratification | STRATA: No strata | COUNTRY: (Tout) | AGE: (Tout) | POPULATION: (Tout) | SAMPLING PERIOD: 1991, 2018, 2005, 2021

LEGEND: LOQ, P05, P10, P25, P50, P75, P90, P95. only percentiles >LOD/LOQ are displayed. If only P90 and P95 are >LOD/LOQ the visualisation looks like this:

REGION: Northern EU, Eastern EU, Western EU, Southern EU

Distribution of substance: Mercury and its organic compounds / biomarker: Tout concentration in Blood (µg/L)

sampling period	country	data collection name	Biomarker + Age	No stratification	N	0.05	0.1	0.2	0.5	1	2	5	10	20
2016-2017	CZ	CzechHBM-CE_2016	Hg total - 3-5y; 6-11y	No strata	411	LOD		LOQ						
2015	CZ	CzechHBM-AE_2015	Hg total - 20-39y; 40-59..	No strata	302		LOD		LOQ					
2010	DE	ESB_2010	Hg total - 20-39y	No strata	457	LOQ								
2010-2012	SK	PRENATAL_Newborn	Hg total - <1y	No strata	294	LOD		LOQ						
			MeHg - <1y	No strata	144	LOD		LOQ						
2009	DE	ESB_2009	Hg total - 20-39y	No strata	424	LOQ								
2009-2010	ES	BIOAMBIENTES	Hg total - 20-39y; 40-59..	No strata	1880		LOQ							
2009	CZ	CzechHBM-AE_2009	Hg total - 20-39y; 40-59..	No strata	405			LOD						
2008	DE	ESB_2008	Hg total - 20-39y	No strata	453	LOQ								
2008-2014	SI	SLO-HBM-I	Hg total - 20-39y; 40-59..	No strata	1083		LOD							
2008	CZ	CzechHBM-CE_2008	Hg total - 6-11y	No strata	198			LOD						
2007	DE	ESB_2007	Hg total - 20-39y	No strata	430	LOQ								
2007	CZ	CzechHBM-AE_2007	Hg total - 20-39y; 40-59..	No strata	411			LOD						
2006	CZ	CzechHBM-CE_2006	Hg total - 6-11y; 12-19y	No strata	382			LOD						
2005	CZ	CzechHBM-AE_2005	Hg total - 20-39y; 40-59..	No strata	405			LOD						
2003-2006	DE	GerES IV (unweighted)	Hg total - 3-5y; 6-11y; 1..	No strata	1550			LOQ						
2002-2008	NO	MoBa	Hg total - 20-39y; 40-59..	No strata	2962	LOD		LOQ						

Participation in PARC general population aligned studies

The aim of the PARC aligned studies is to measure concentrations of environmental pollutants in the European population and to obtain comparable data across different EU countries

The study covers three age groups

- Children 6–11 years
- Adolescents 12–17 years
- Adults 18–39 years

Targeting the following substances

- Bisphenols, Phthalates, Pesticides, Metals
- Bisphenols, Phthalates, PFAS, Pesticides, Arsenic species
- Bisphenols, Phthalates, PFAS, Pesticides, Metals

Studied in

- 14 countries
- 11 countries
- 20 countries

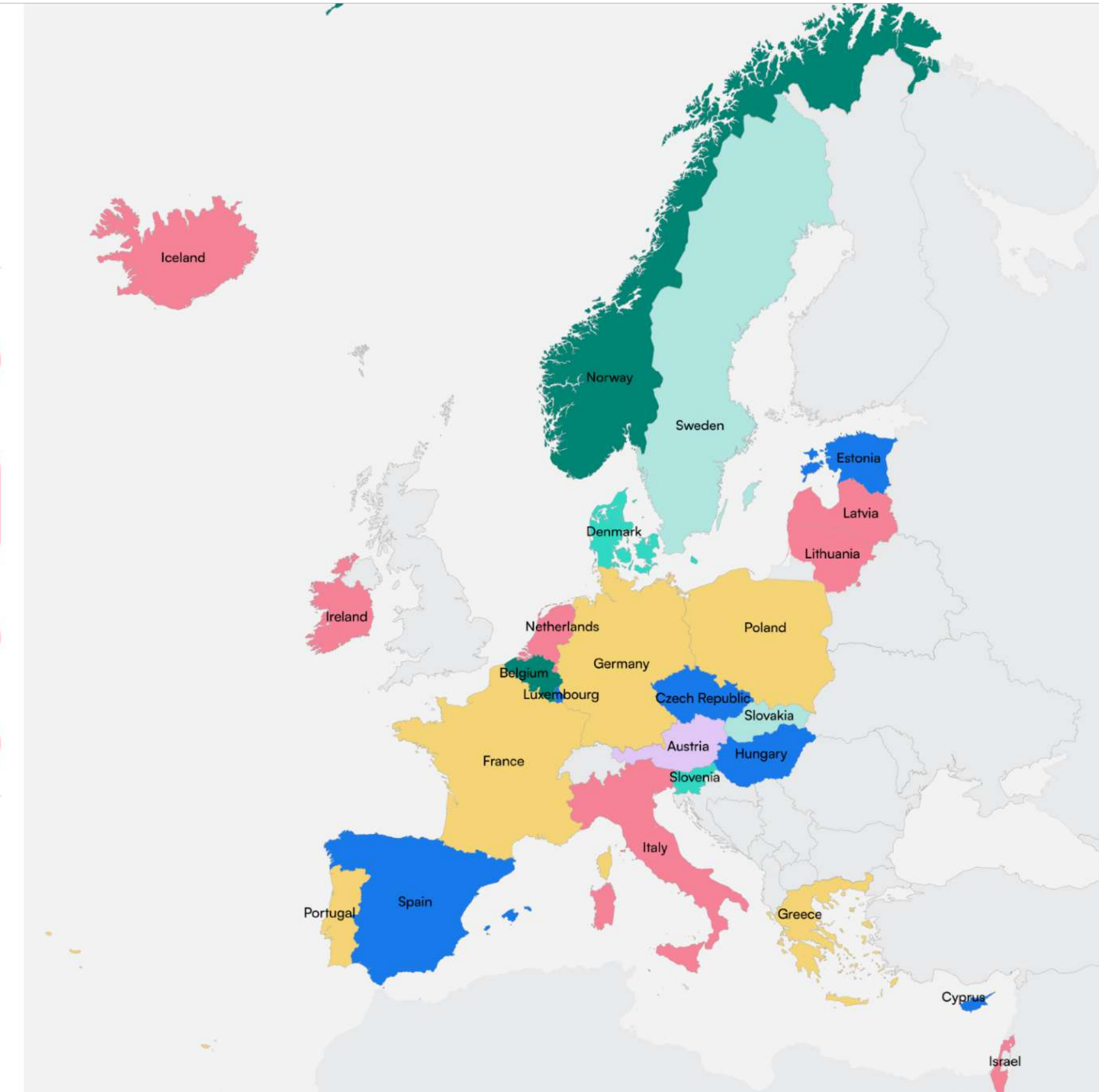
The (target) number of participants is

- ± 3250
- ± 2610
- ± 4750

Legend general population study

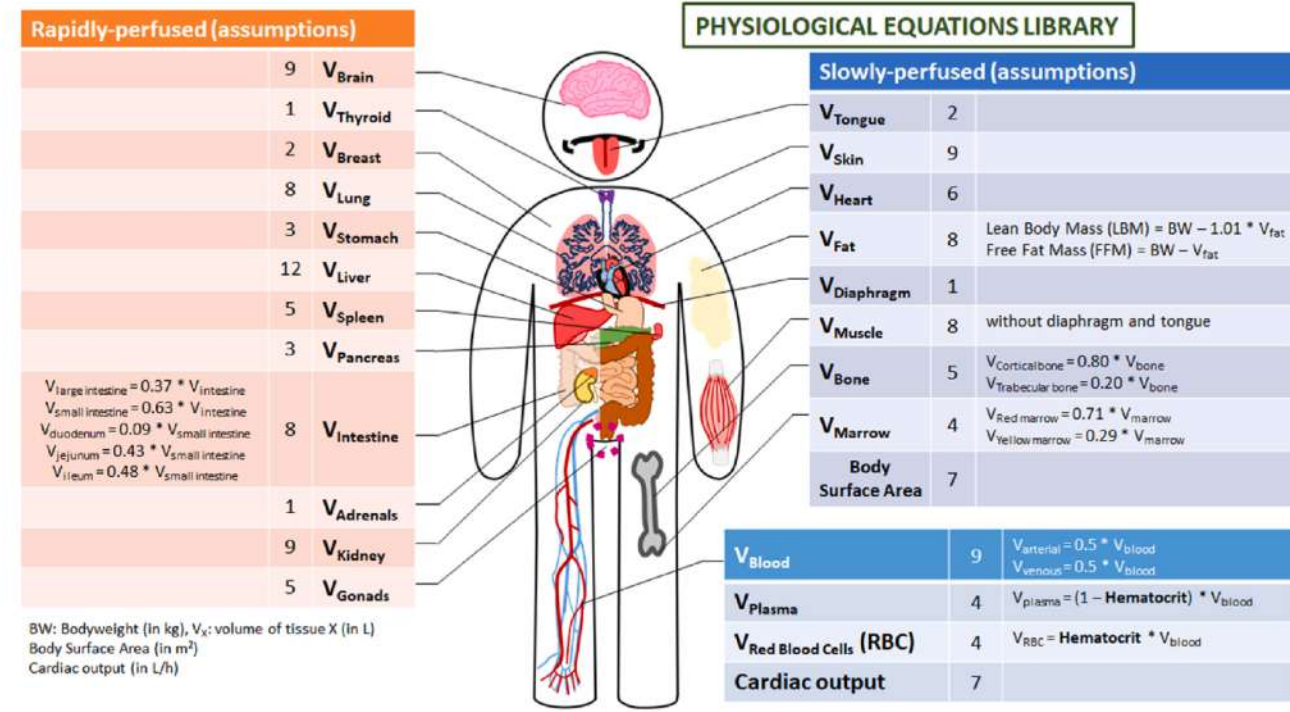
Countries involved in following studies

- Only children
- Children & adults
- Children & adolescent
- Only adolescent
- Adolescent & adults
- Only adult
- Children & adolescent & adults



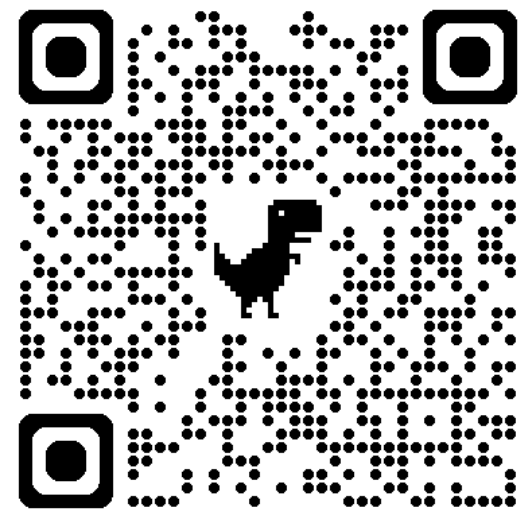
PARC activities on Mercury

Integrated methods for Risk and Health Impact Assessment



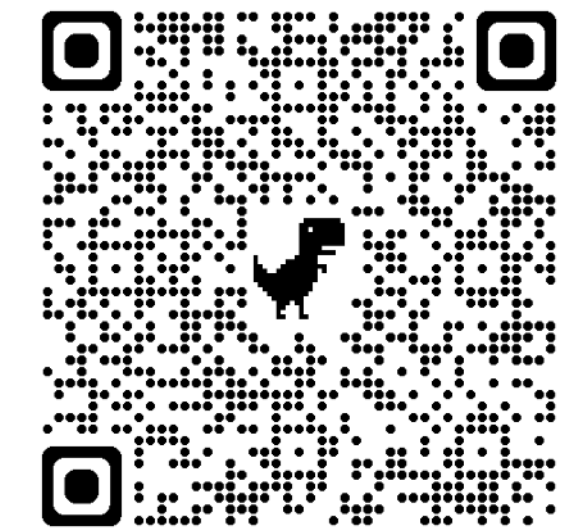
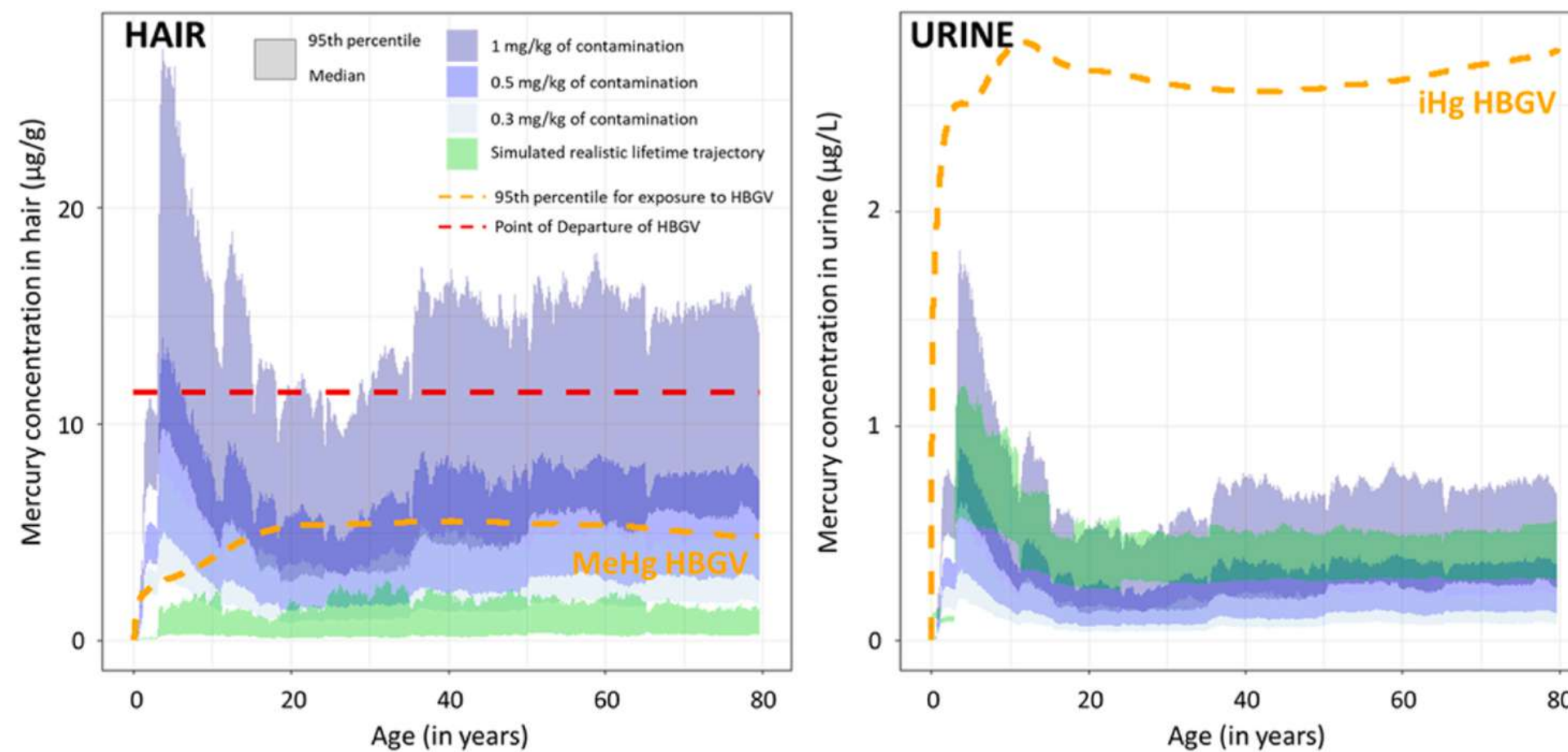
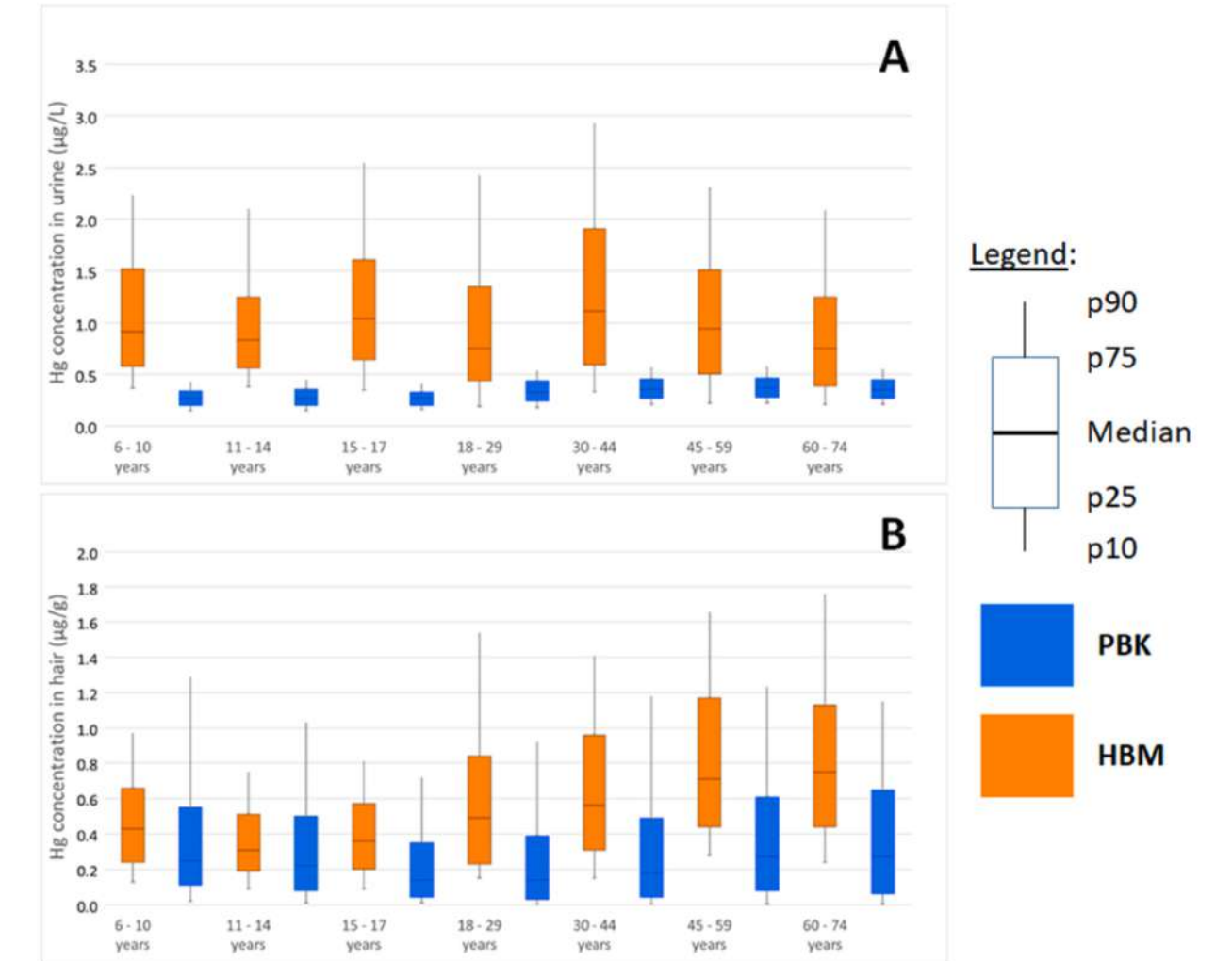
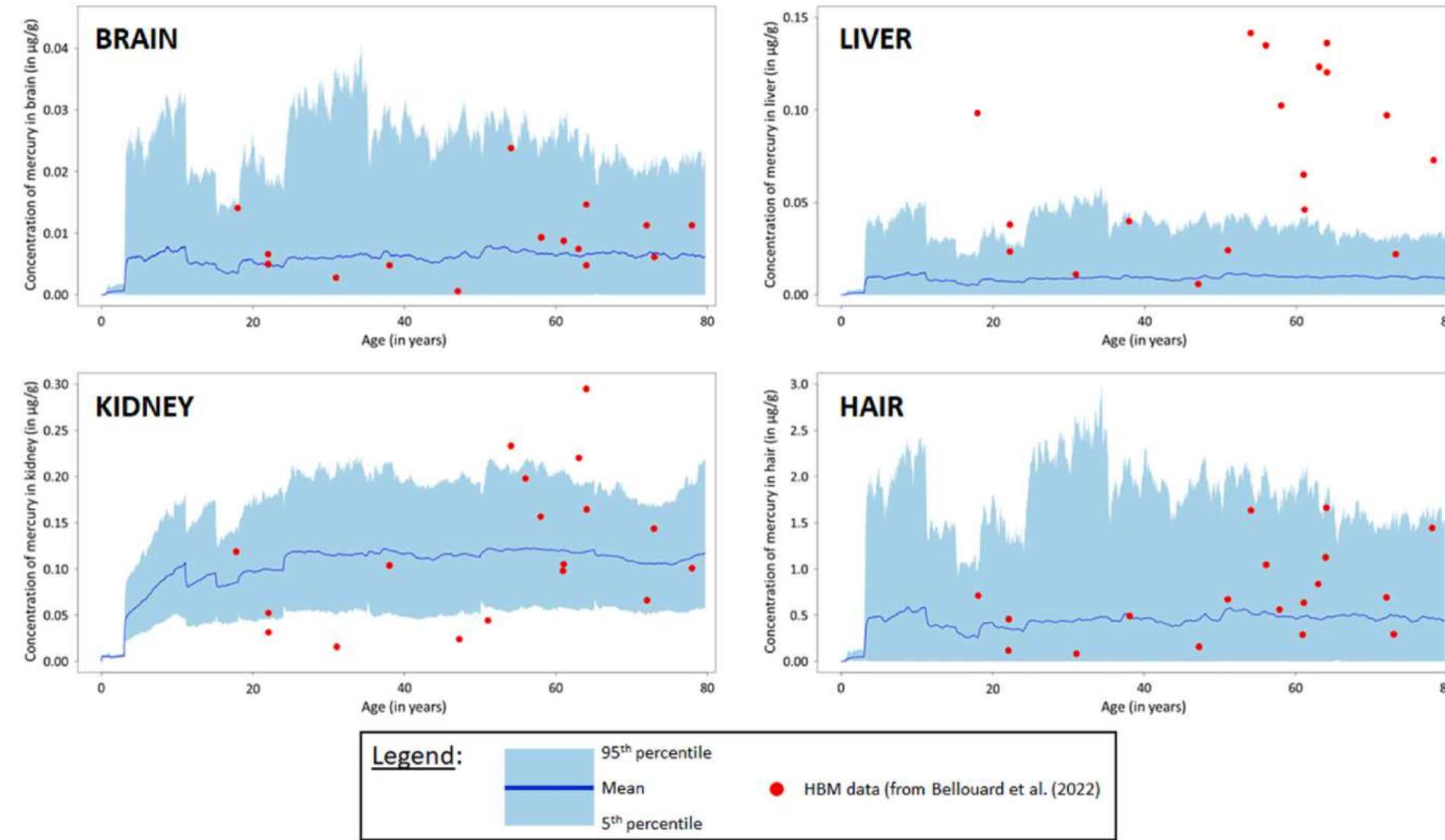
- Integrative PBPK modelling
- Simulation of entire life exposure

Compared with HBM Guidance values



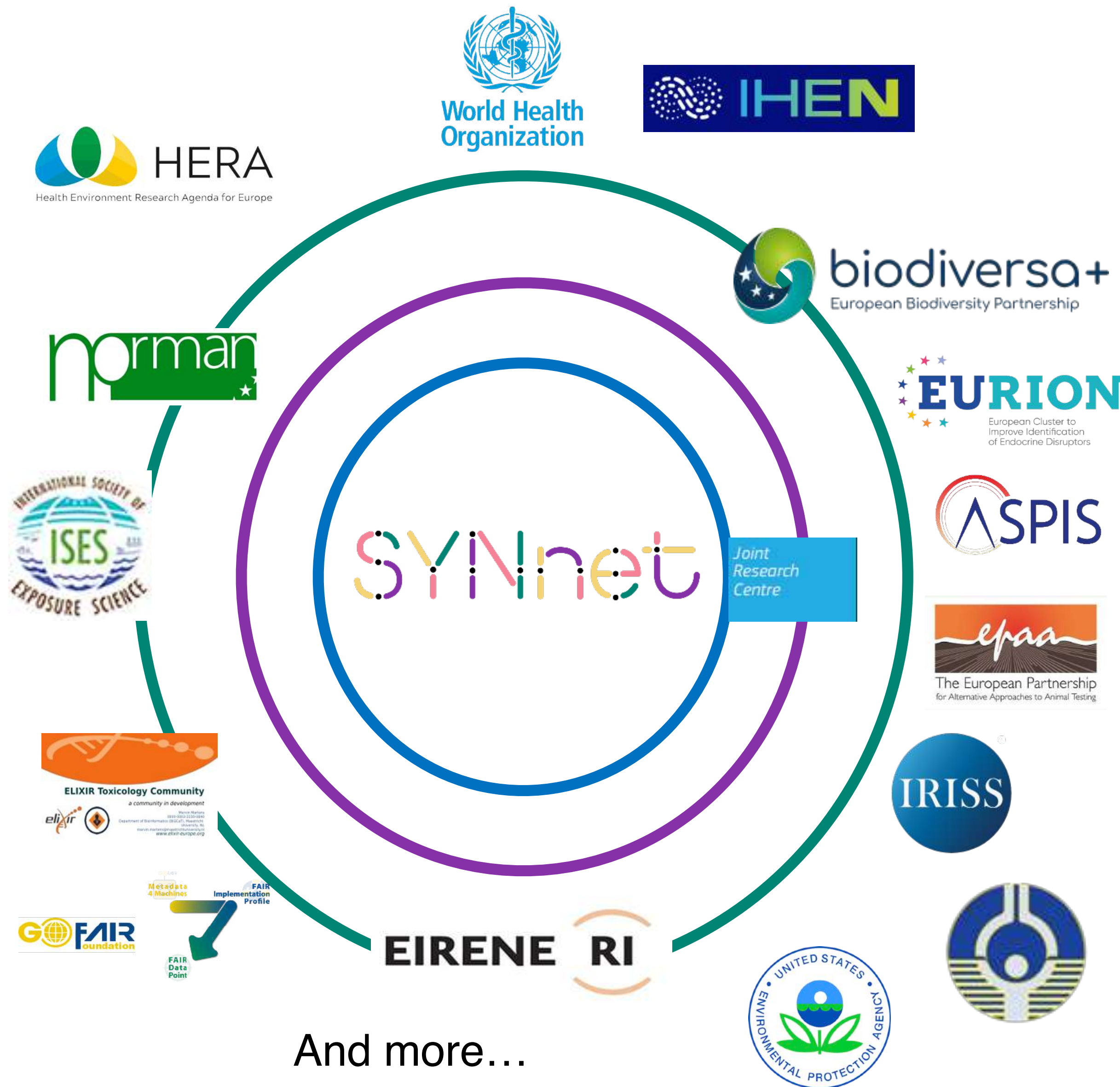
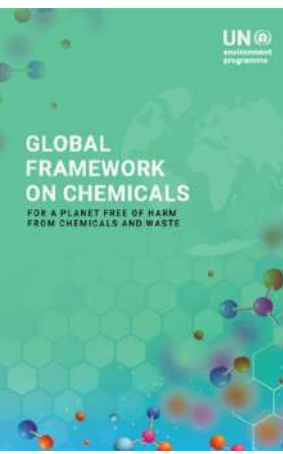
Gastellu et al, Environmental Research PARC

Compared with Observed HBM data



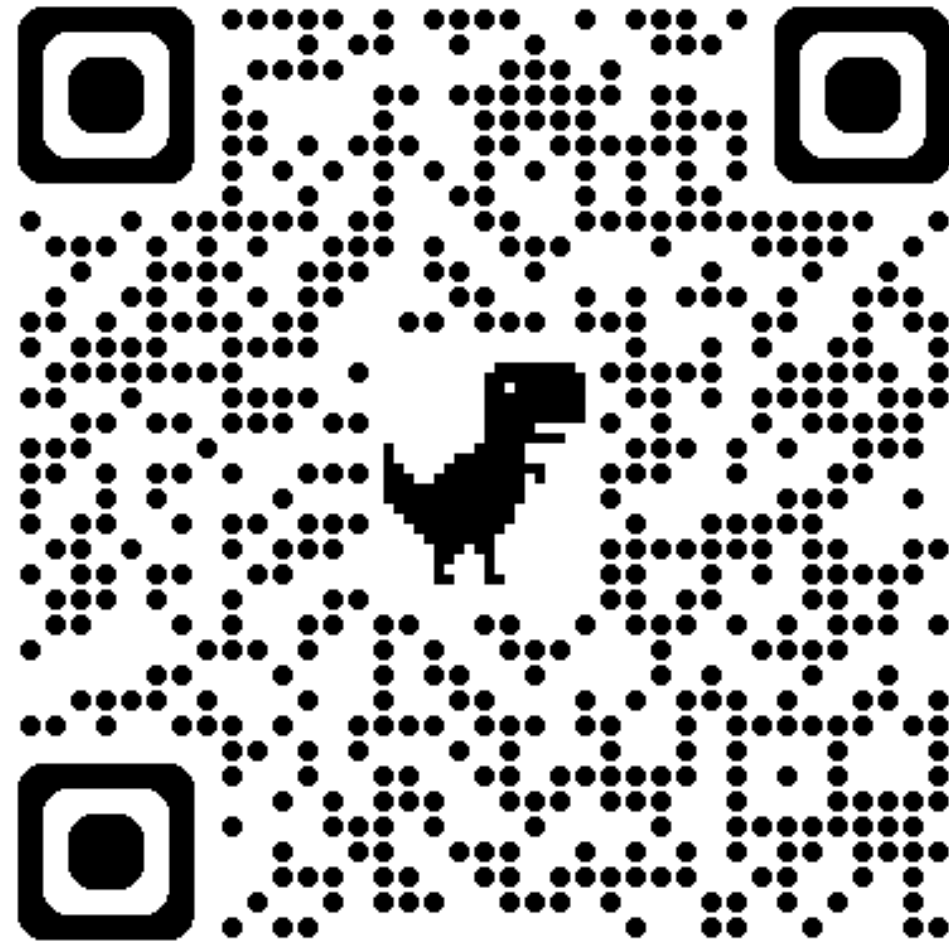
Gastellu et al, Food and Chemical Toxicology

How do we support the global framework on chemicals

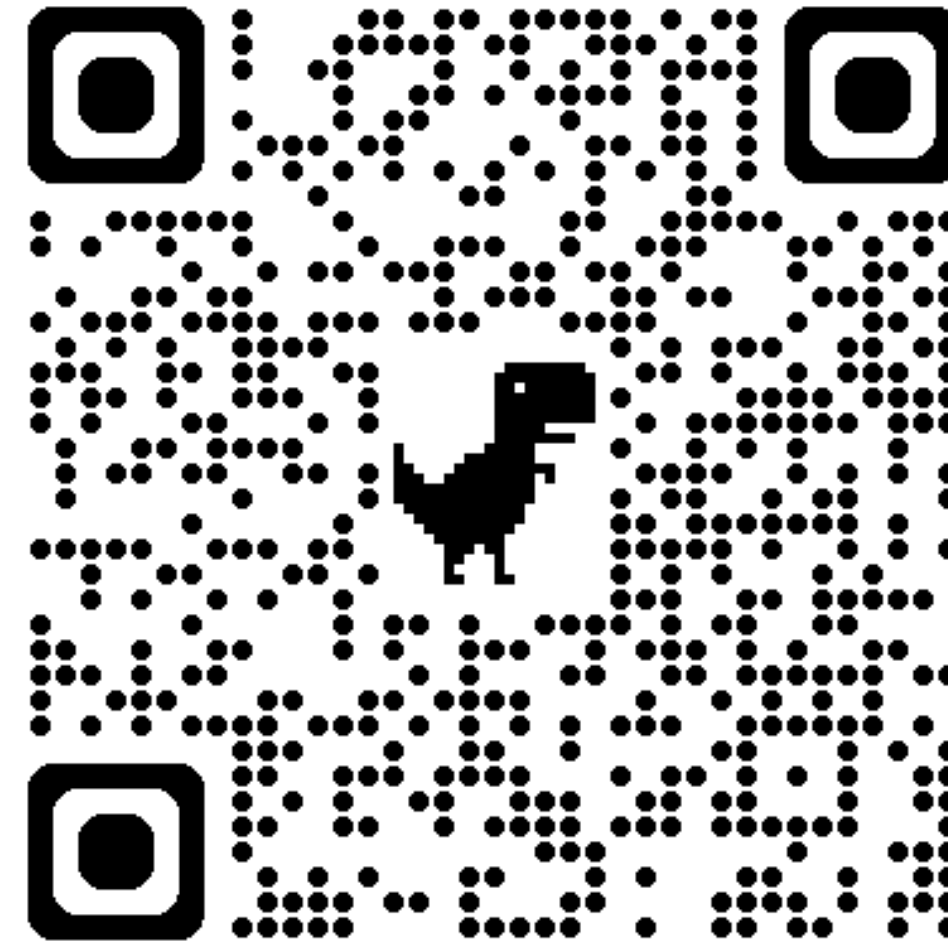


Strategic Objectives

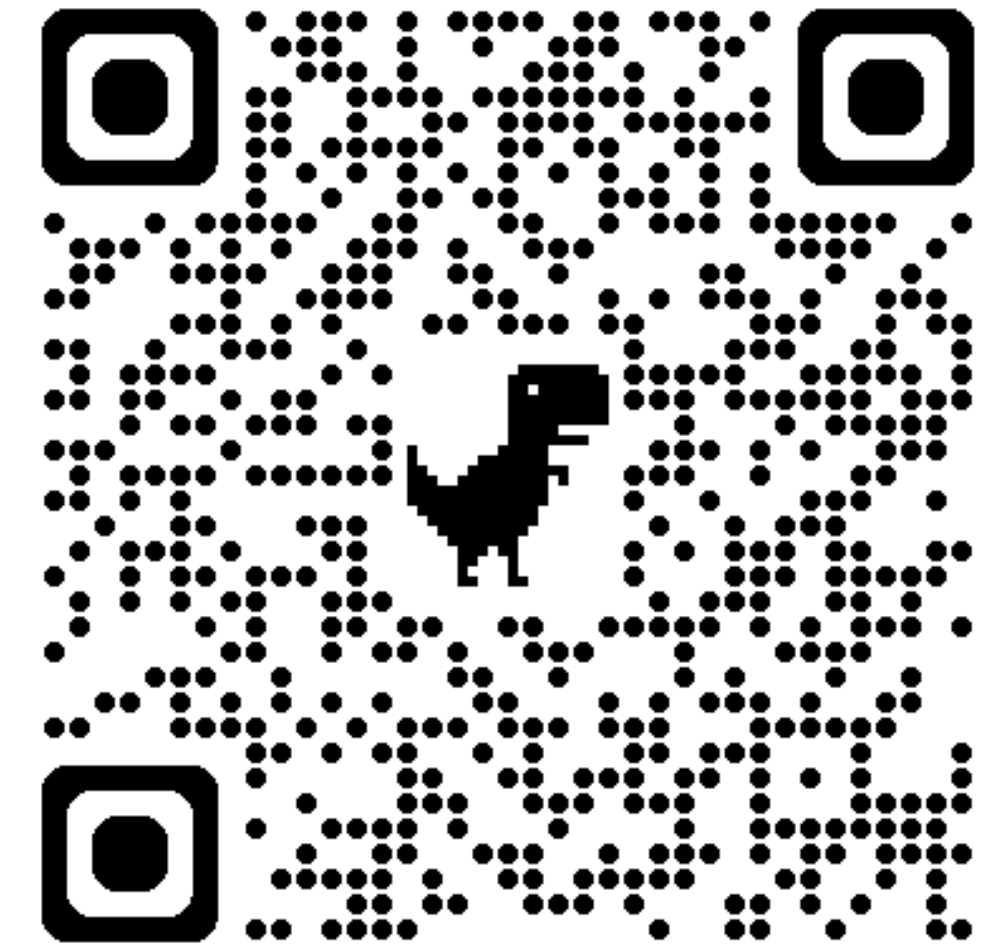
- A. Legal frameworks, institutional mechanisms and capacities are in place to support and achieve the safe and sustainable management of chemicals throughout their life cycle.
- B. Comprehensive and sufficient knowledge, data and information are generated, available and accessible to all to enable informed decisions and actions.
- C. Issues of concern are identified, prioritized and addressed.
- D. Safer alternatives and innovative and sustainable solutions in product value chains are in place so that benefits to human health and the environment are maximized and risks are prevented or, where prevention is not feasible, minimized.
- E. Enhanced implementation occurs through increased and effective resource mobilization, partnerships, cooperation, capacity-building, and integration into all relevant decision-making processes.



PARC Website
www.eu-parc.eu



PARCopedia
www.parcopedia.eu



PARC SSbD
www.parc-ssbd.eu



- PARC Contact: PARC@anses.fr
- Coordinator: Pascal.Sanders@anses.fr
- Deputy Coordinator: Christophe.Rousselle@anses.fr



ESFRI infrastructure EIRENE



RESEARCH INFRASTRUCTURE FOR ENVIRONMENTAL EXPOSURE RISK ASSESSMENT IN EUROPE (EIRENE)

LINKING SCIENCE WITH POLICY MAKING

Jana Klánová on behalf of the EIRENE Consortium

RECETOX Research Infrastructure



10.3 Environmental sciences

RECETOX Research Infrastructure



Acronym: RECETOX RI
Hosting institution: Masaryk University
Phase: construction
Character: single-sited
Responsible person: Prof. Jana Klánová, Ph.D., klanova@recetox.muni.cz
Website: www.recetox.muni.cz/index-en.php
Year of inclusion on the Czech Roadmap: 2010

Motto: Science for a healthy future.

MUNI | RECETOX
Research Infrastructure

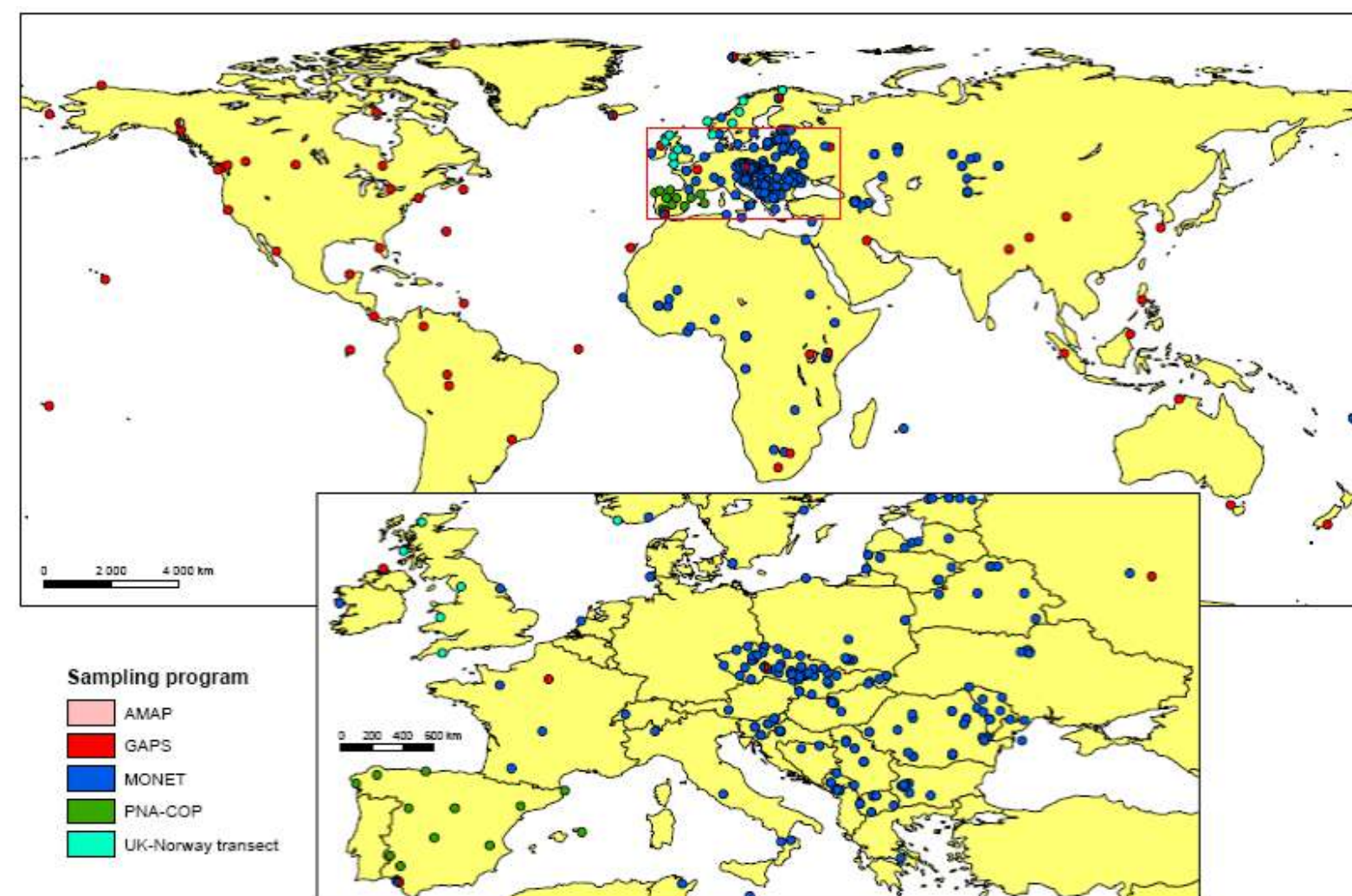
Characteristics

RECETOX RI enables research on both environmental and human health risks related to environmental contamination, and supports the safe management of chemicals. The existing and newly built capacities of the RECETOX RI core facilities offer a wide range of expertise needed for making environmental impact assessments for a variety of uses. They provide access to analytical, chemical, biological, and toxicological laboratories, the environmental monitoring network **MONET** (Monitoring Network) population studies **GENESIS** (Central Europe Longitudinal Study of Parents and Children), and real data sources. They allow for the presentation of external data through the **GENESIS** (Global Environmental Assessment and Information System) information platforms. The capacities for data analysis, interpretation and modelling are also available together with advanced bioinformatics and bioinformatics offering a portfolio of services to users from both the academic and private sectors in the Czech Republic and abroad. The comprehensive interdisciplinary approach taken by RECETOX RI is unique in the European context. RECETOX RI offers capacities for the assessment of environmental impacts on human health, a platform for the development of innovative methods, know-how and technology transfer, teaching and consulting. The education and training activities of RECETOX RI at all levels of higher education improve the quality and professional readiness of its graduates. The training courses, workshops, and the international summer schools are also organized for all degrees from universities, research institutes, health facilities, industrial enterprises, regional and state authorities, ministries, governments and international organisations. RECETOX RI is associated with the Czech nodes of the AC TRIS (Aerosol, Clouds and Trace Gases Research Infrastructure), **ELISE** (European Life-Science-Infrastructure for Biological Information), and **EMBL-EBI** (Bioinformatics and Biomolecular Resources Infrastructure) European research infrastructures. It coordinates the EIRENE (European Environmental Exposure Assessment Network) project for the updated ESRI Roadmap, and the **GENESIS** (Global Earth Observation) initiative **GENESIS** (Global Observation System for Persistent Organic Pollutants). It also contributes to the implementation and management of joint European programmes such as **EMBL-EBI** (Human Biomedicine for Europe) and **PLANET** (European Network for Observing our Changing Planet).

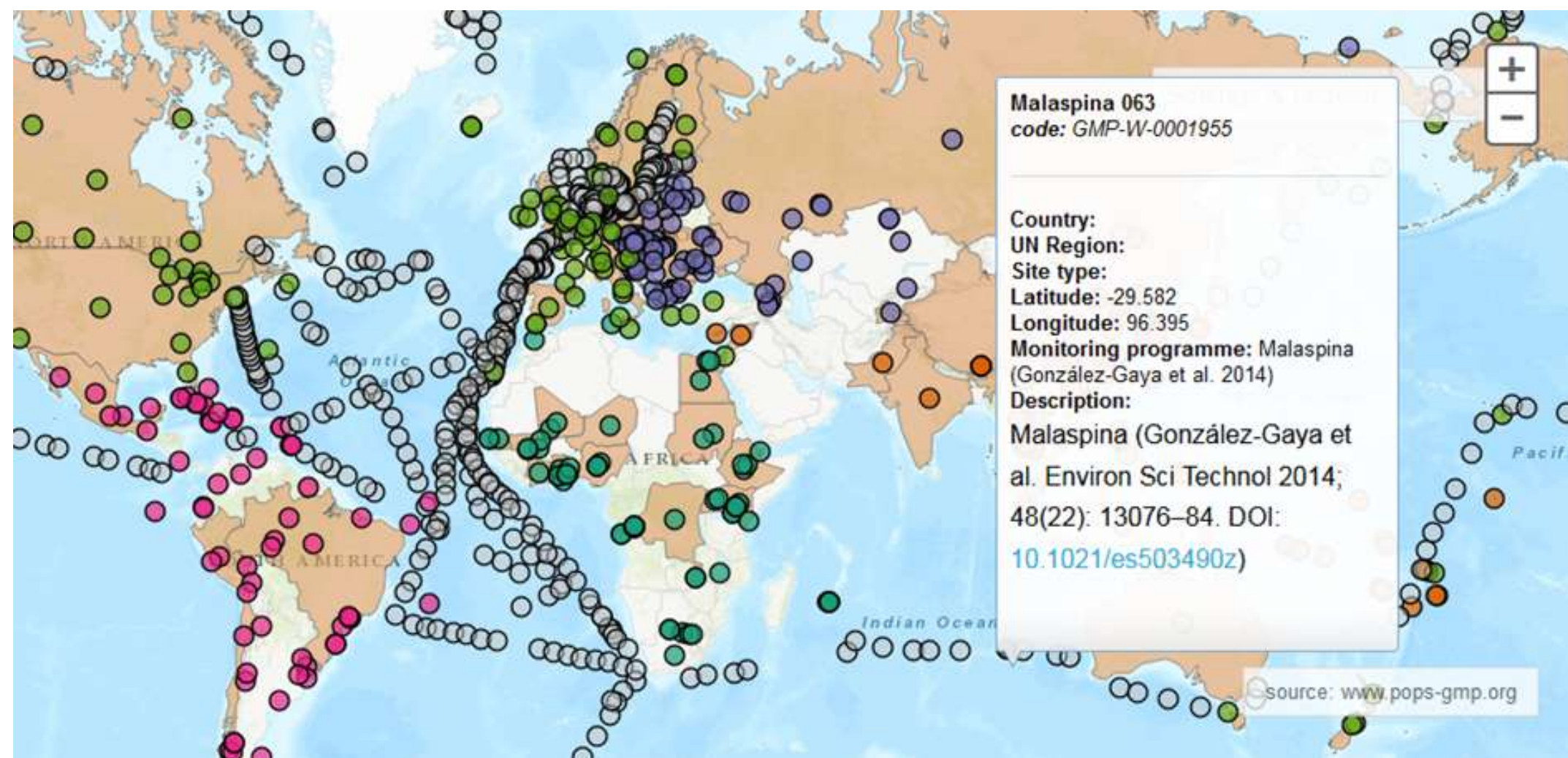
Socio-economic benefits

RECETOX RI develops new approaches to assess the causal links between human exposure to toxic substances and the development of chronic diseases, and improves our understanding of the mechanisms of such interactions. It identifies toxic mixtures in the environmental samples, consumer products and human tissues, as well as sources of such chemical mixtures, their health effects and most vulnerable populations. It explores the links between these environmental exposures and socio-economic factors that affect the human health, and allows for the prioritization and better targeting of the relevant legislation. It contributes to the better management of toxic chemicals, the safe production of food and consumer products, and safe waste processing. It enhances the protection of human health, the development of preventive measures, and sustainability of healthcare. It collaborates with **UNEP** (United Nations Environment Programme) and **WHO** (World Health Organization), and supports the implementation of the concepts of a circular economy and health by smart cities. It also provides university education and builds international capacities for assessing environmental exposures.

Existing capacities of the RECETOX RI



RECETOX accredited laboratories (TAL)
CELSPAC population cohorts
MONET environmental monitoring networks
GENESIS information platforms



Analysis of organic pollutants, their metabolites, trace elements, metals, and species

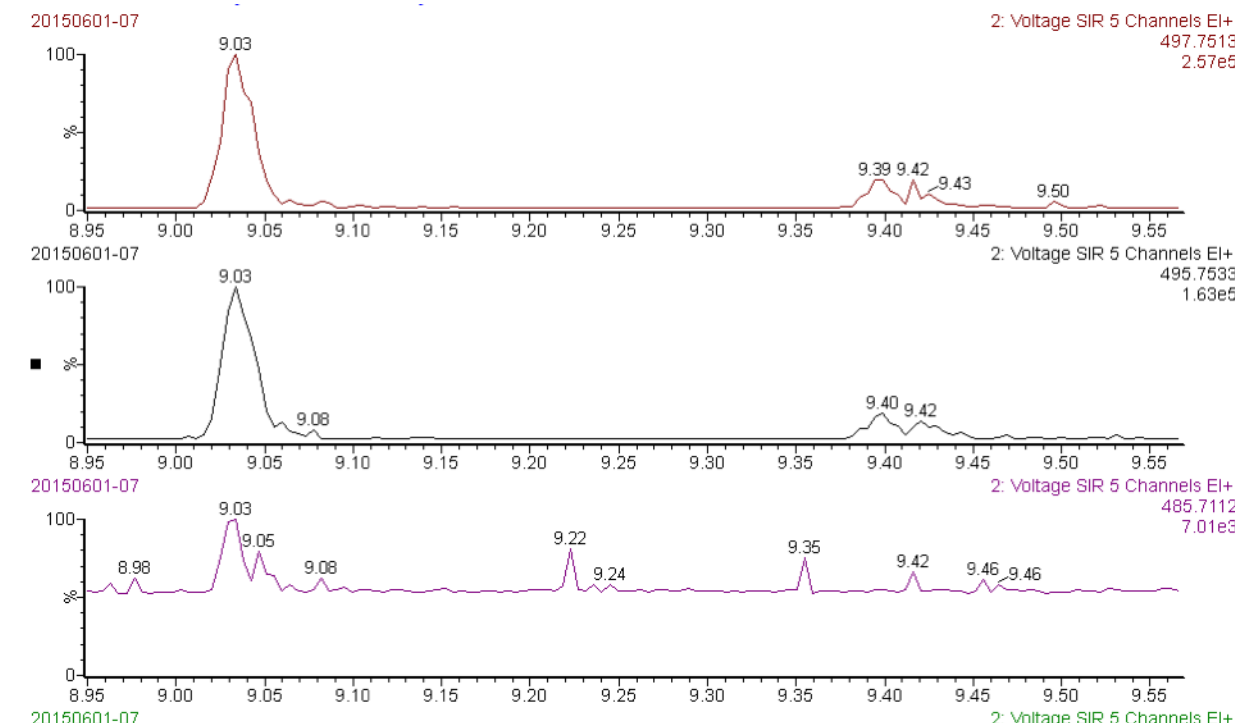
Organic pollutants:

- Polychlorinated dibenzo-*p*-dioxins/furans (PCDDs/Fs)
- Polychlorinated biphenyls (PCBs) – indicator and dioxin-like
- Brominated and organophosphorus flame retardants
- Organochlorine, cyclodiene, and polar pesticides
- Polycyclic aromatic hydrocarbons (PAHs), NO_x-, and oxy-PAHs
- hopanes
- Perfluorinated compounds (PFAS)
- Pharmaceuticals and cosmetic products
- Bisphenols
- Thyroid hormones

Metabolites:

- OH-PAHs
- Phthalates metabolites + DINCH
- Pesticides metabolites + OP pesticides metabolites
- UV filters
- Mycotoxins

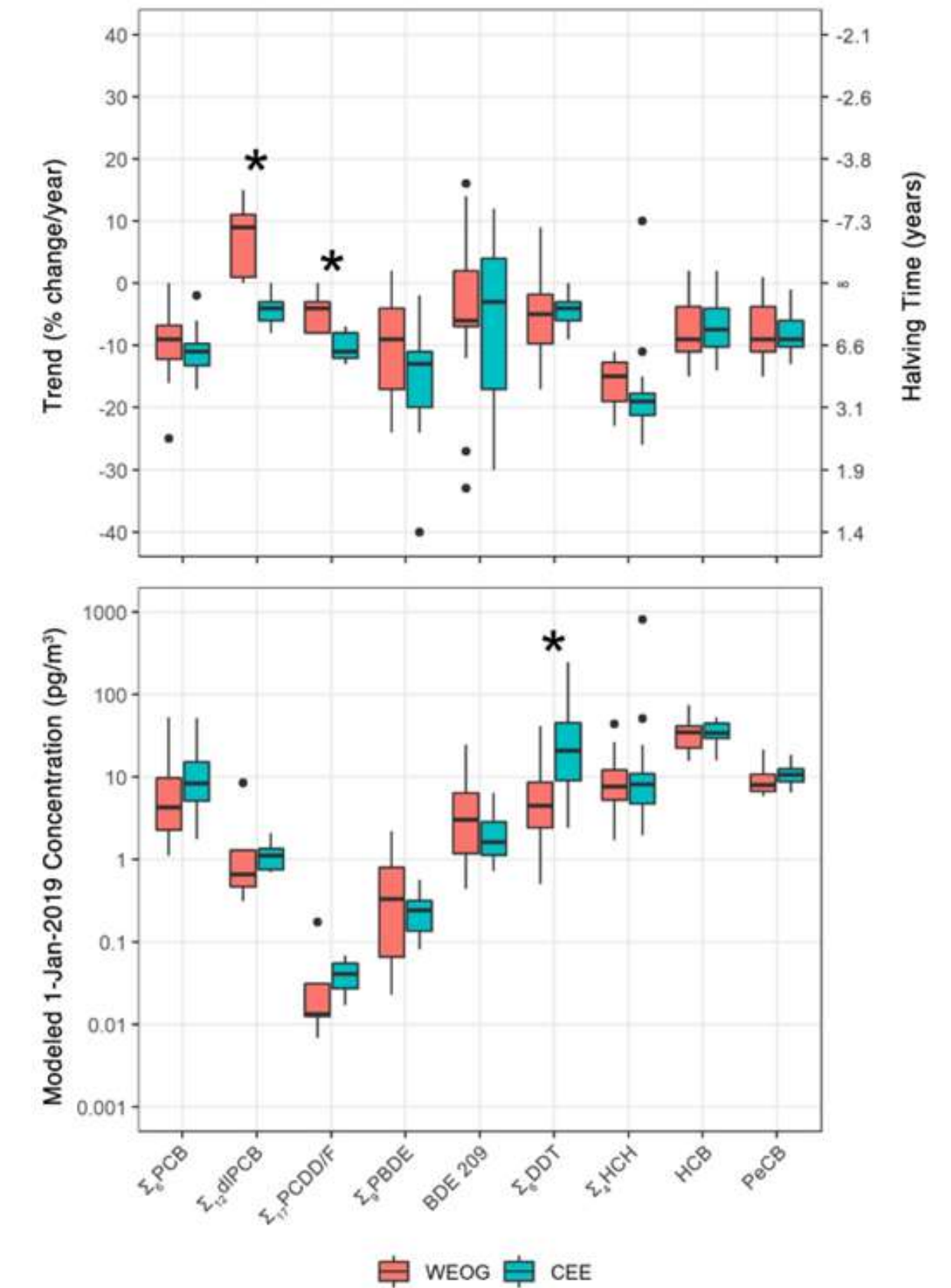
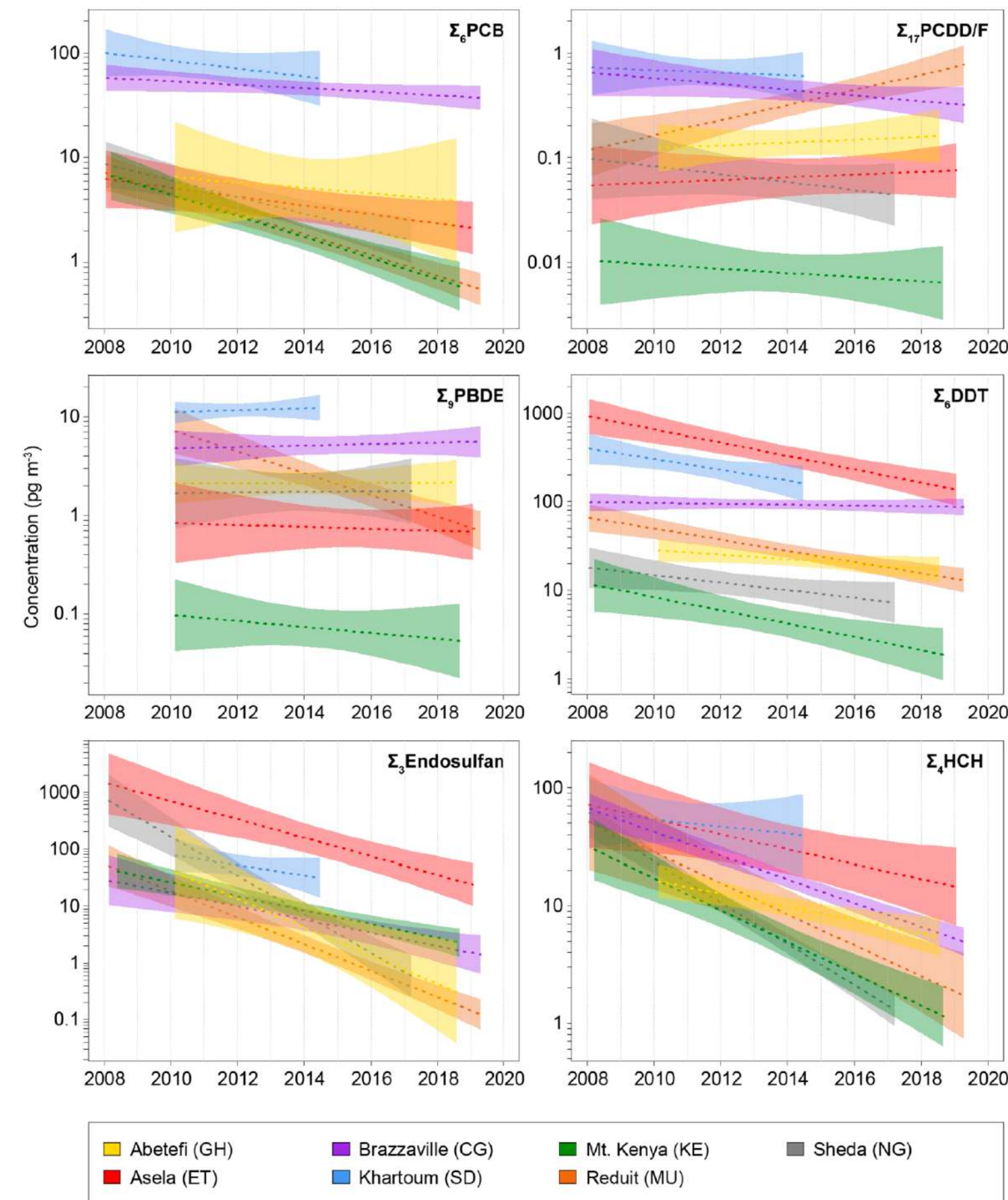
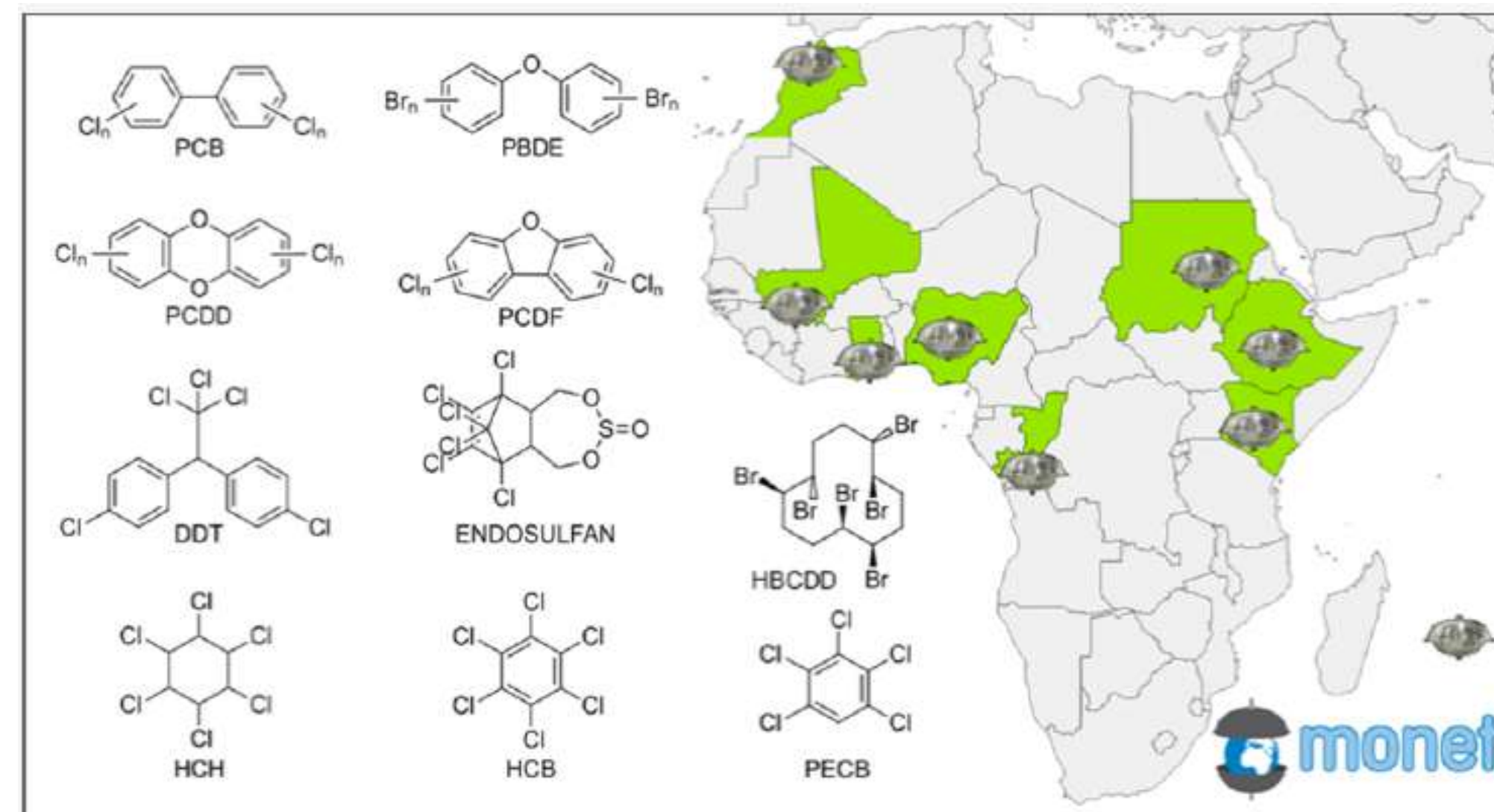
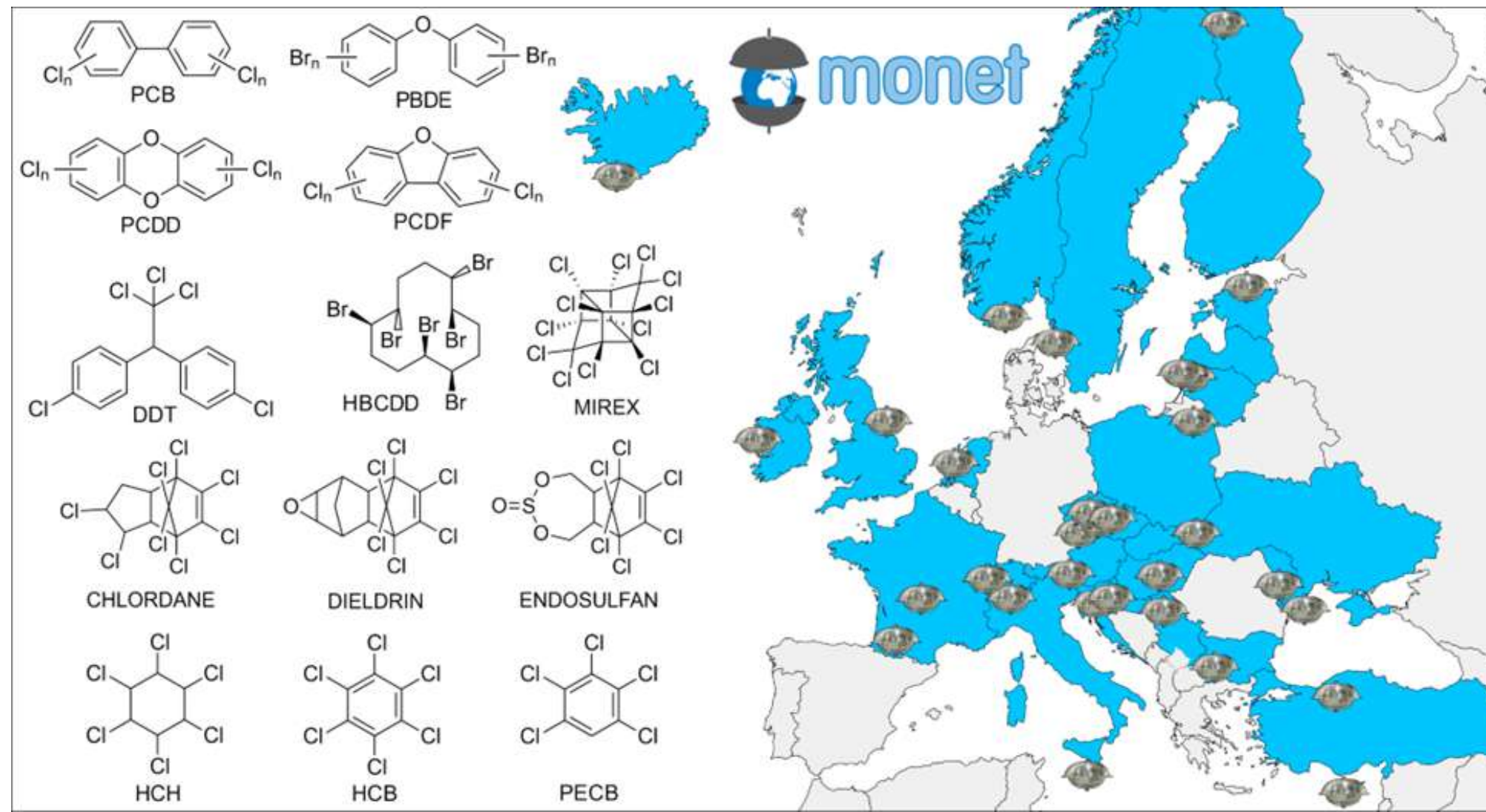
Toxic metals including mercury and their species, trace elements



EIRENE RI



MONET: temporal trends in atmospheric and water levels of organic pollutants



- New sensors development (including personal)
- Setting monitoring studies
- Data provision

CELSPAC Population Studies

The Platform for Biomedical Research



CELSPAC Population Studies

1991-2

2015(7)

2019

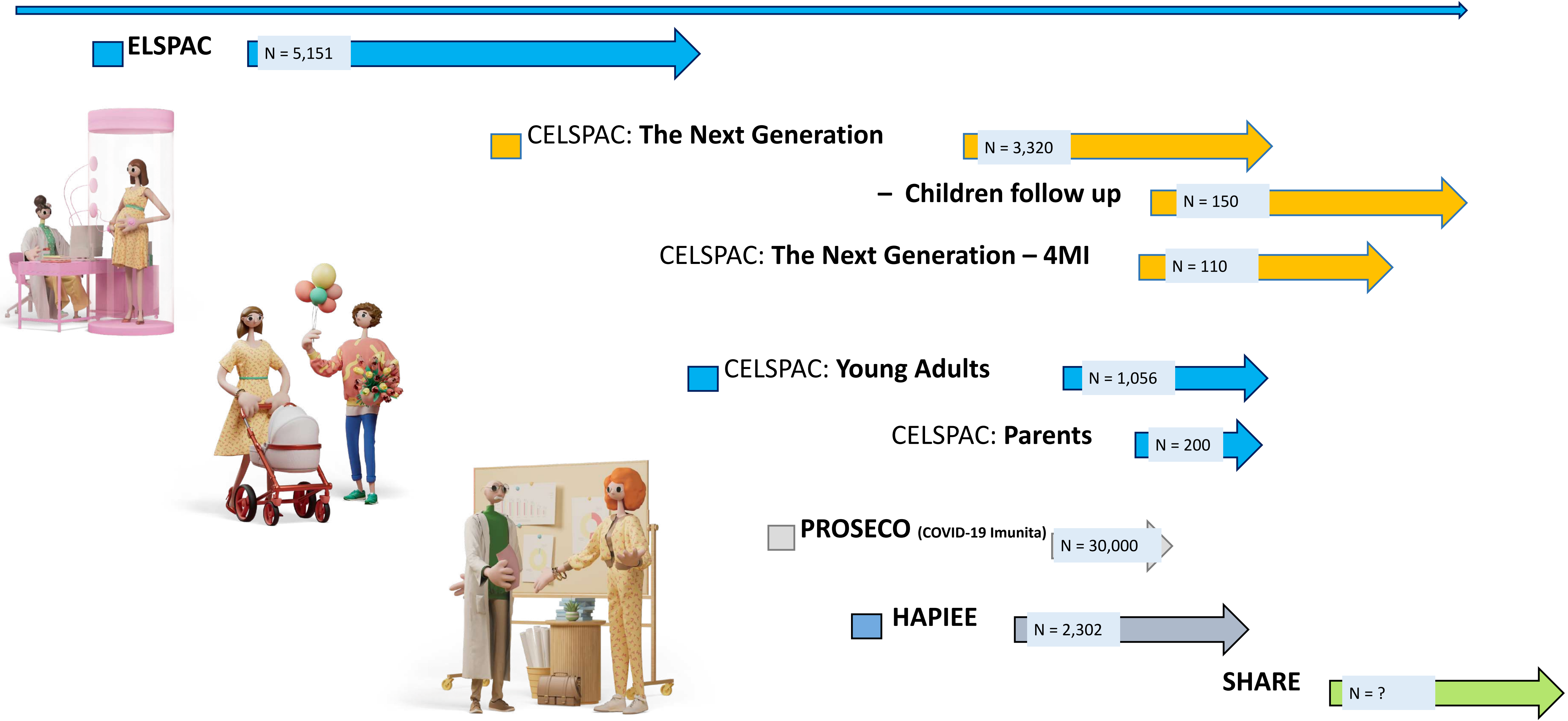
2020

2022

2024

2025

2026



6,700+ of active participants plus 30,000 of PROSECO study's participants

Biobanking & Laboratory Methods

- Fully automated processing (HAMILTON) and storing samples (ASKION)
- Automated DNA/RNA isolation and Quality control (Perkin Elmer Systems)
- Immunological analyses (ALEX – ELISA-based *in-vitro* multiplex allergy chip)
- Clinical chemistry and immunology analyses (ROCHE, Sysmex)
- Accreditation Swiss label BBMR-ERIC and ISO standard

ČSN ISO 20387:2021 Biotechnology – Biobanking – General requirements for biobanking



Services provided via OA online system

<https://openaccess.recetox.cz/>

➤ Data & Biological material
from the CELSPAC studies

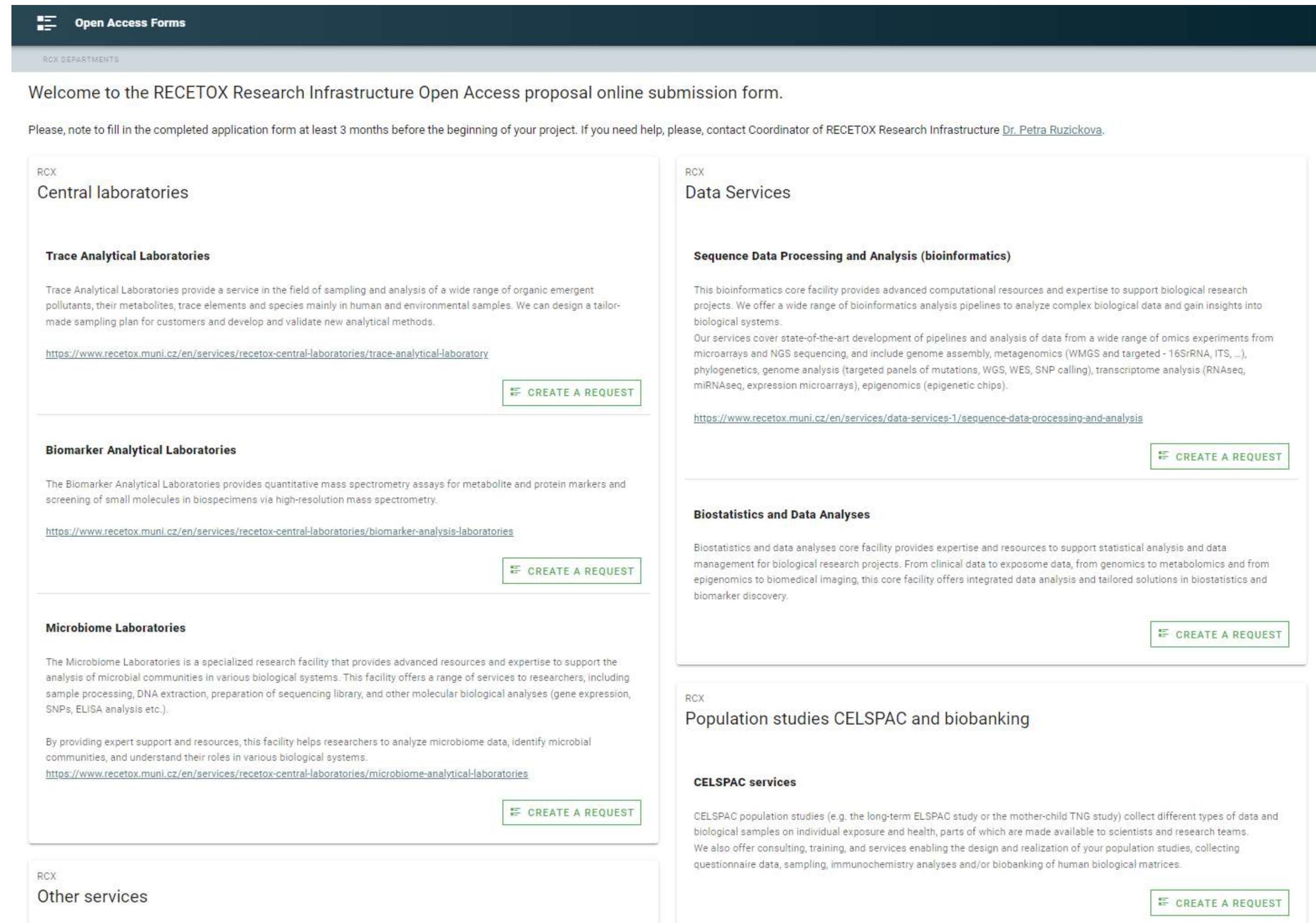
➤ Realization of new epidemiological study

Research protocol

Questionnaire design New data collection and analysis

New sample collection and analysis

Storage of human biological samples



The screenshot shows the 'Open Access Forms' page on the RECETOX website. The page is titled 'Open Access Forms' and lists various services provided by the RECETOX Research Infrastructure. The services are organized into two columns. Each service card includes a title, a brief description, a URL, and a 'CREATE A REQUEST' button.

Open Access Forms

RCX DEPARTMENTS

Welcome to the RECETOX Research Infrastructure Open Access proposal online submission form.

Please, note to fill in the completed application form at least 3 months before the beginning of your project. If you need help, please, contact Coordinator of RECETOX Research Infrastructure [Dr. Petra Ruzickova](#).

RCX Central laboratories

Trace Analytical Laboratories

Trace Analytical Laboratories provide a service in the field of sampling and analysis of a wide range of organic emergent pollutants, their metabolites, trace elements and species mainly in human and environmental samples. We can design a tailor-made sampling plan for customers and develop and validate new analytical methods.

<https://www.recetox.muni.cz/en/services/recetox-central-laboratories/trace-analytical-laboratory>

CREATE A REQUEST

Biomarker Analytical Laboratories

The Biomarker Analytical Laboratories provides quantitative mass spectrometry assays for metabolite and protein markers and screening of small molecules in biospecimens via high-resolution mass spectrometry.

<https://www.recetox.muni.cz/en/services/recetox-central-laboratories/biomarker-analysis-laboratories>

CREATE A REQUEST

Microbiome Laboratories

The Microbiome Laboratories is a specialized research facility that provides advanced resources and expertise to support the analysis of microbial communities in various biological systems. This facility offers a range of services to researchers, including sample processing, DNA extraction, preparation of sequencing library, and other molecular biological analyses (gene expression, SNPs, ELISA analysis etc.).

By providing expert support and resources, this facility helps researchers to analyze microbiome data, identify microbial communities, and understand their roles in various biological systems.

<https://www.recetox.muni.cz/en/services/recetox-central-laboratories/microbiome-analytical-laboratories>

CREATE A REQUEST

RCX Data Services

Sequence Data Processing and Analysis (bioinformatics)

This bioinformatics core facility provides advanced computational resources and expertise to support biological research projects. We offer a wide range of bioinformatics analysis pipelines to analyze complex biological data and gain insights into biological systems.

Our services cover state-of-the-art development of pipelines and analysis of data from a wide range of omics experiments from microarrays and NGS sequencing, and include genome assembly, metagenomics (WMGS and targeted - 16SrRNA, ITS, ...), phylogenetics, genome analysis (targeted panels of mutations, WGS, WES, SNP calling), transcriptome analysis (RNAseq, miRNAseq, expression microarrays), epigenomics (epigenetic chips).

<https://www.recetox.muni.cz/en/services/data-services-1/sequence-data-processing-and-analysis>

CREATE A REQUEST

Biostatistics and Data Analyses

Biostatistics and data analyses core facility provides expertise and resources to support statistical analysis and data management for biological research projects. From clinical data to exposome data, from genomics to metabolomics and from epigenomics to biomedical imaging, this core facility offers integrated data analysis and tailored solutions in biostatistics and biomarker discovery.

CREATE A REQUEST

RCX Population studies CELSPAC and biobanking

CELSPAC services

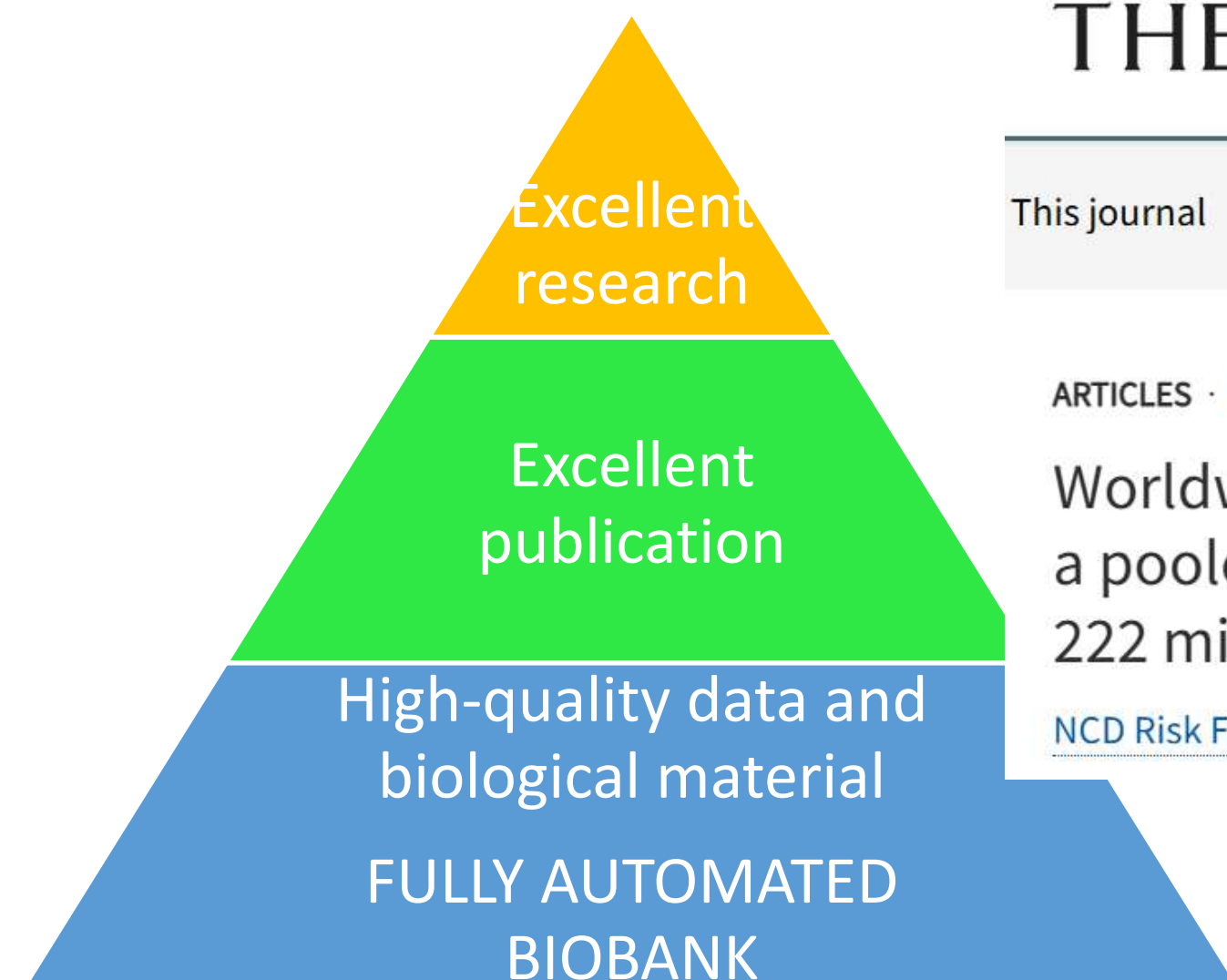
CELSPAC population studies (e.g. the long-term ELSPAC study or the mother-child TNG study) collect different types of data and biological samples on individual exposure and health, parts of which are made available to scientists and research teams. We also offer consulting, training, and services enabling the design and realization of your population studies, collecting questionnaire data, sampling, immunochemistry analyses and/or biobanking of human biological matrices.

CREATE A REQUEST

RCX Other services

Population Studies as a platform for excellent research

	Totally	2024-Q2/2025
Study's participants	48,600	2,500
Stored aliquots of biological samples	570,000	75,000
Released aliquots of biological samples	27,000	6,200
Data variables	560,000	16,000
Exported datasets	160 datasets with 210,000 variables	44 datasets with 60,000 variables
Open Access RI Applications	546	53
Publication based on PopStudies	147, \emptyset IF 7.9	21



THE LANCET

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ARTICLES · Volume 403, Issue 10431, P1027-1050, March 16, 2024 · [Open Access](#)

[Download Full Issue](#)

Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults

[NCD Risk Factor Collaboration \(NCD-RisC\)](#)[†]



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Article

Altered Transcriptome Response in PBMCs of Czech Adults Linked to Multiple PFAS Exposure: B Cell Development as a Target of PFAS Immunotoxicity

Published as part of *Environmental Science & Technology* virtual special issue "The Exposome and Human Health".

Barbora Rudzanová, Vojtěch Thon, Hana Vespalcová, Christopher J. Martyniuk, Pavel Piler, Martin Zvonař, Jana Klánová, Luděk Bláha, and Ondrej Adamovsky*

[Cite This:](#) *Environ. Sci. Technol.* 2024, 58, 90–98

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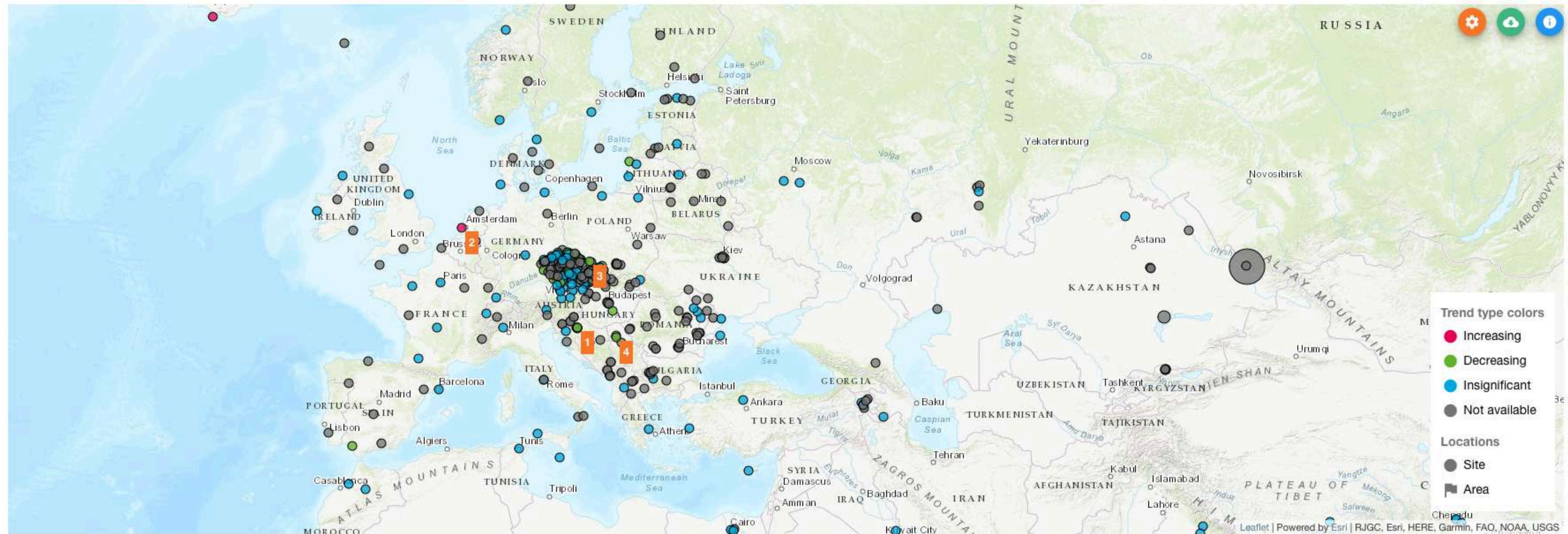
[Article Recommendations](#)

[Supporting Information](#)

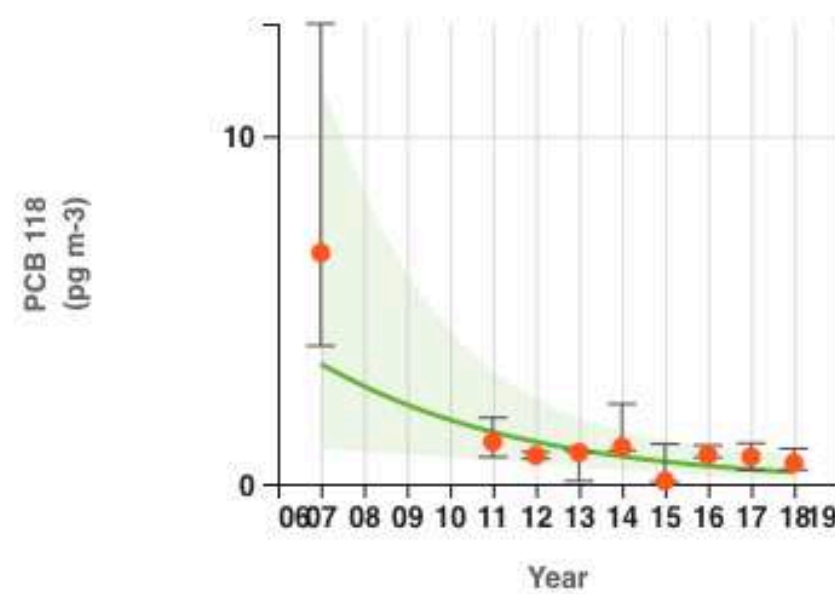
ABSTRACT: While the immunomodulation effects of per- and polyfluoroalkyl substances (PFASs) are described on the level of clinical signs in epidemiological studies (e.g., suppressed antibody response after vaccination), the underlying mechanism has still not been fully elucidated. To reveal mechanisms of PFAS exposure on immunity, we investigated the genome-wide



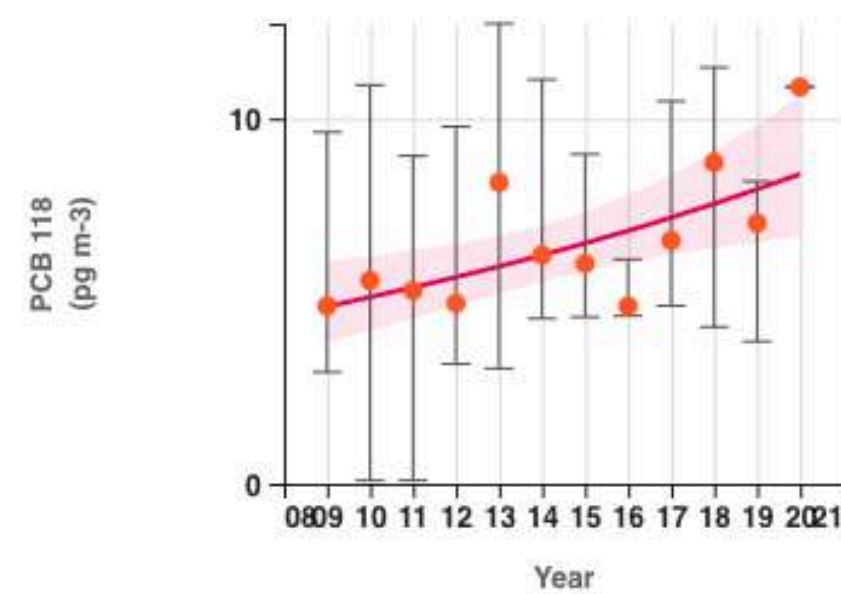
from environmental databases GENASIS and GMP DWH



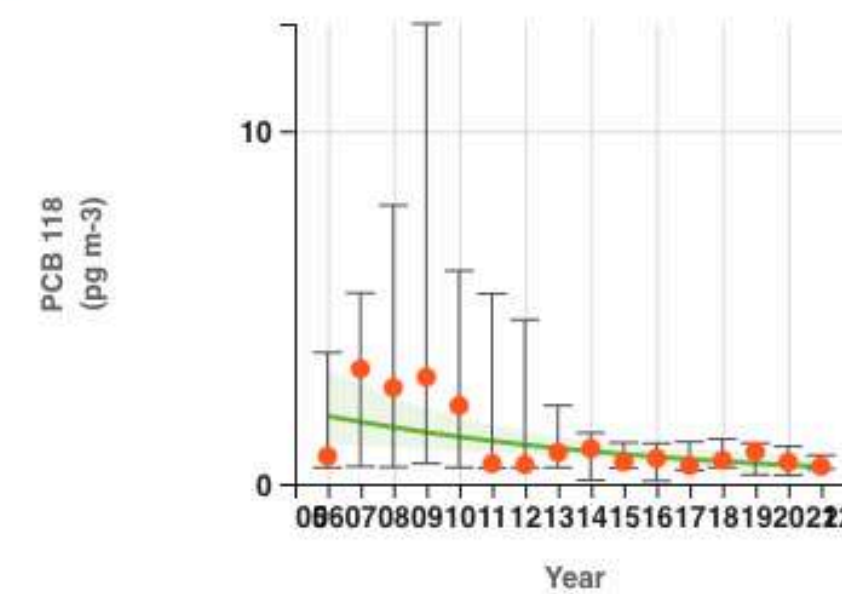
1 Zagreb, IMI, Croatia



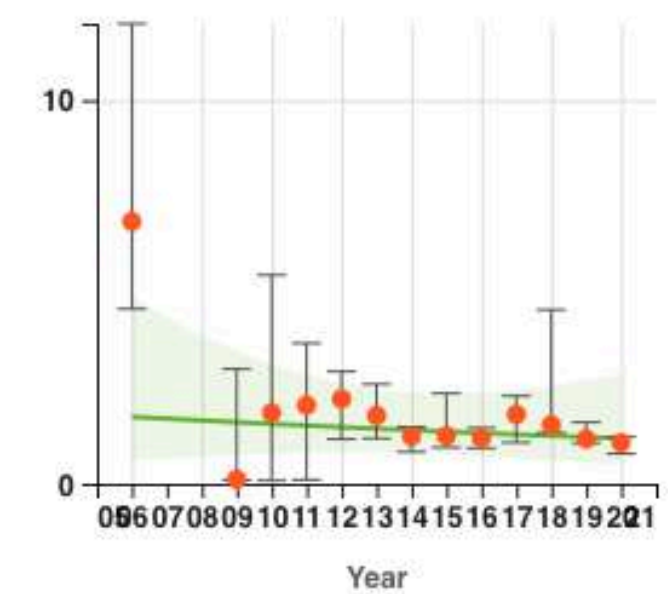
2 De Zilk, EMEP, Netherlands (the)



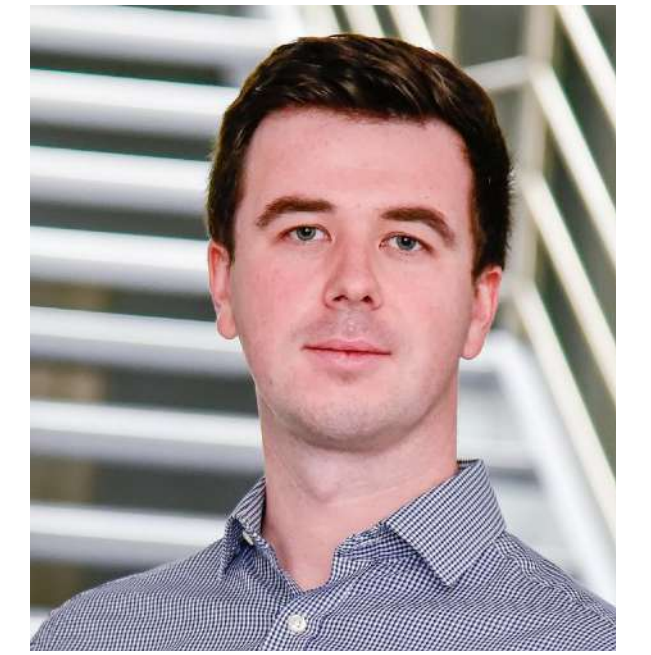
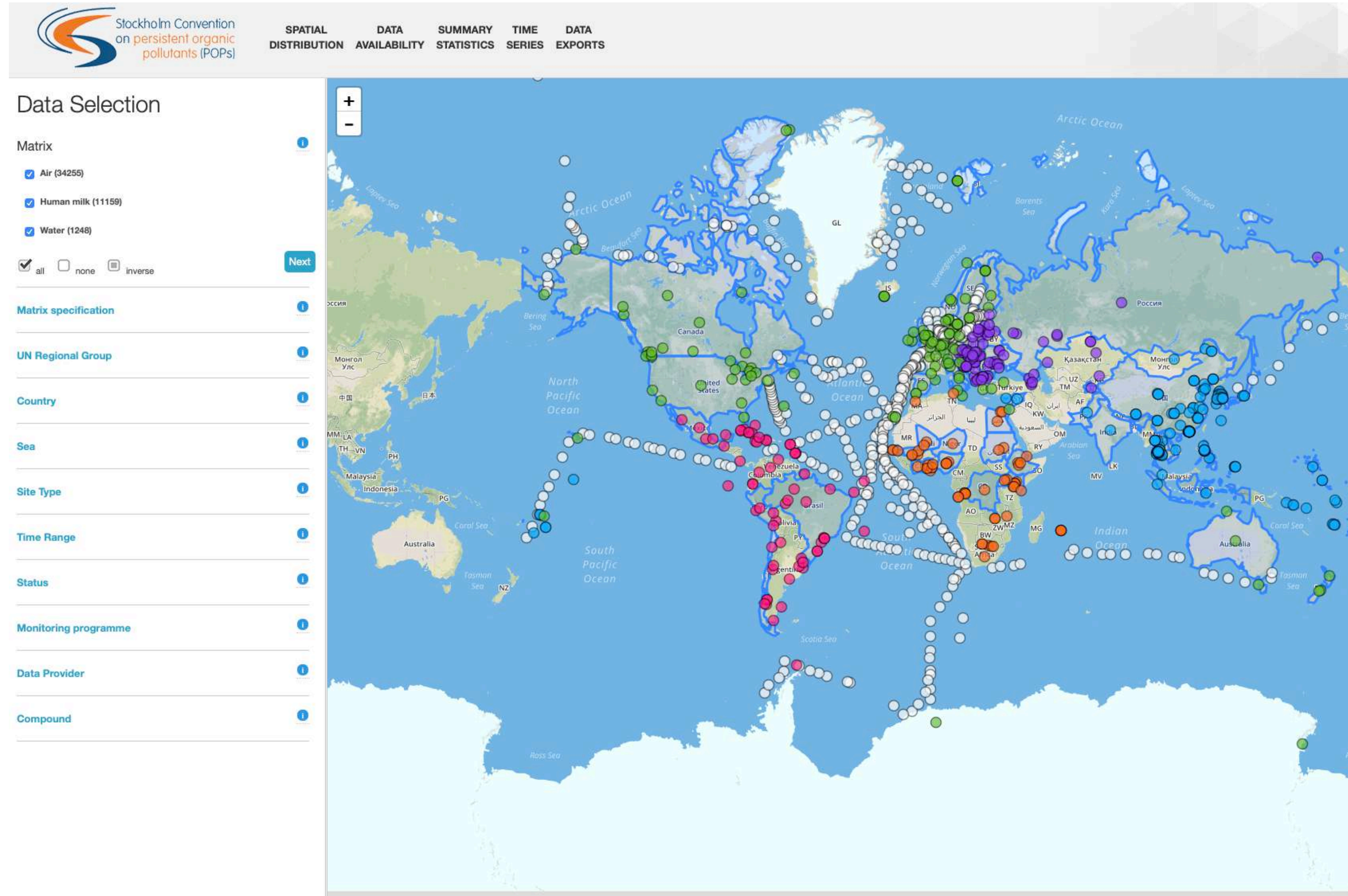
3 Jeseník, Jeseníky, Czechia



4 Fruska Gora, Serbia



GENASIS information system

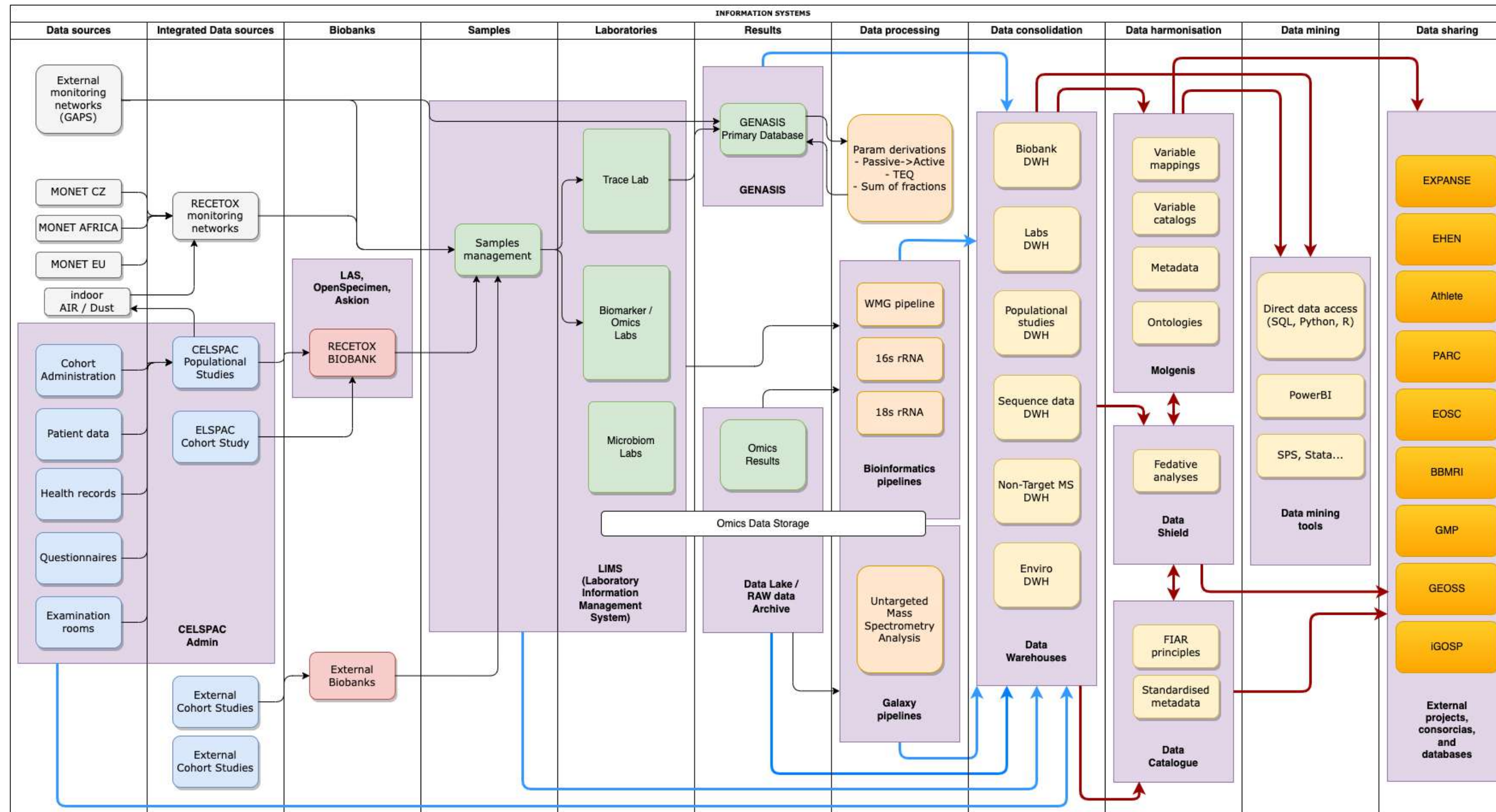


- Data collection and harmonisation
- Data hosting and visualisation
- Data integration and analysis
- Services to UNEP, WHO, government and authorities
- Support for the GMP

<https://www.genasis.cz>
<https://www.pops-gmp.org>

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...to complex data integrations

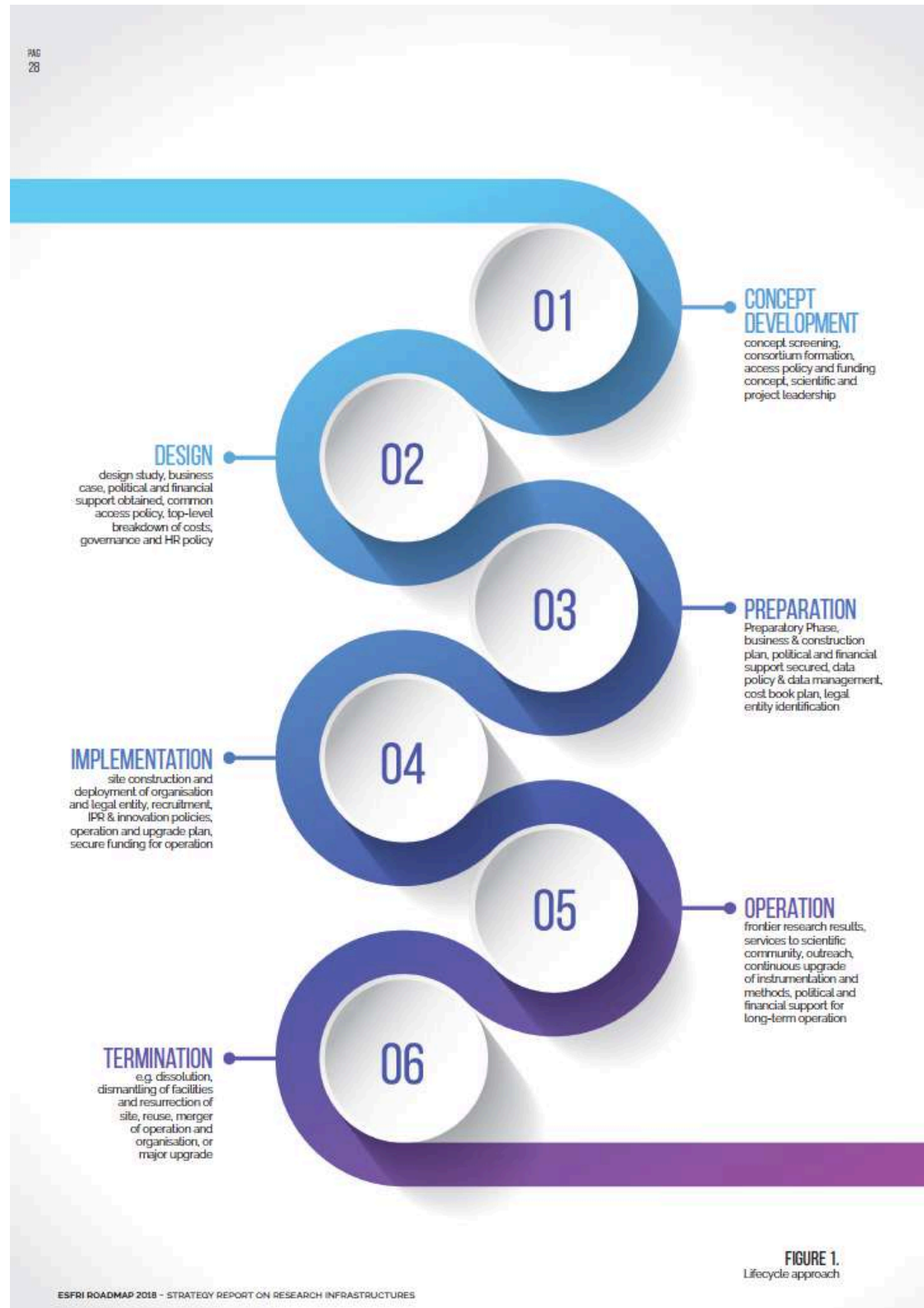


- CELSPAC Admin
- CELSPAC questionnaires
- Biobanking system
- Repositories for hi-res data
- Sensitive cloud

- FAIR Data management
- Building ontologies
- Co-leading PARC data activities
- Leading CZ-EOSC ENV

- High-res MS data processing
- Sequencing data
- Integrative omics
- Leading CZ-EOSC ENV

Gap in the 2018 ESFRI Roadmap



EIRENE RI: Prioritised in the 2021 ESFRI Roadmap

EIRENE RI

Research Infrastructure for Environmental Exposure assessment in Europe

Website
pending

Headquarters
Masaryk University
Brno, Czech Republic

Legal status
pending

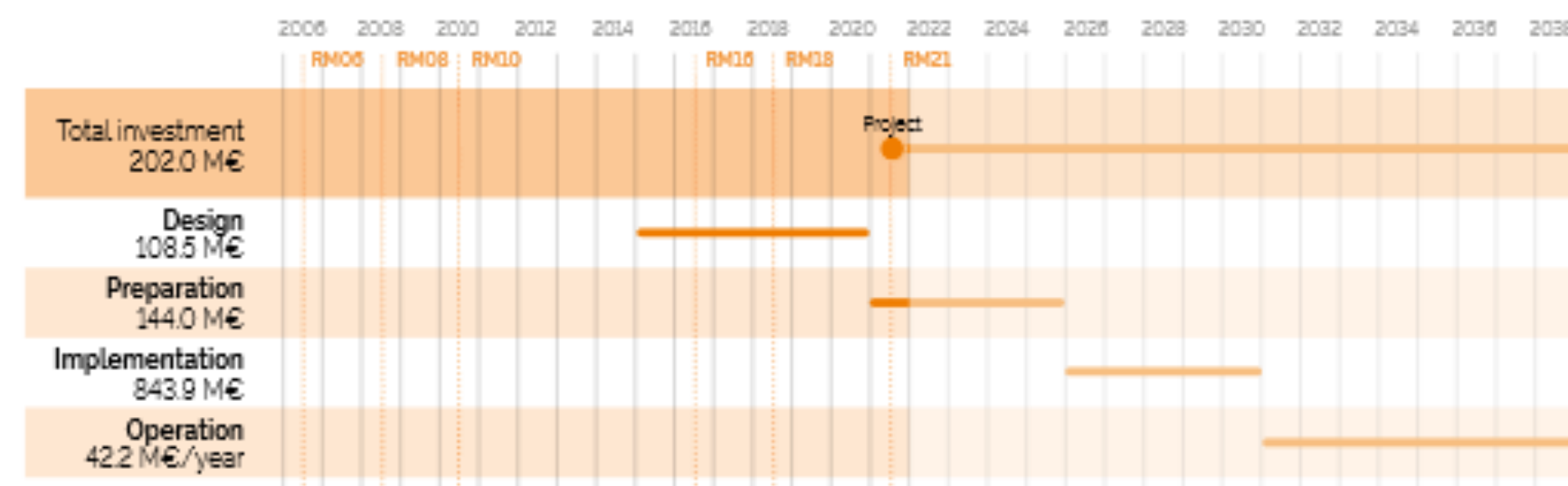
Type
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DESCRIPTION

The Research Infrastructure for Environmental Exposure assessment in Europe (EIRENE RI) pioneers the first European Research Infrastructure on environmental determinants of human health, the Human Exposome. EIRENE RI intends to support large-scale research for the interdisciplinary assessment of environmental determinants of health, including indoor and outdoor environment factors, lifestyle, socioeconomic, and the individual's ability to cope with various stressors such as infection or disease. EIRENE RI will provide harmonised workflows and integrated services for data and sample collection, as well as knowledge and tools that will be made accessible to academic researchers, private companies, public authorities and citizens through the EIRENE open-access system and the EIRENE knowledge hub.

The concept of a pan-European Infrastructure supporting research on the effects of long-term exposures to various types of stressors on population health and the roles these exposures play in the development of chronic diseases is based on ten-year experience of Czech national RECETOX RI. Entered in the ESFRI Roadmap 2021, EIRENE RI already connects 50 research institutions from 17 countries. It builds on the legacy of the European environmental monitoring networks and their databases (EMEP, GMP, GMOS), GEO Initiatives (GOS4POP and GOS4M) and related H2020 projects (ERA, PLANET, e-SHAPE), EU biomonitoring initiatives (DEMOCOPHES, HBM4EU), UNEP/WHO global biomonitoring efforts, EU exposome (HELIX, EXPOSOMICS, HEALS and EHEN cluster) and other related projects (HERA, EURION cluster).

TIMELINE & ESTIMATED COSTS



INTERCONNECTIONS



POLITICAL SUPPORT



Lead

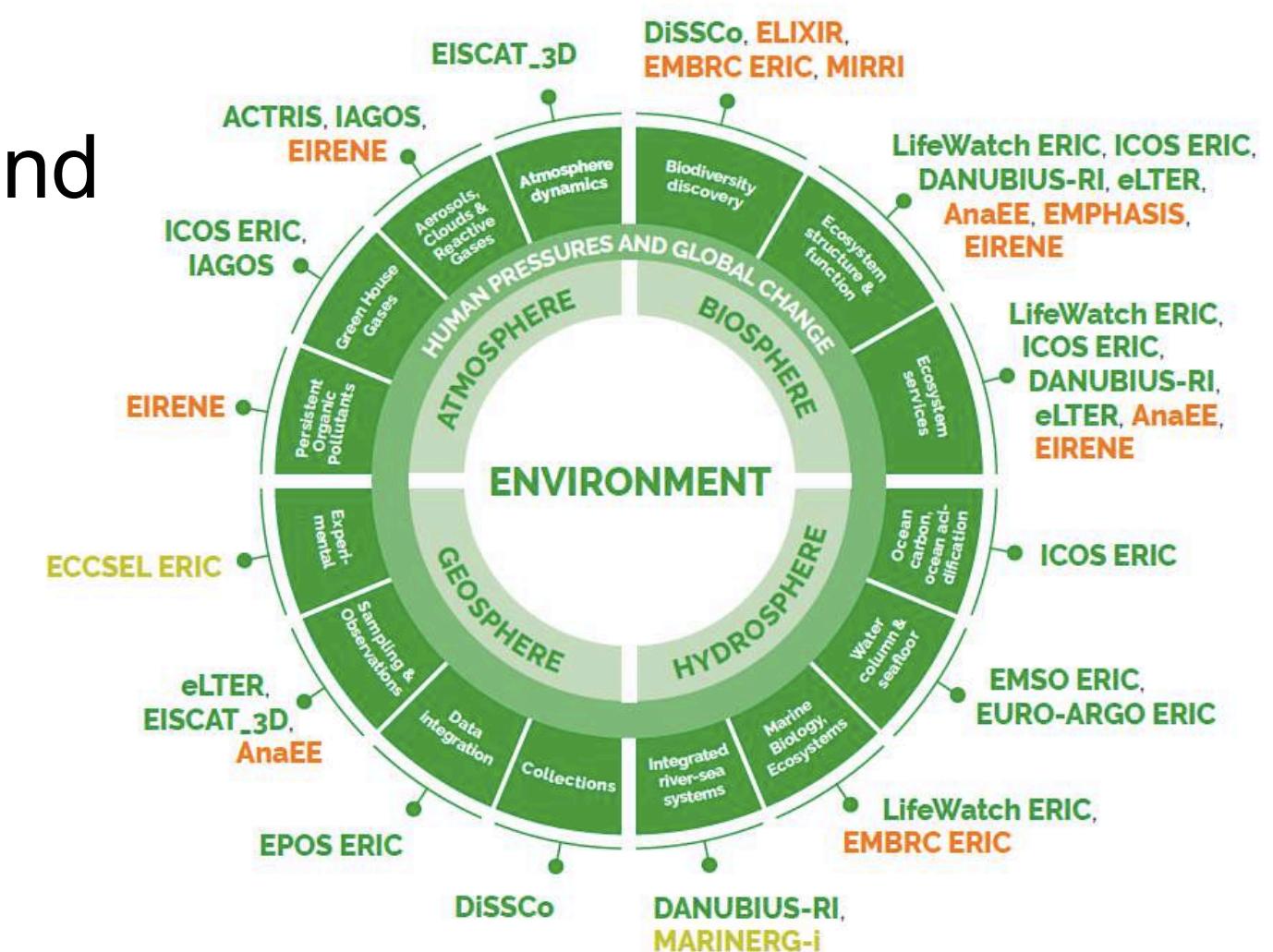
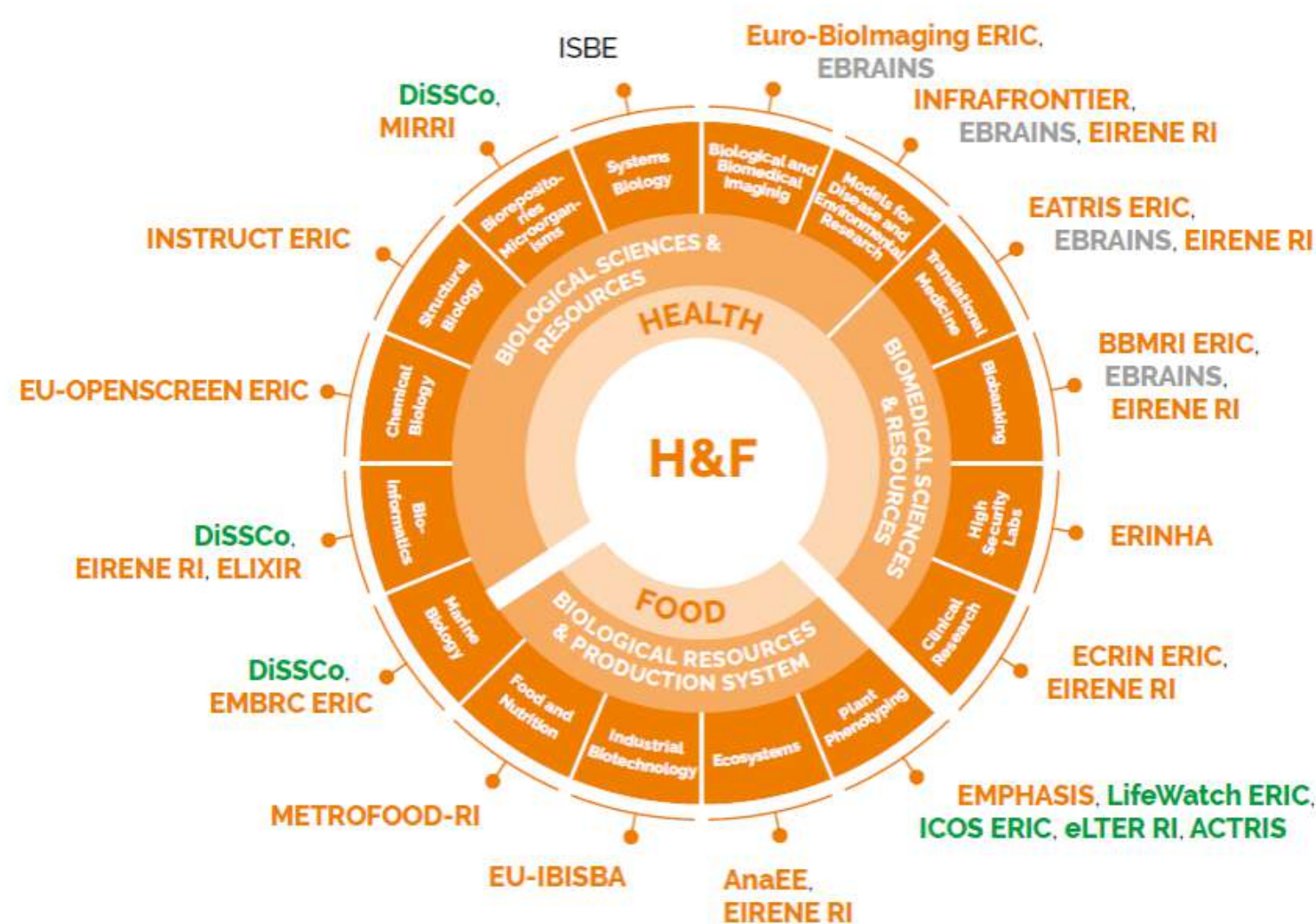
CZ

Prospective member

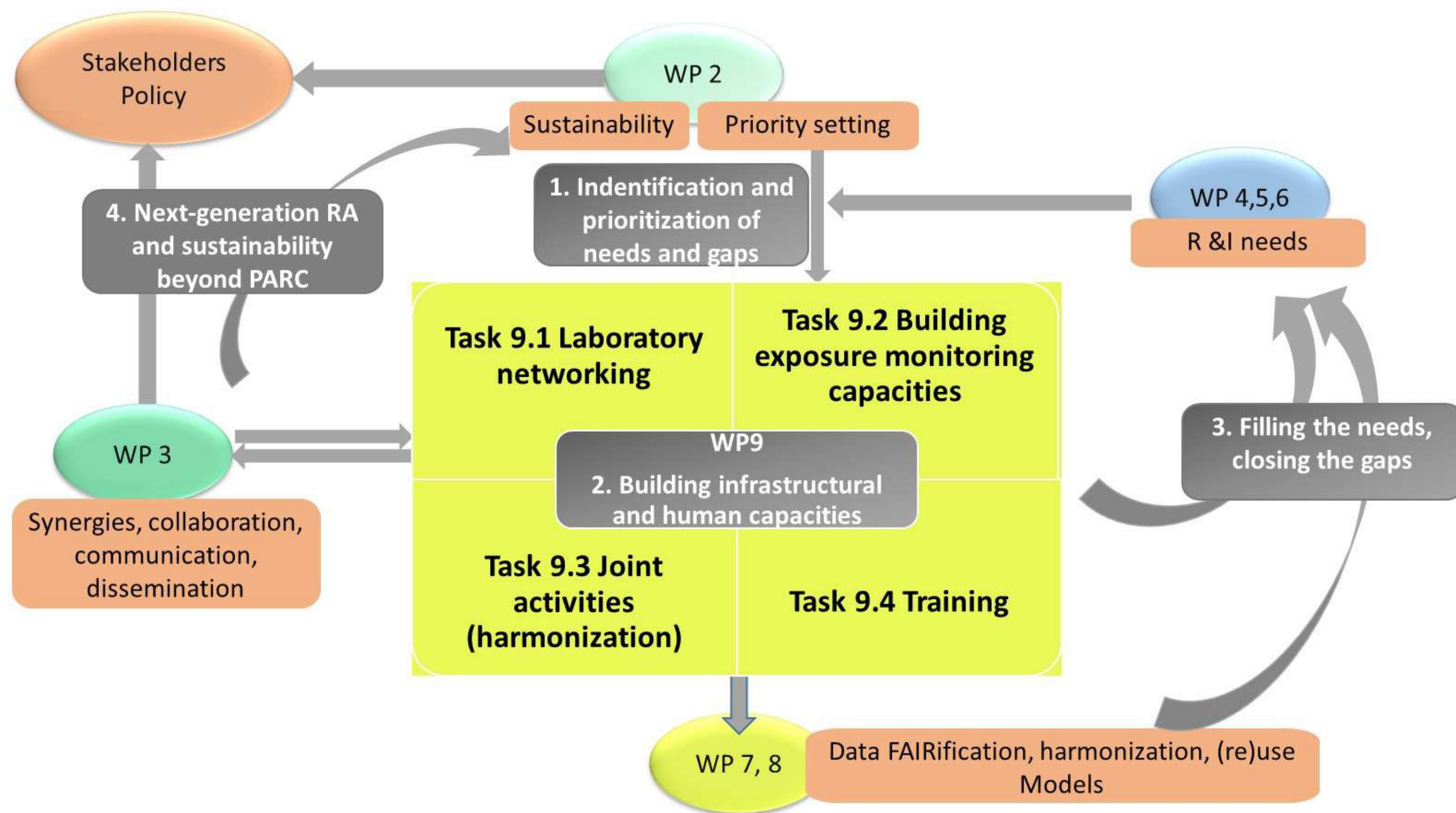
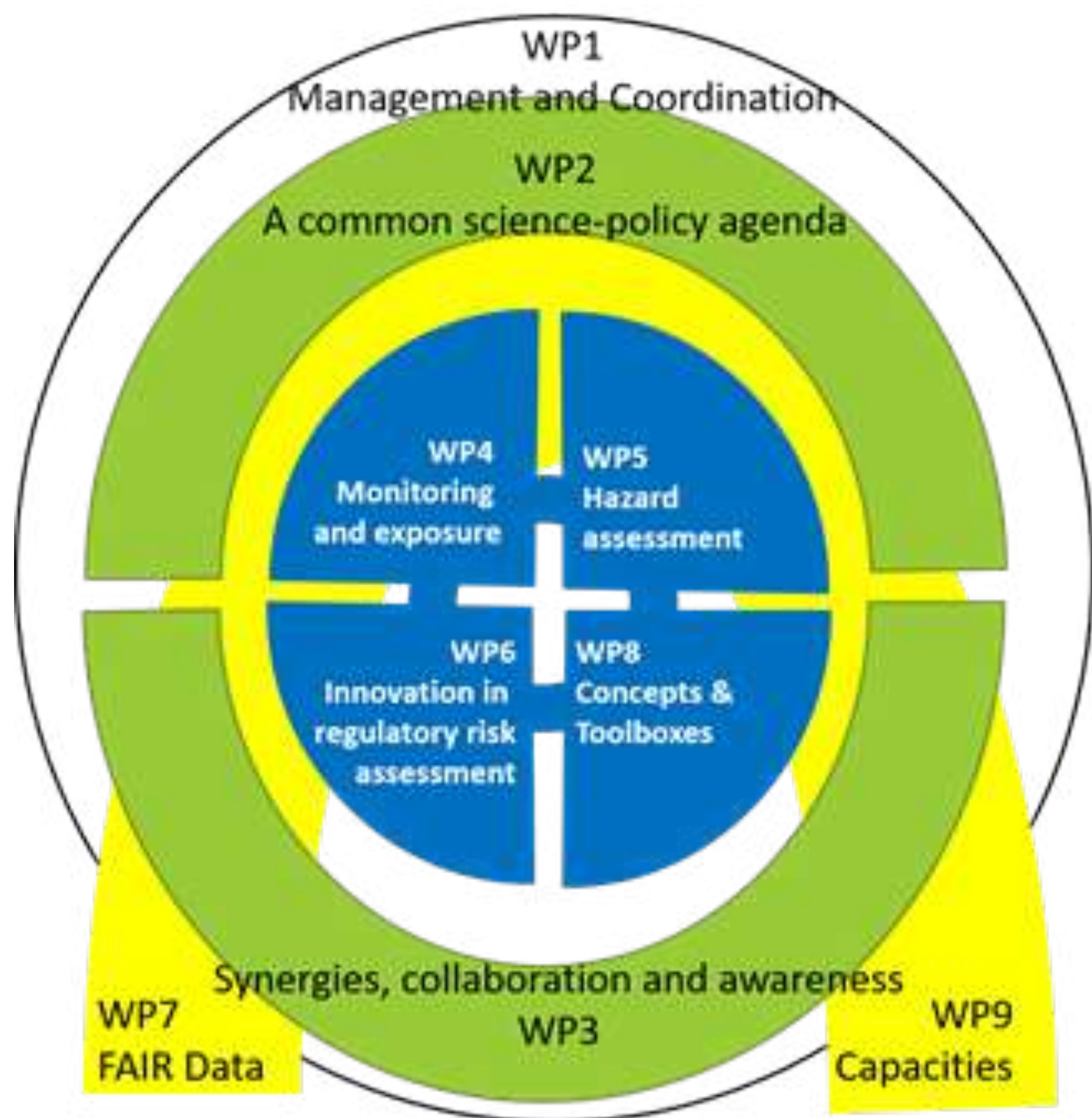
AT, BE, DE, EL, ES, IS, IT, NL, SK

Members

- Austria, Belgium, Czechia, Italy, Netherlands
- Germany, Greece, Iceland, Slovakia
- France, Norway, Sweden
- Finland, Slovenia, Spain, UK, US
- Cyprus, Denmark, Luxembourg, Portugal
- Australia, Canada, Japan, Switzerland
- EMBL/EBI

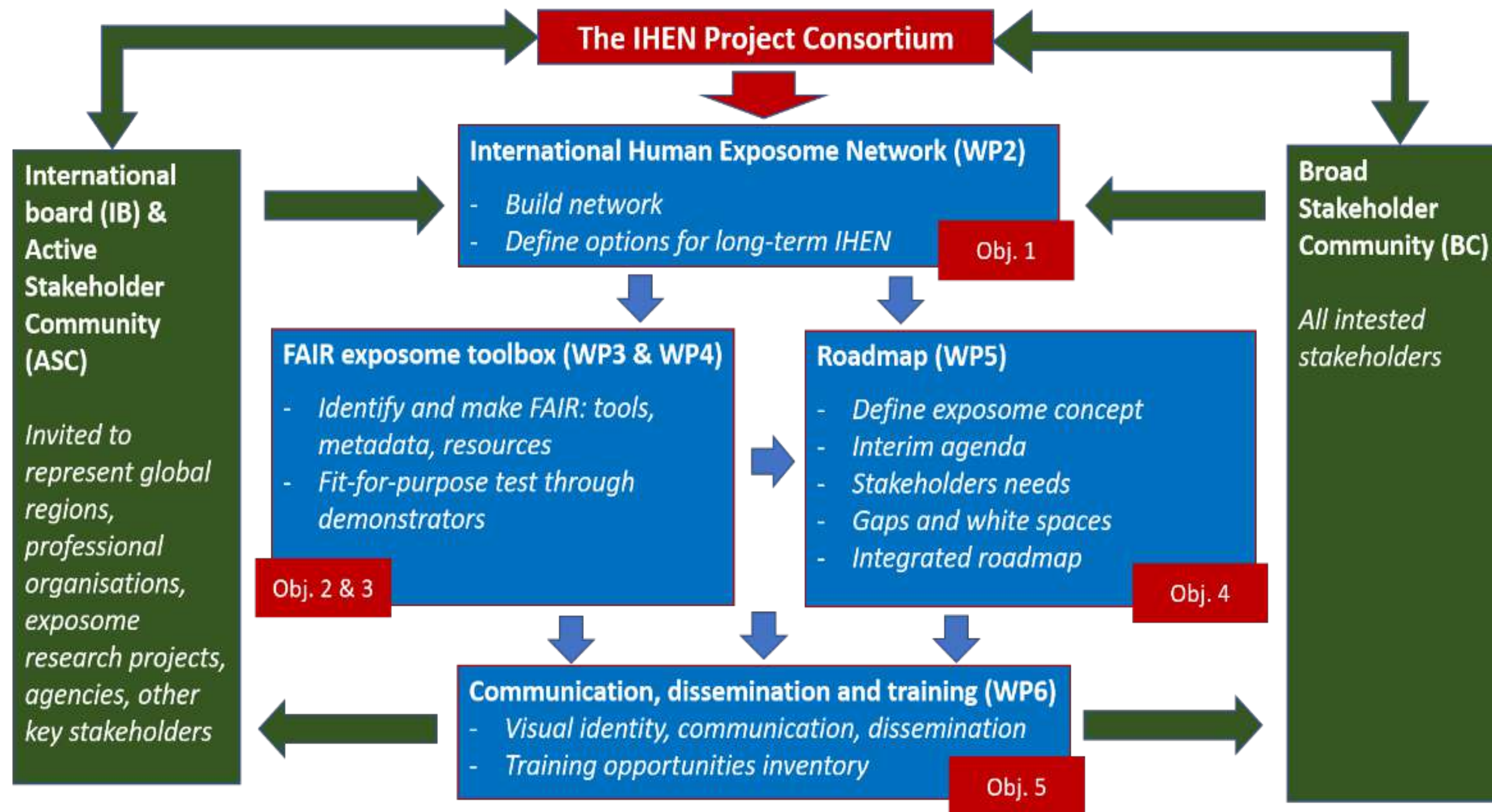


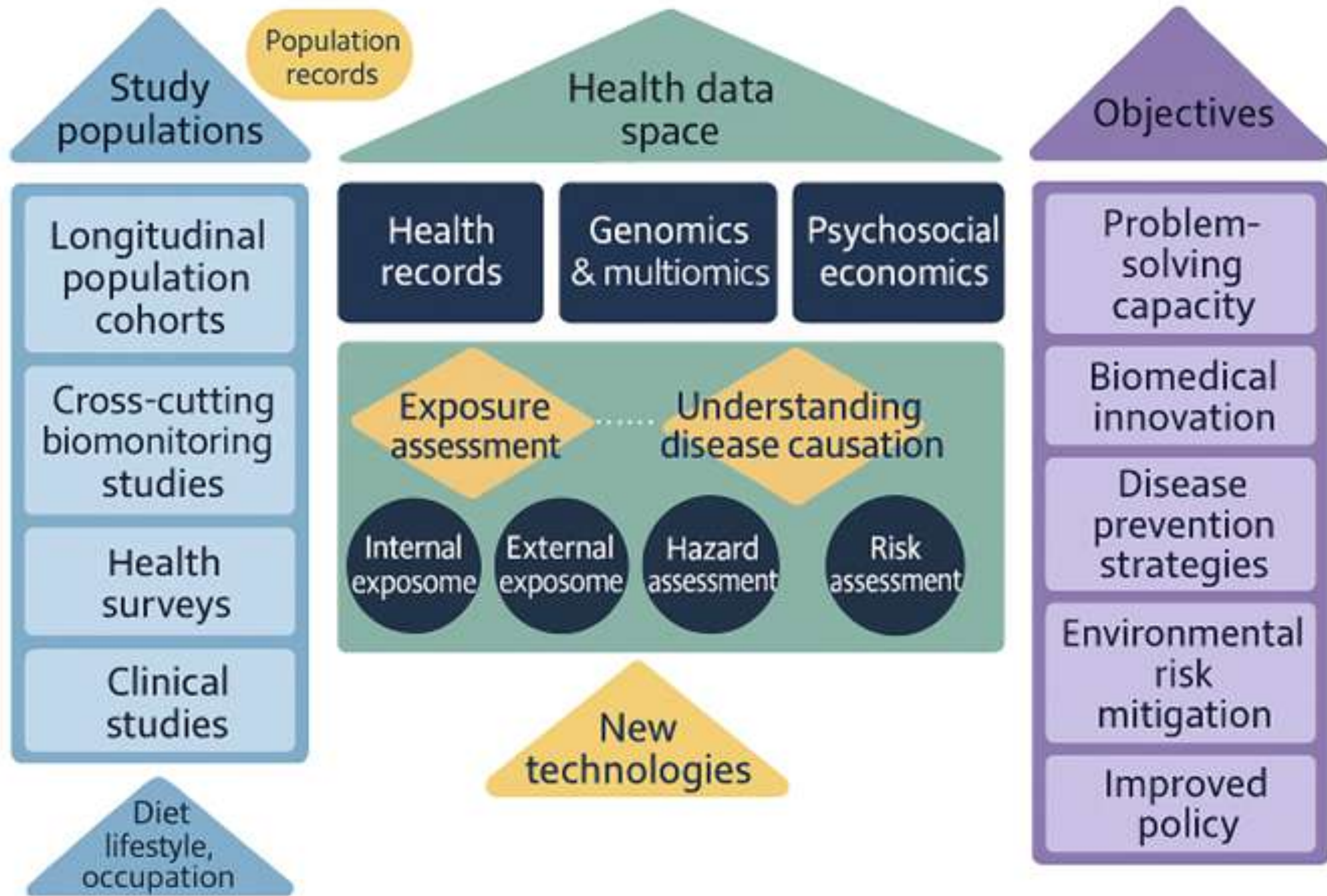
Building infrastructural and human capacities in PARC



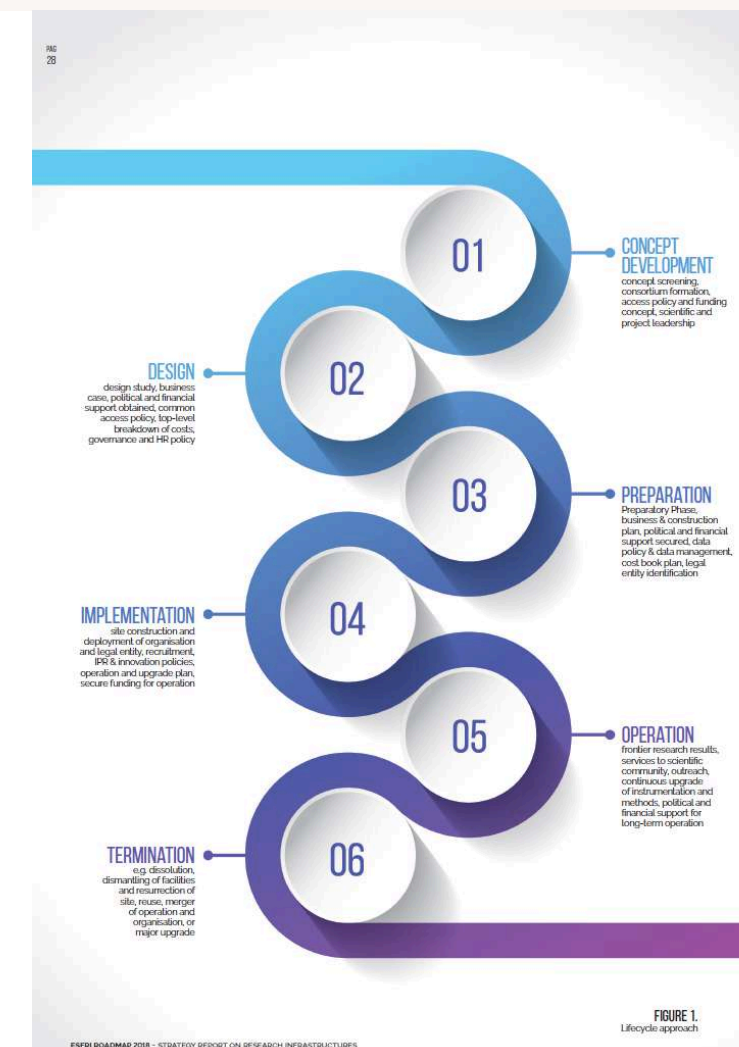
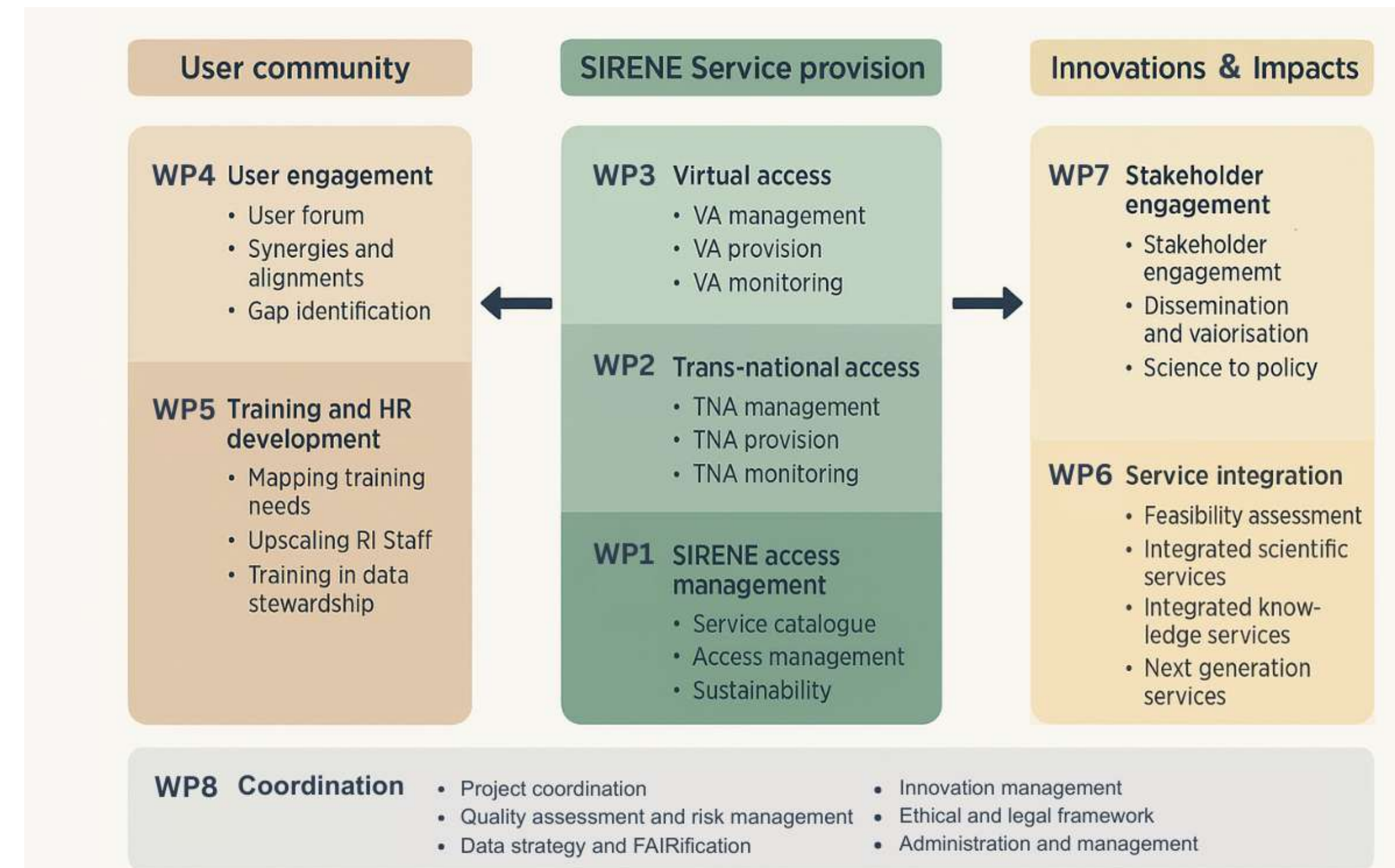
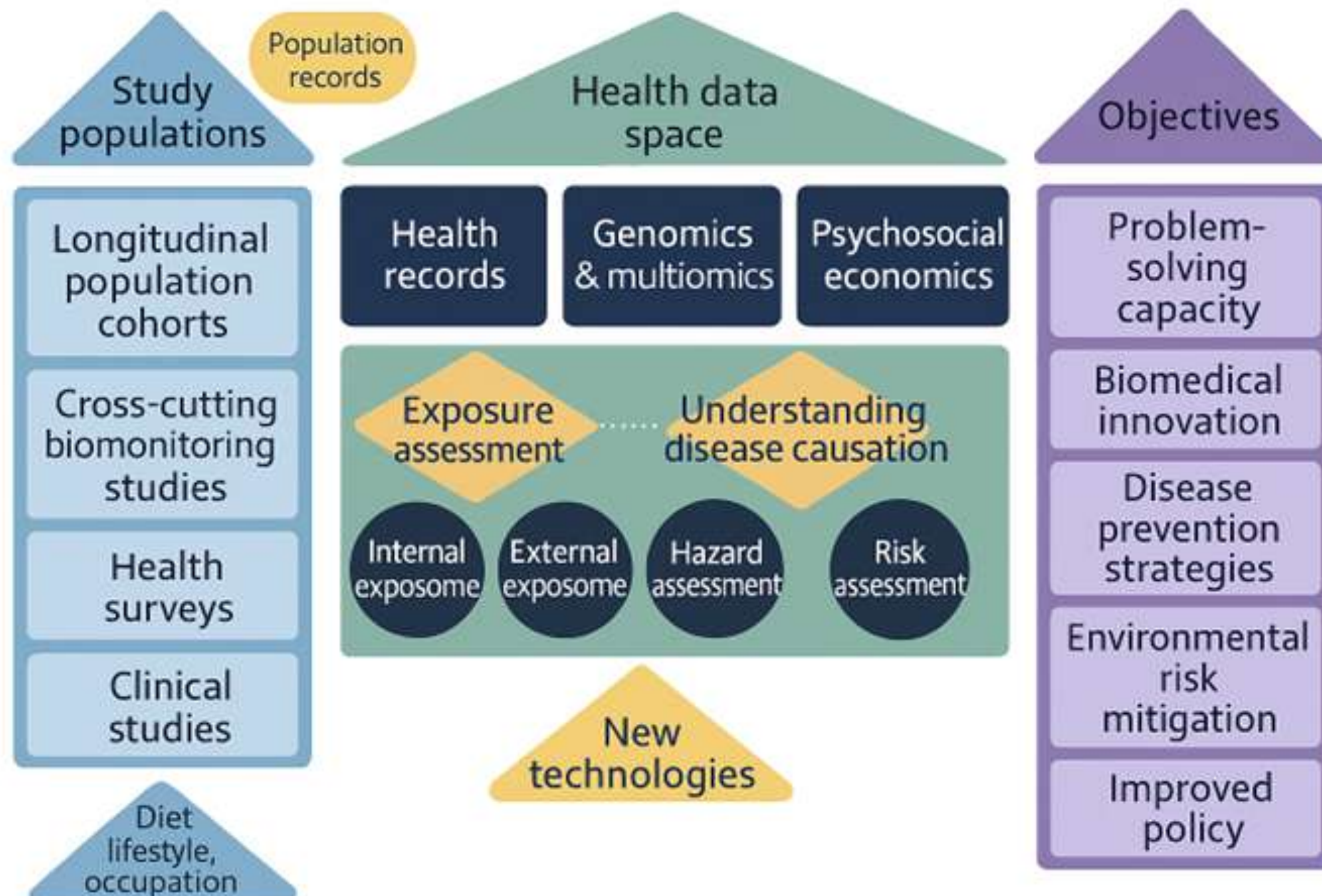
IHEN Vision

To establish an international network that will improve global research and cooperation on the exposome





SIRENE project



EIRENE
BBMRI
ECRIN
SHARE
EATRIS

ACTRIS
AnaEE
EMBRC
EuroBioImaging
ELIXIR

EIRENE's and PARC's side event on COPs 2025

The RECETOX Centre has been operating at the science-to-policy interface at the national, European and global levels for two decades. As the Stockholm Convention Regional Centre (SCRC) for capacity building and technology transfer it supports the implementation of the global conventions protecting human health from the chemical risks and presents its activities at the Conferences of Parties of these conventions at the regular basis.



Human
exposome
research

Potential, limitations
and public policy
implications



Global Forum of the Group of Earth Observations 2025

„The Earth Talks“ was a motto of the 2025 Global Forum of the [Group of Earth Observations](#) (GEO) held on May 5-9 in the Auditorium della Tecnica in Rome. GEO brought together all elements of our society – from ministers and global leaders to citizens – to harness Earth Intelligence to empower informed and ambitious actions to ensure food security, restore ecosystems, prevent disasters, and confront the triple planetary crisis, transforming the Sustainable Development Goals into an achievable reality.

STUDY
Panel for the Future of Science and Technology



EPRS | European Parliamentary Research Service
Scientific Foresight Unit (STOA)
PE 765.791 – April 2025



Coordinating European Research Infrastructure on Human Exposome (EIRENE)

EIRENE RI

Research Infrastructure for Environmental Exposure assessment in Europe

Website pending

Headquarters
Masaryk University
Brno, Czech Republic

Legal status pending

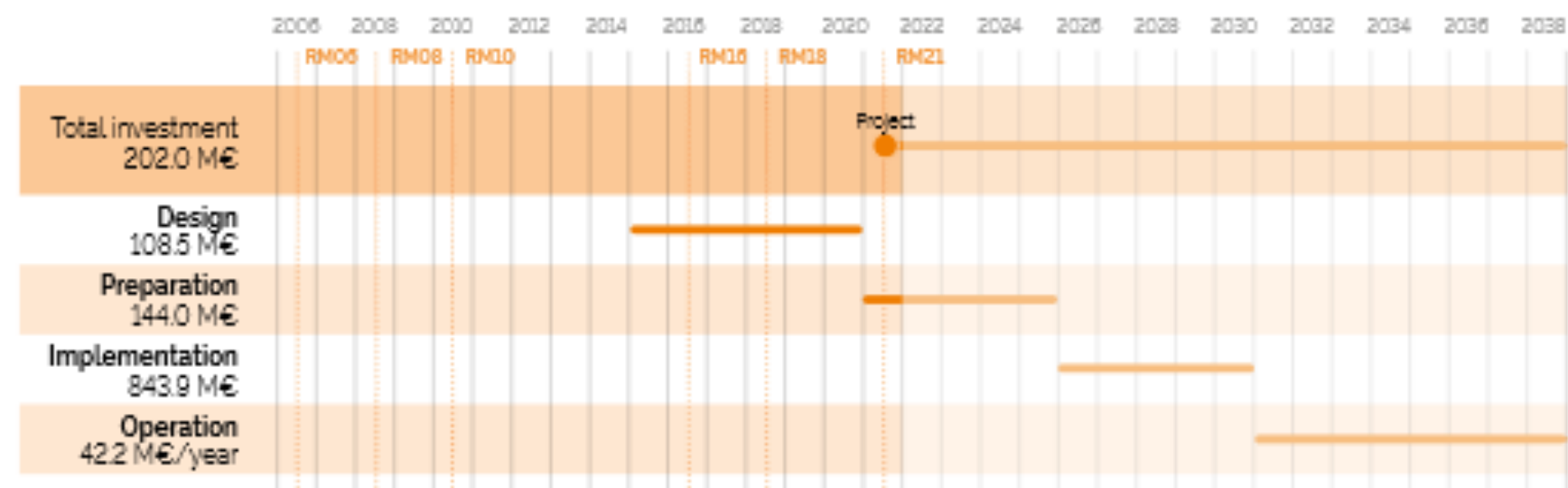
Type distributed

DESCRIPTION

The Research Infrastructure for Environmental Exposure assessment in Europe (EIRENE RI) pioneers the first European Research Infrastructure on environmental determinants of human health, the Human Exposome. EIRENE RI intends to support large-scale research for the interdisciplinary assessment of environmental determinants of health, including indoor and outdoor environment factors, lifestyle, socioeconomics, and the individual's ability to cope with various stressors such as infection or disease. EIRENE RI will provide harmonised workflows and integrated services for data and sample collection, as well as knowledge and tools that will be made accessible to academic researchers, private companies, public authorities and citizens through the EIRENE open-access system and the EIRENE knowledge hub.

The concept of a pan-European Infrastructure supporting research on the effects of long-term exposures to various types of stressors on population health and the roles these exposures play in the development of chronic diseases is based on ten-year experience of Czech national RECETOX RI. Entered in the ESFR1 Roadmap 2021, EIRENE RI already connects 50 research institutions from 17 countries. It builds on the legacy of the European environmental monitoring networks and their databases (EMEP, GMP, GMOS), GEO Initiatives (GOS4POP and GOS4M) and related H2020 projects (ERA, PLANET, e-SHAPE), EU biomonitoring initiatives (DEMOCOPHES, HBM4EU), UNEP/WHO global biomonitoring efforts, EU exposome (HELIX, EXPOSOMICS, HEALS and EHEN cluster) and other related projects (HERA, EURION cluster).

TIMELINE & ESTIMATED COSTS



INTERCONNECTIONS



POLITICAL SUPPORT



Lead

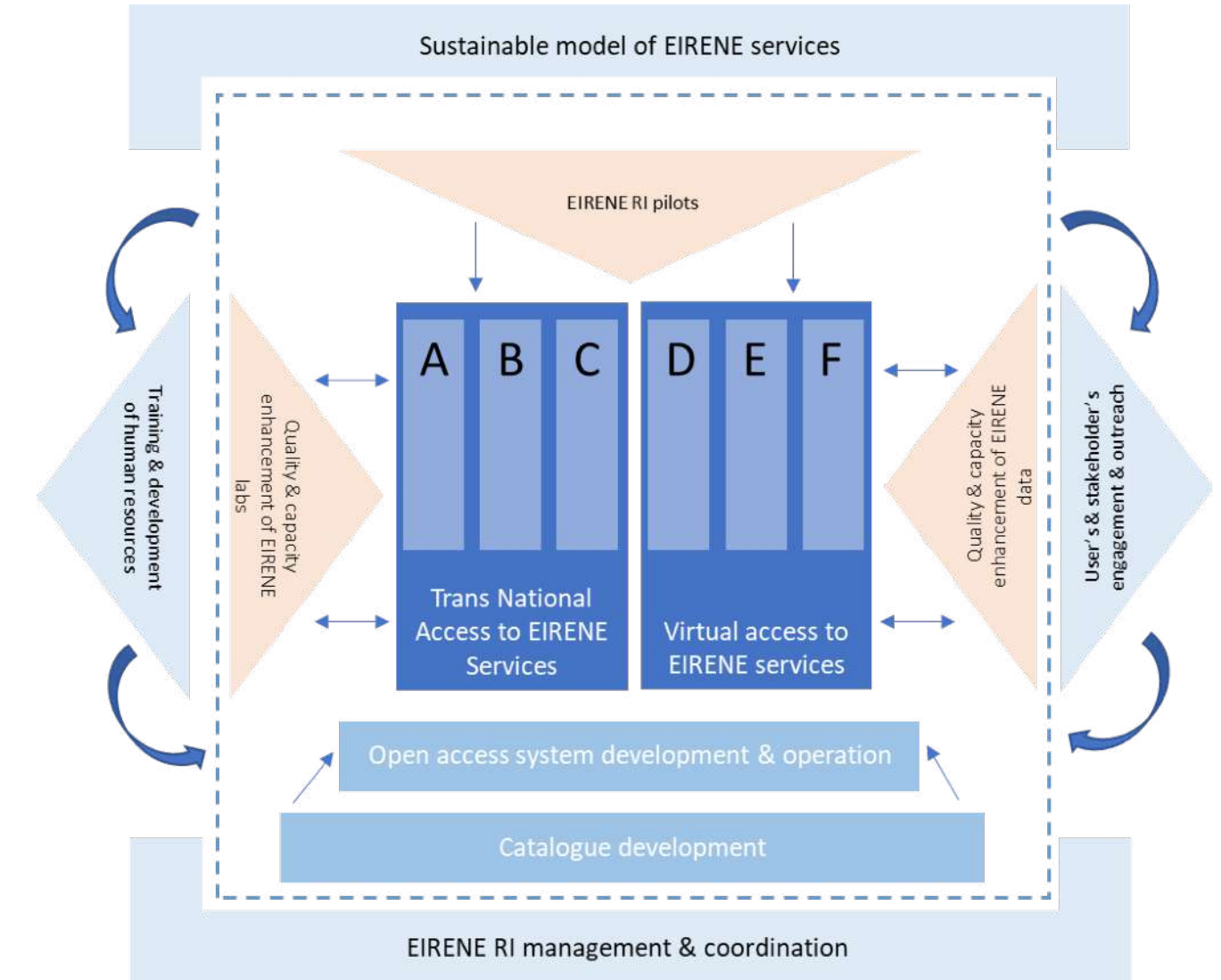
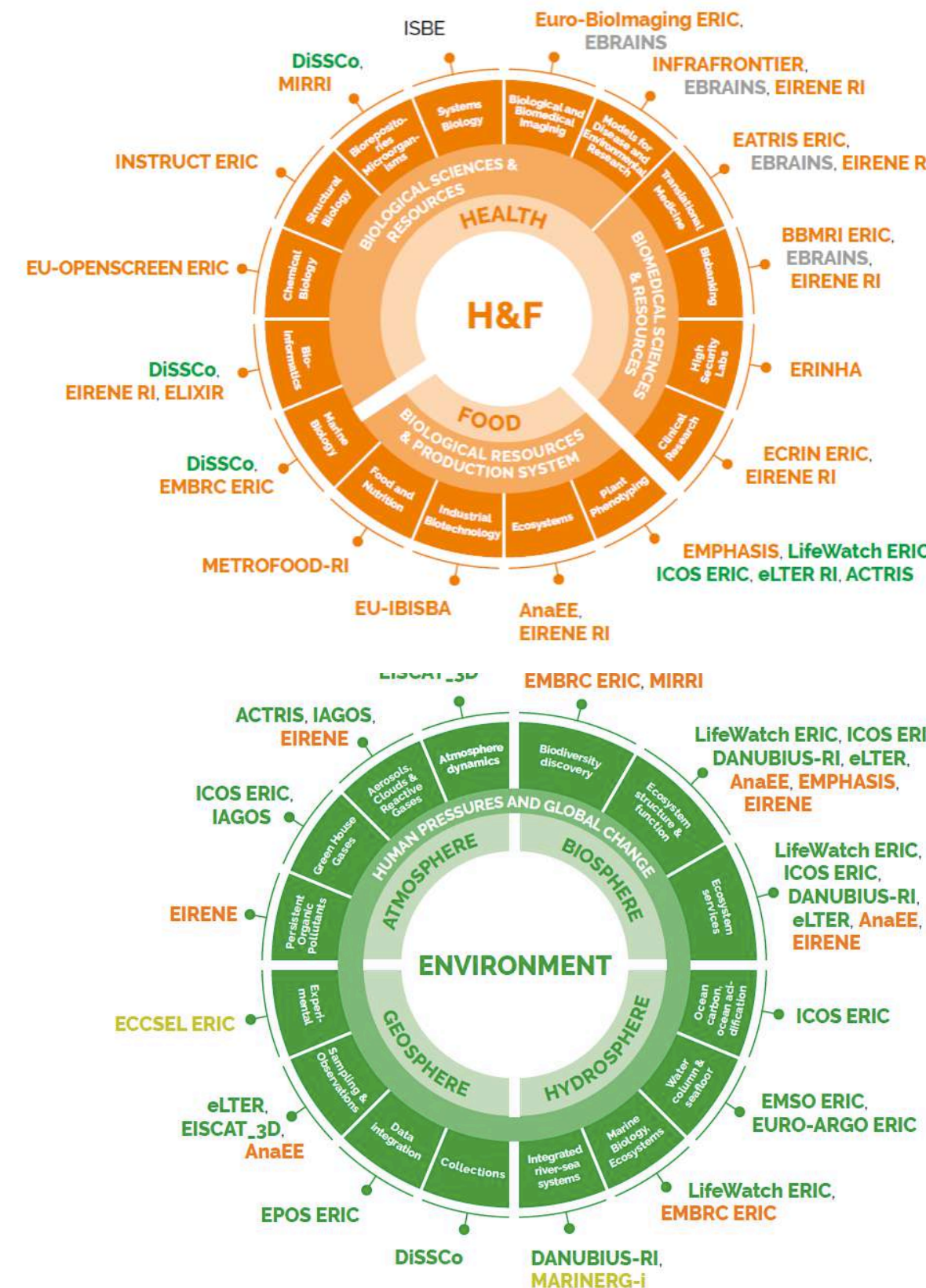
CZ

Prospective member

AT, BE, DE, EL, ES, IS, IT, NL, SK

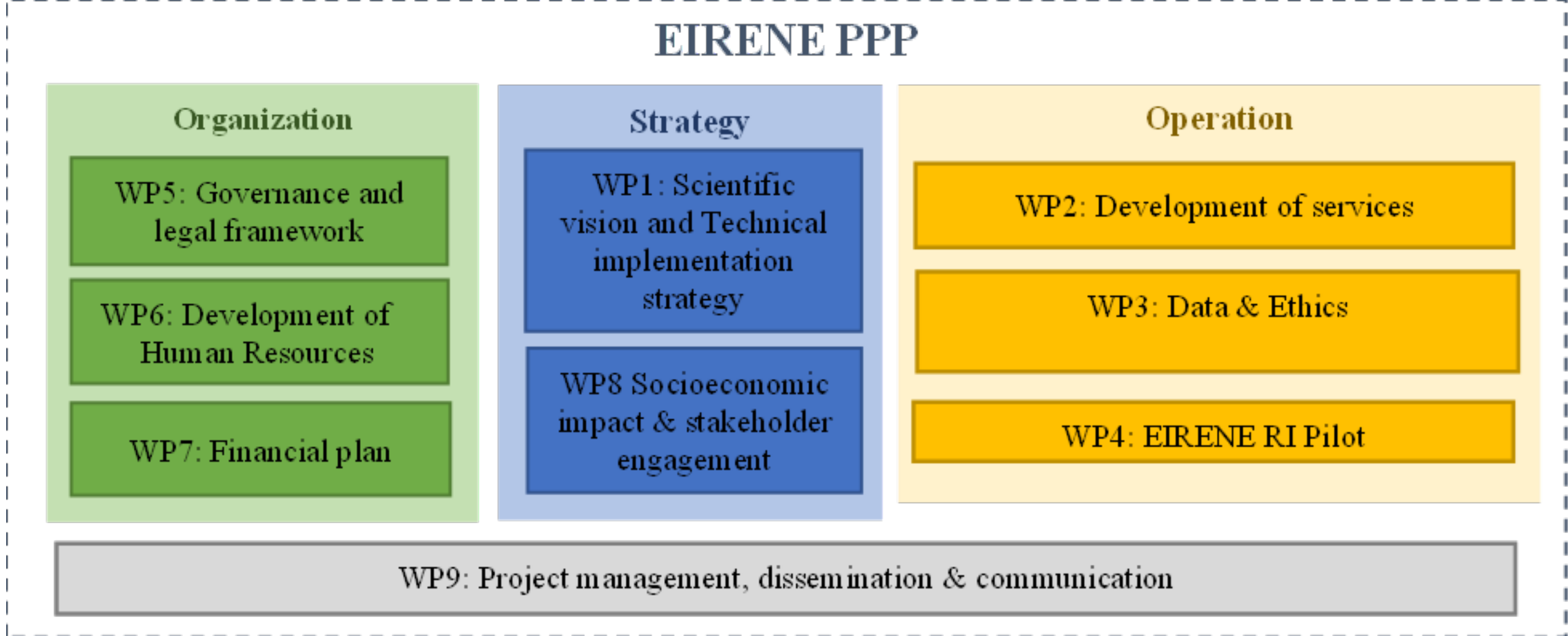
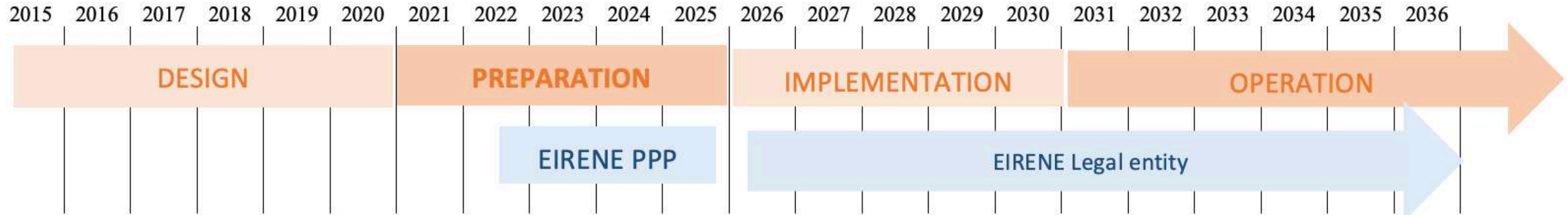
Member states

- Austria, Belgium, Czech Republic, France, Italy, Netherlands
- Germany, Greece, Iceland, Slovakia, Slovenia
- Finland, Norway, Sweden, Spain
- UK, US, Australia, Canada, Japan
- Cyprus, Denmark, LX, Portugal



- A – chemical (exposure) profiling
- B – biological (response) profiling
- C – hazard (risk) assessment
- D – environmental data
- E – human data
- F – data processing tools & platforms

EIRENE PPP Horizon Europe project



ESFRI evaluation 2025
INFRA DEV EIRENE IMP
INFRA SERV SIRENE

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-2030	2031-2050	
FP7 exposome related projects																
				HBM4EU JPI												
				ERA-Planet												
					H2020 EHEN Cluster projects											
					PARC partnership											
				EIRENE RI: Design Phase			EIRENE RI: Preparatory phase			Implementation			Operation			

EIRENE as an opinion leader



Human
exposome
research

Potential, limitations
and public policy
implications

Science

Current Issue

HOME > SCIENCE > VOL. 388, NO. 6745 > INTEGRATING EXPOSOMICS INTO BIOMEDICINE

🔒 | PERSPECTIVE | BIOMEDICINE

Integrating exposomics into biomedicine

Assessing a full range of environmental exposures will improve human health

GARY W. MILLER AND BANBURY EXPOSOMICS CONSORTIUM [Authors Info & Affiliations](#)

SCIENCE • 24 Apr 2025 • Vol 388, Issue 6745 • pp. 356-358 • DOI: 10.1126/science.adr0544

STUDY

Panel for the Future of Science and Technology



EPRS | European Parliamentary Research Service

Scientific Foresight Unit (STOA)
PE 765.791 – April 2025



Want to know more?

- Brochures and leaflets or website www.recetox.muni.cz
- RECETOX Research infrastructure open access - <https://www.recetox.muni.cz/en/services/for-users>
- PARC materials and website www.eu-parc.eu

MUNI | RECETOX

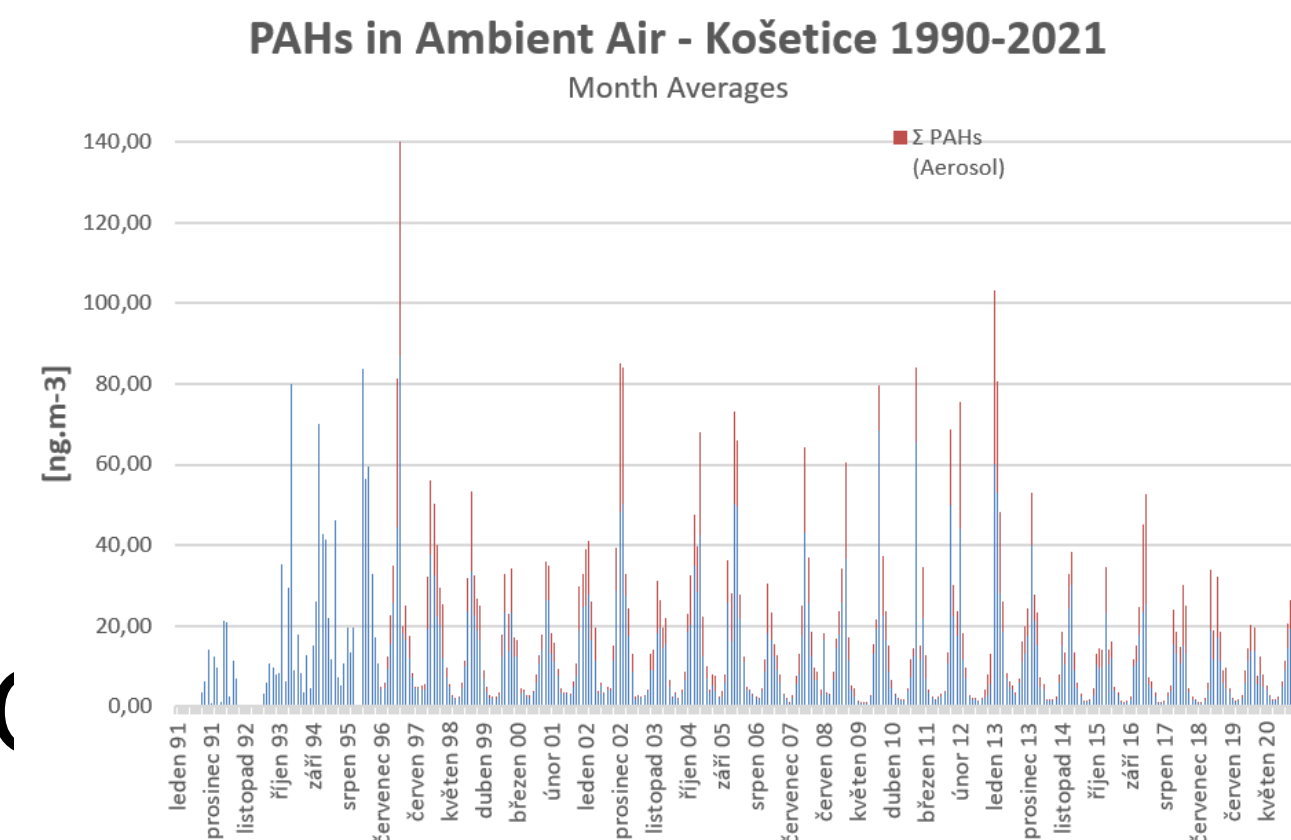
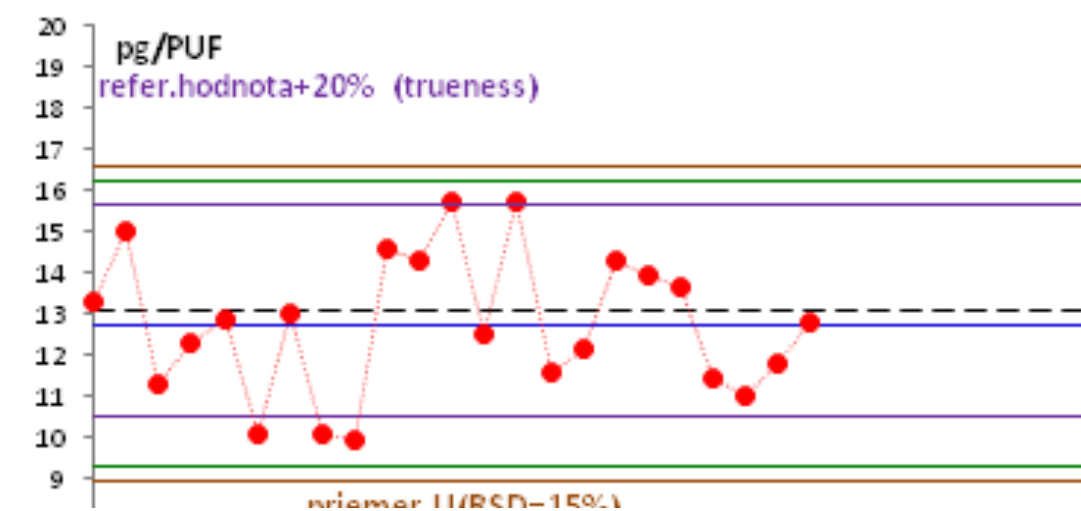
katerina.sebkova@recetox.muni.cz

Should you have questions, do not hesitate to contact me!

Thank you for your kind attention!

Trace Analytical Laboratory offers

- Sampling
- Samples preparation
- Analysis and data evaluation
- QA/QC system
- Monitoring studies
- Monitoring Networks (MONET EU and Africa, AC)



Analysis of organic pollutants, their metabolites, trace elements, metals, and species

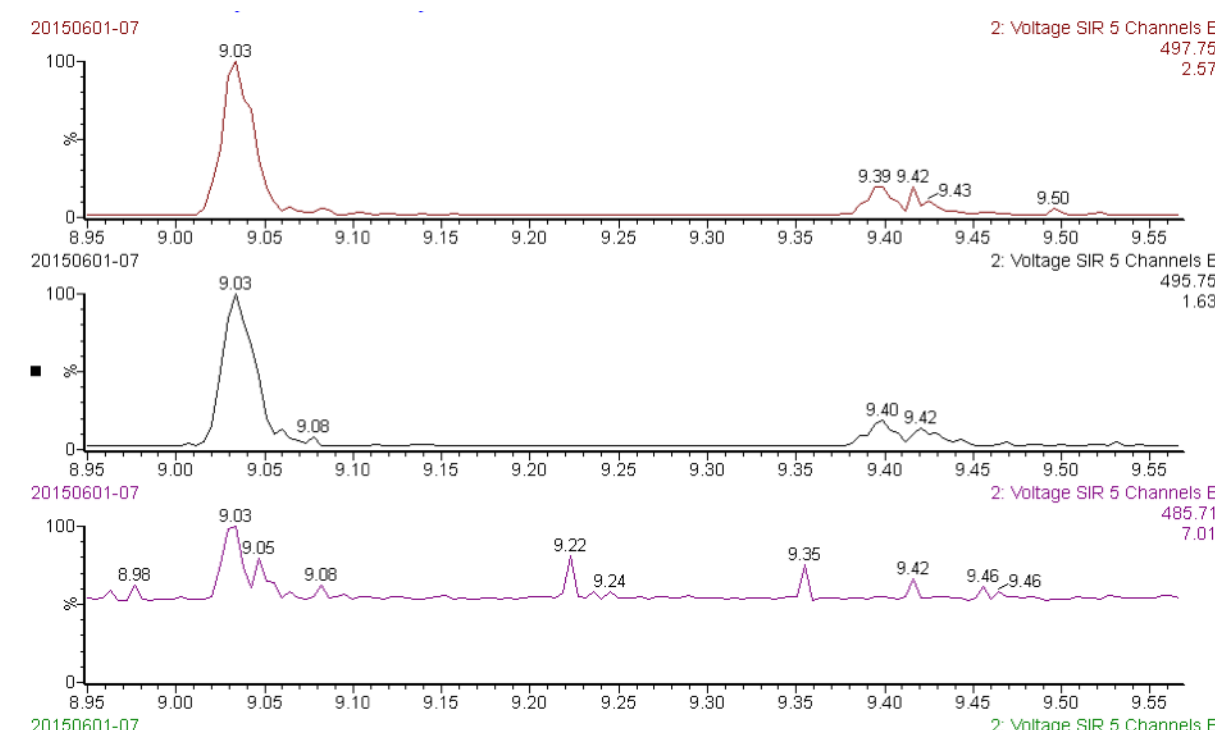
Organic pollutants:

- Polychlorinated dibenzo-*p*-dioxins/furans (PCDDs/Fs)
- Polychlorinated biphenyls (PCBs) – indicator and dioxin-like
- Brominated and organophosphorus flame retardants
- Organochlorine, cyclodiene, and polar pesticides
- Polycyclic aromatic hydrocarbons (PAHs), NO_x-, and oxy-PAHs
- hopanes
- Perfluorinated compounds (PFAS)
- Pharmaceuticals and cosmetic products
- Bisphenols
- Thyroid hormones

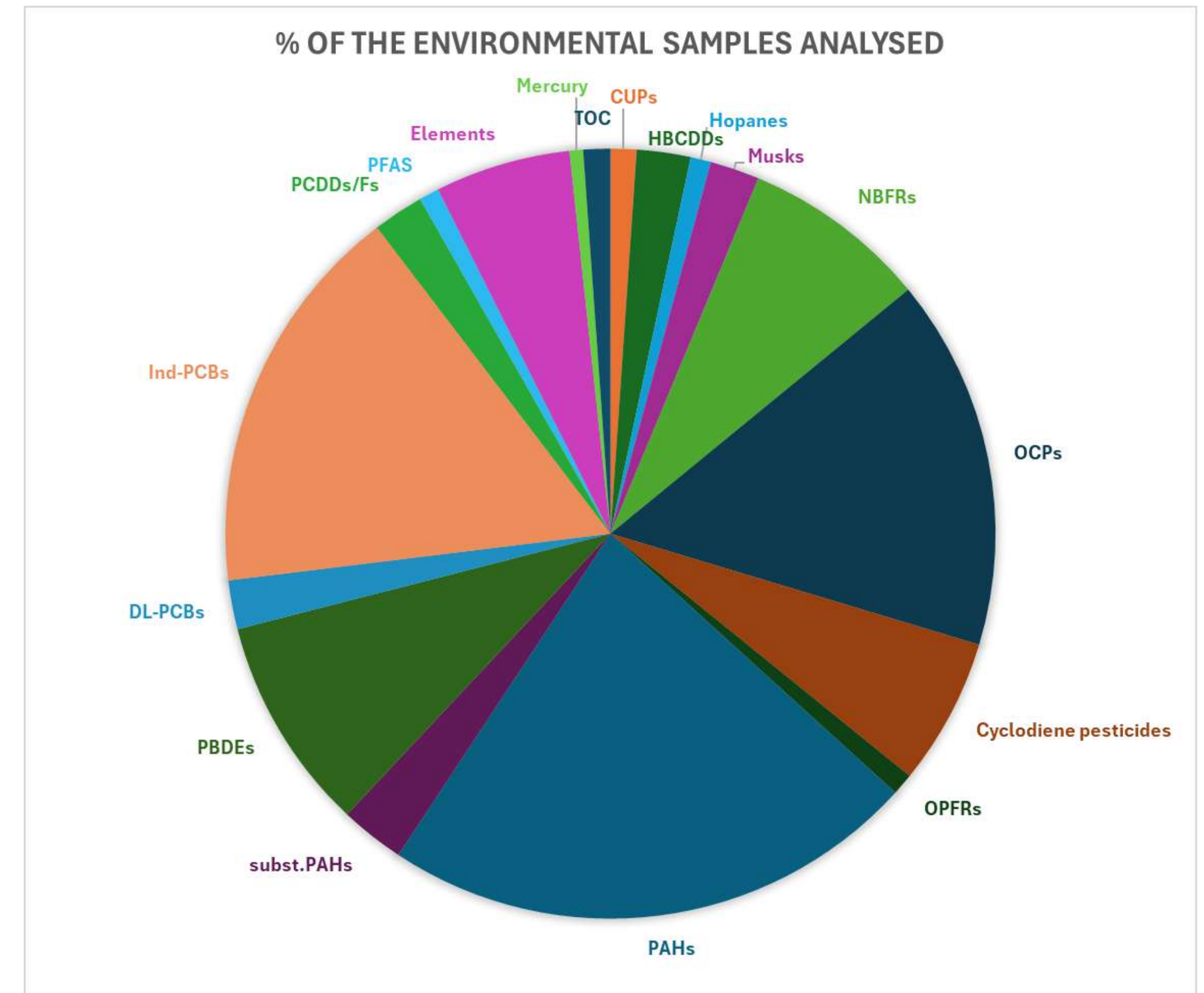
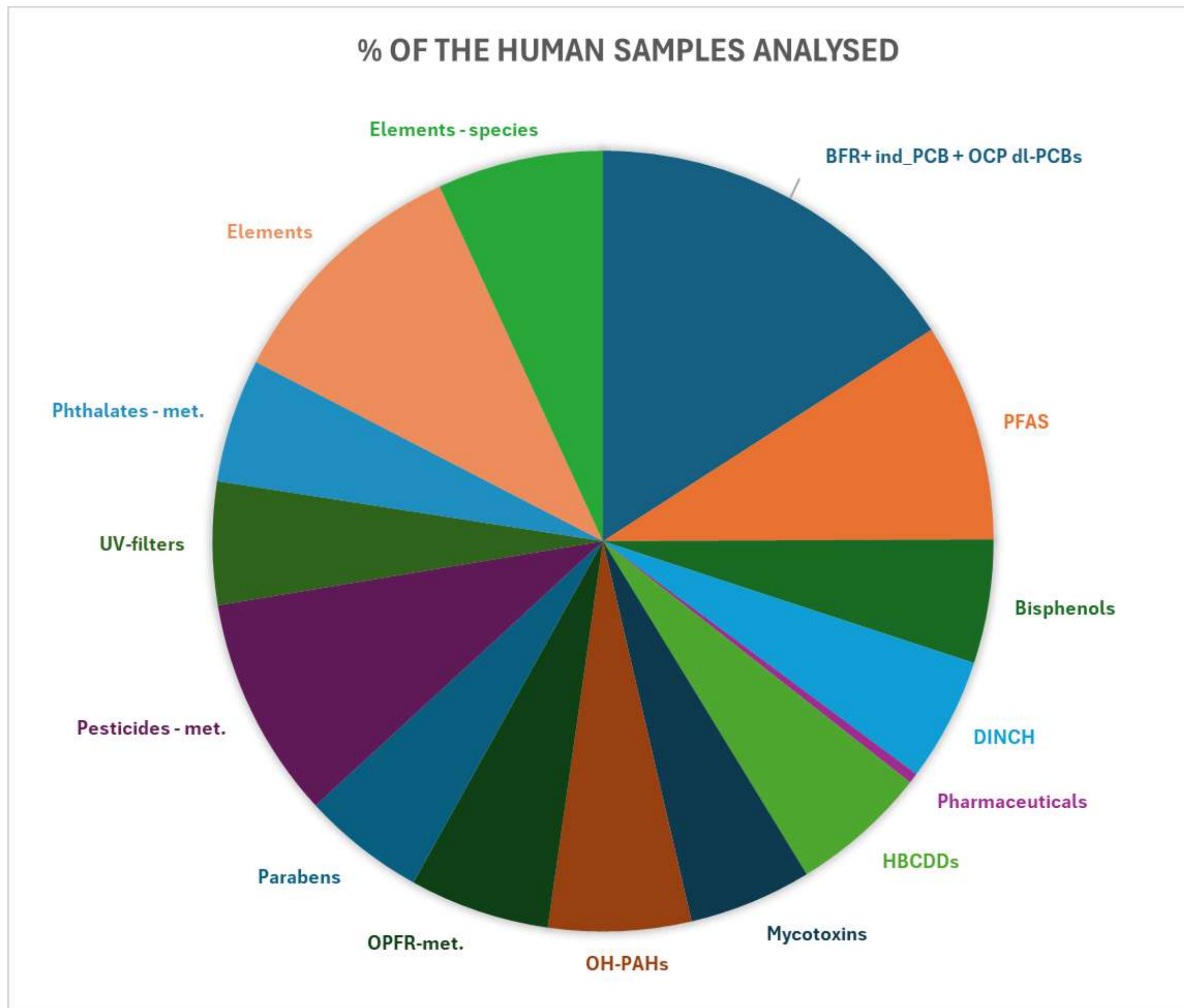
Metabolites:

- OH-PAHs
- Phthalates metabolites + DINCH
- Pesticides metabolites + OP pesticides metabolites
- UV filters
- Mycotoxins

Trace elements, heavy metals, species, arsenic species in urine



35 000 analyses (70% human samples : 30% environmental samples)



Newly used methods in human samples:

- OP pesticides metabolites
- UV filters
- Mycotoxins
- Arsenic species in urine
- Titanium and nickel ions

Artificial samples:

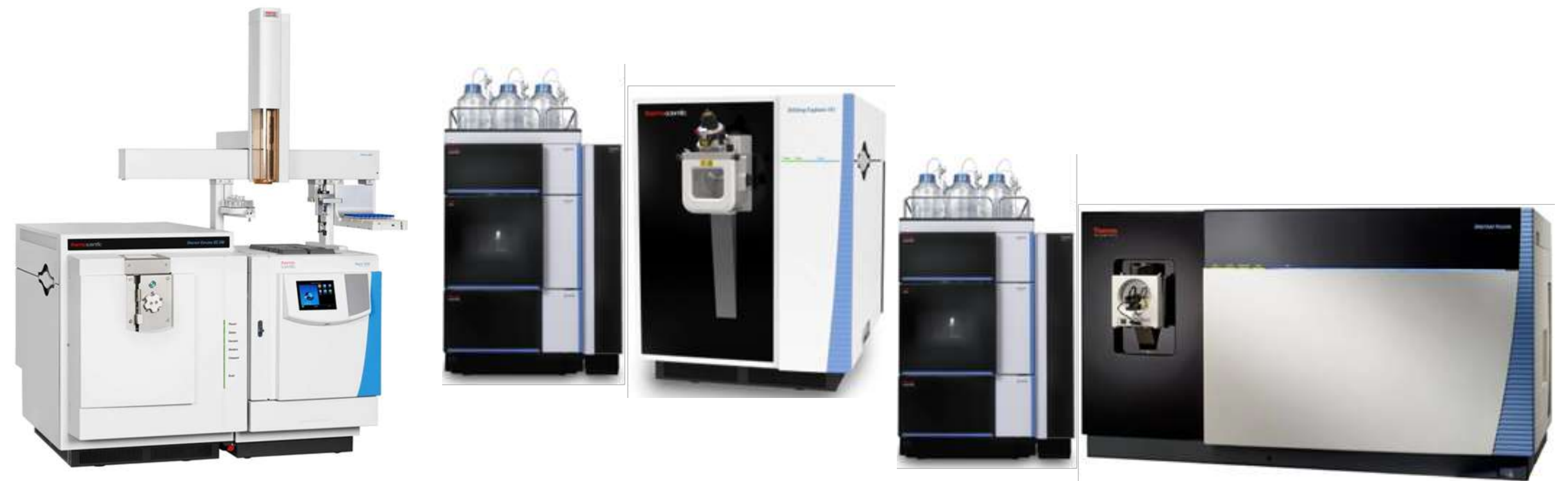
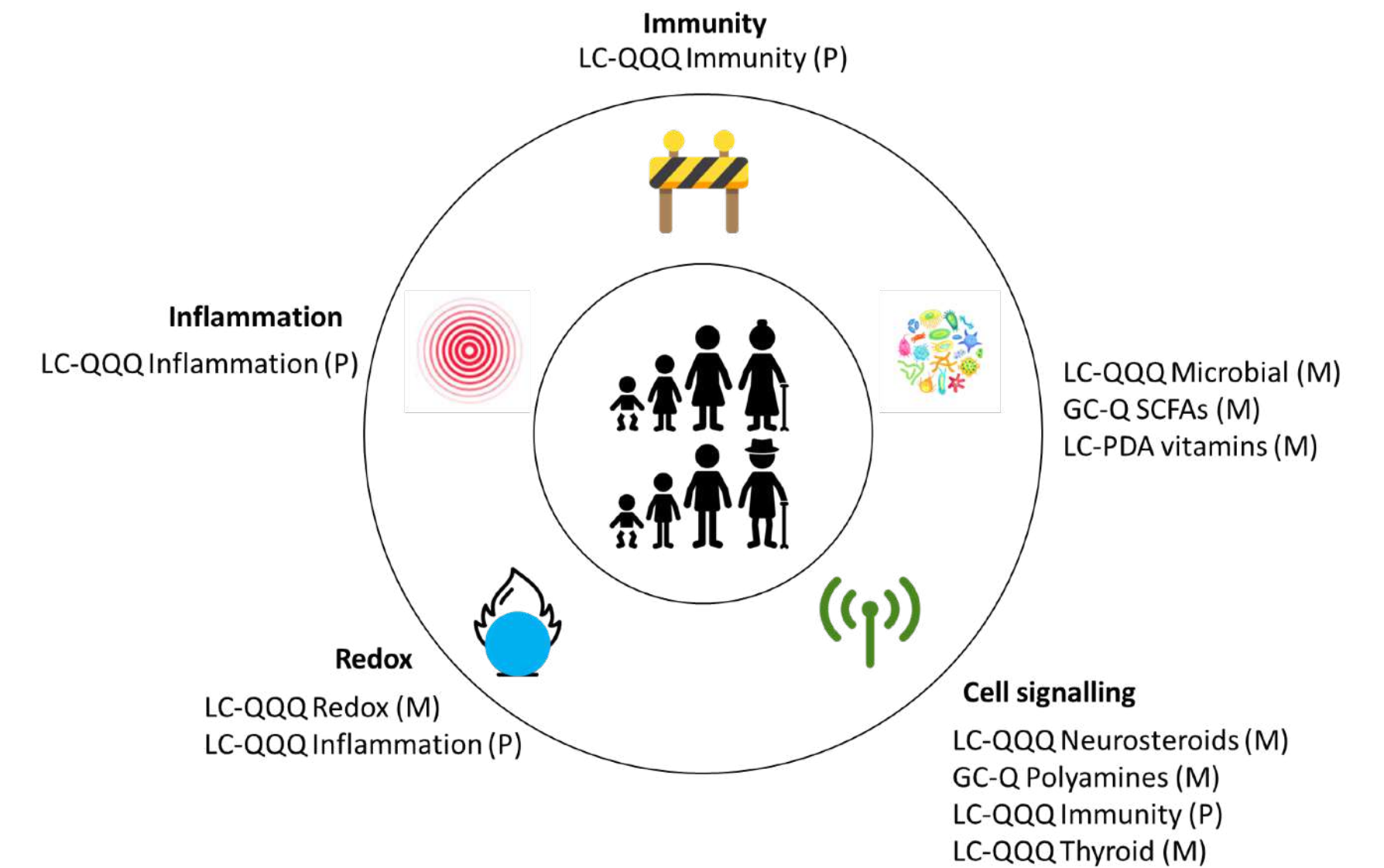
- Bile acids and precursors
- Mycotoxins
- Arsenic species in urine
- Experimental, pharmaceuticals based on zinc nanomaterials

Newly used methods in environmental samples:

- Phthalates (GC-MS)
- Hopanes (GC-MS)
- Musks (GC-MS)
- New CUPs (LC-MS)
- OPFR (LC-MS)
- New PFAS (LC-MS)

Biomarker Analytical Laboratory

- Quantitative assays of clinically relevant proteins, including **protein variants**
- Quantitative **multiplexed metabolite** assays for **molecular hallmarks**
- **Reproducible, scalable** chemical exposure & metabolite **screening** assays



Open Science

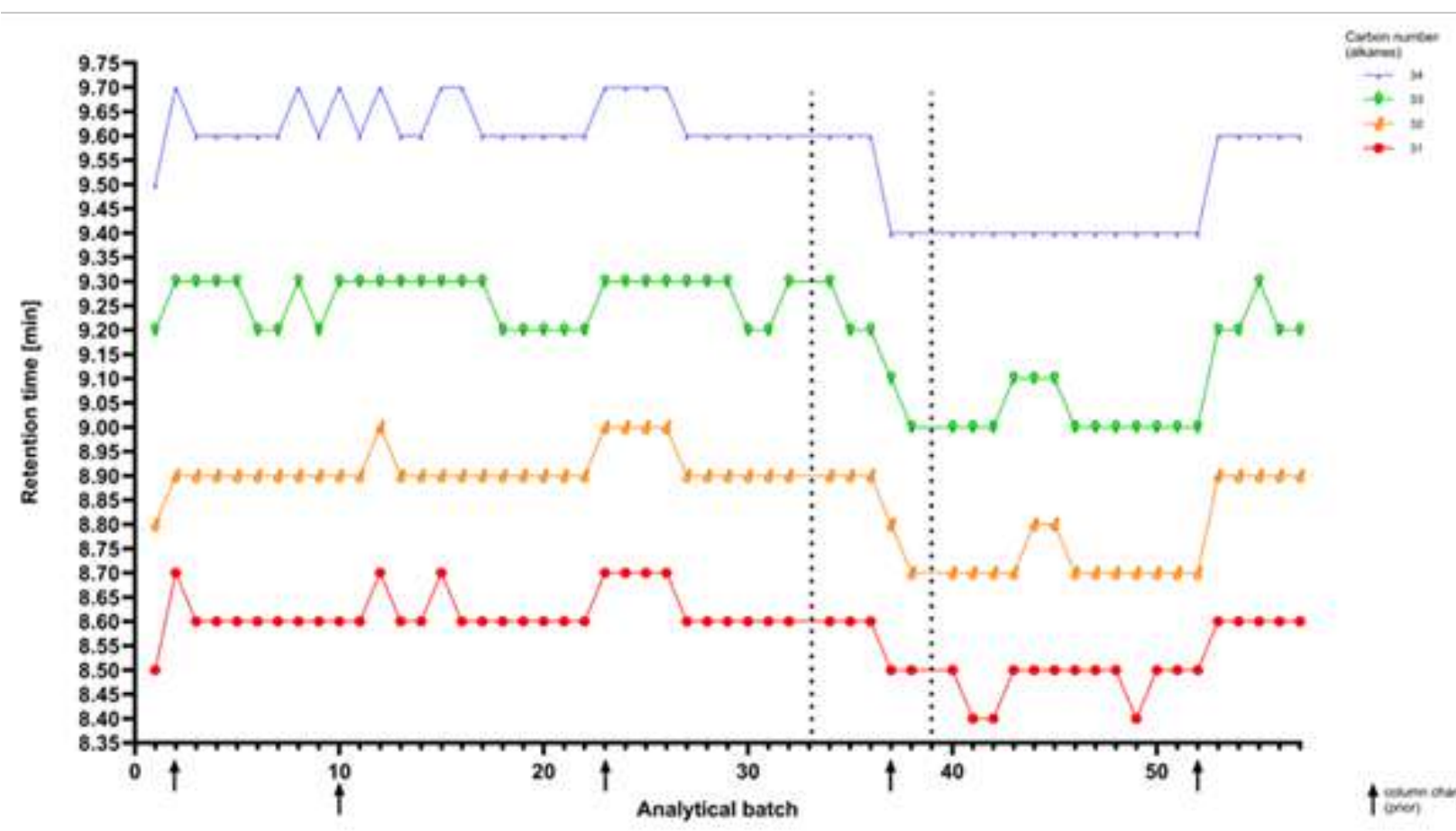
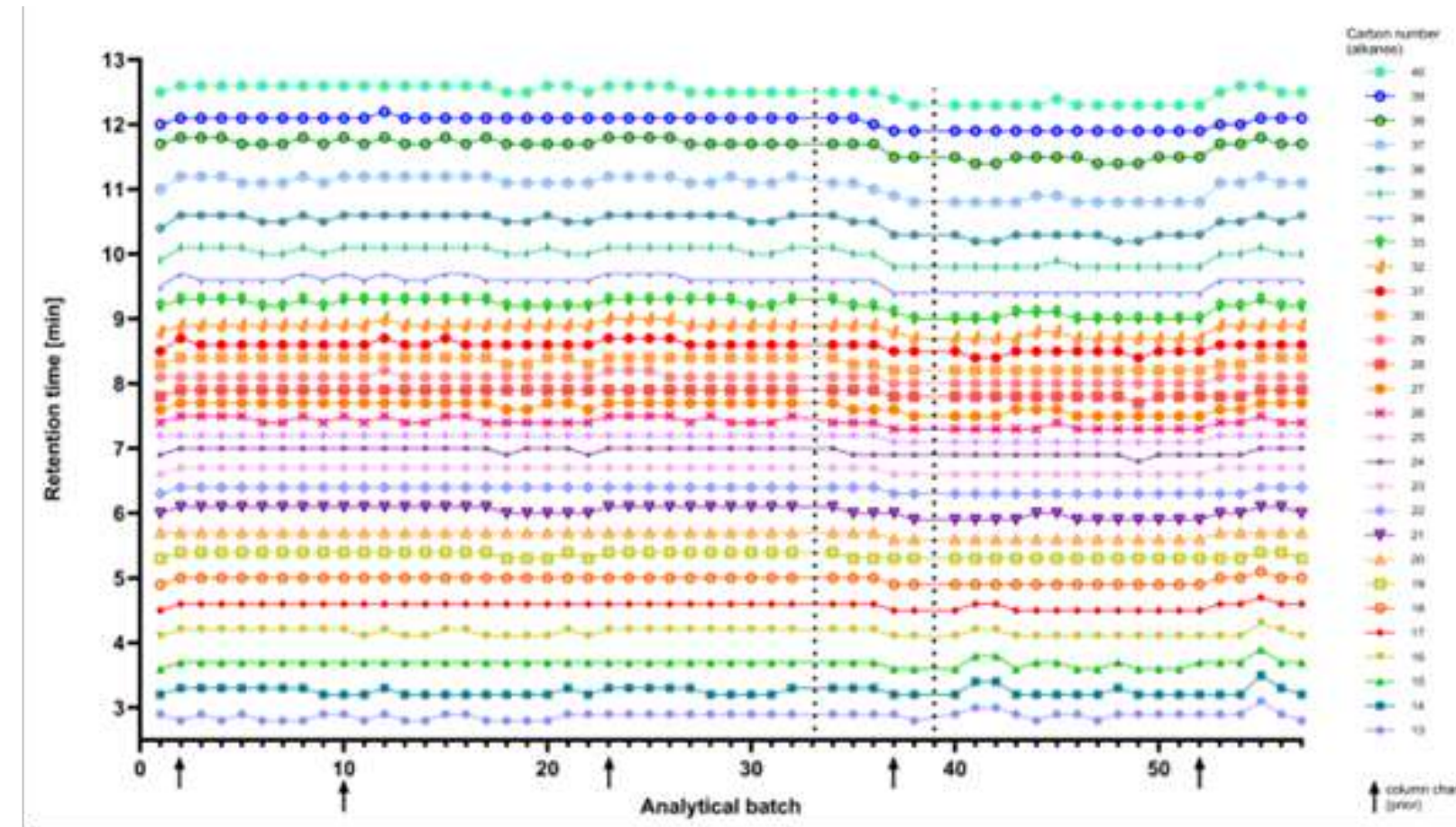
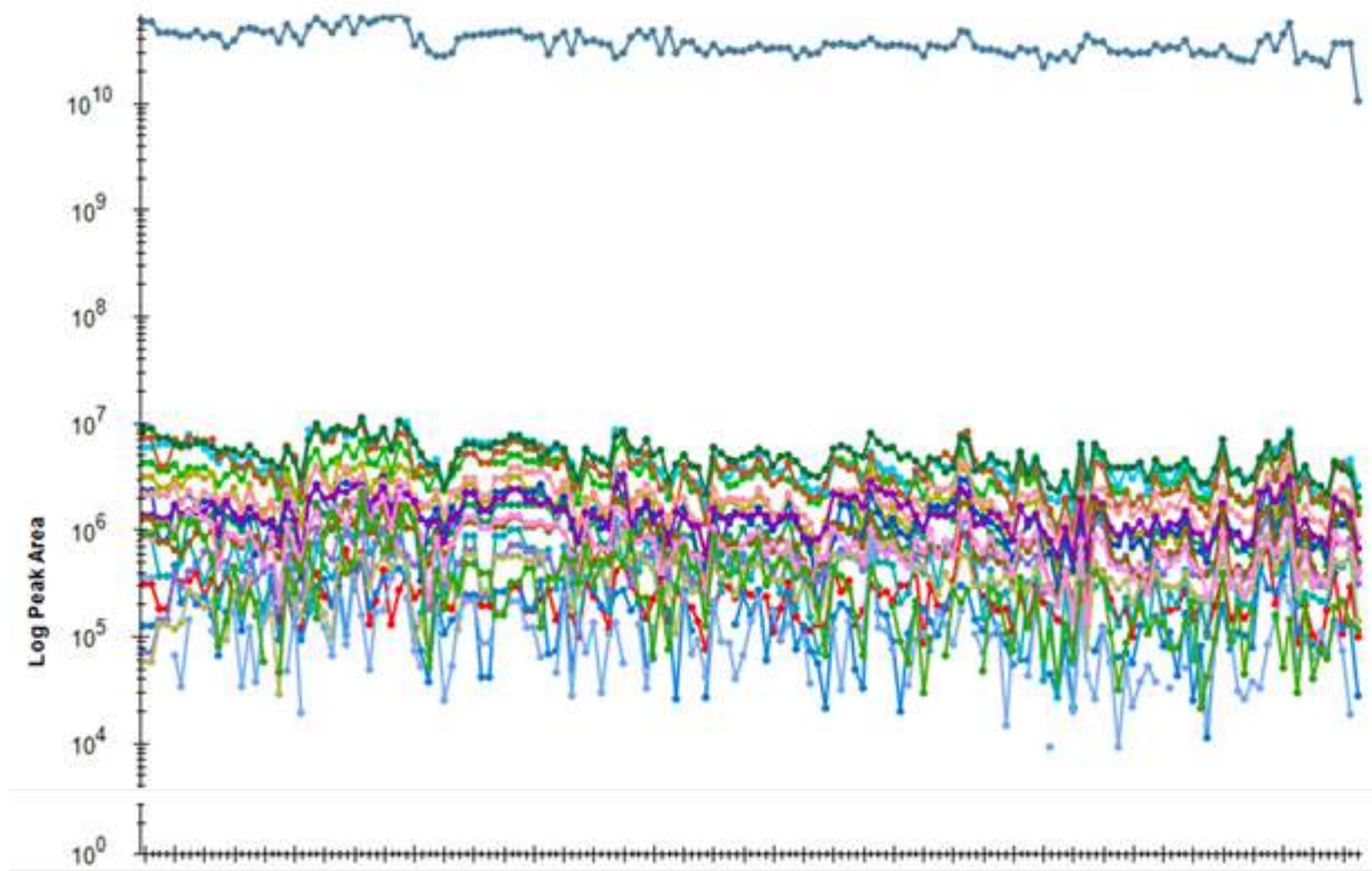
- All resources for reproduction are openly shared:
 - experimental & analytical SOPs
 - mass spectral library resources
 - data processing pipelines and workflows
 - QA/QC procedures and data – proof of measurement validity

- 45 methodological SOPs available

The screenshot shows the Zenodo website interface. At the top, there is a search bar and navigation links for 'Communities' and 'My dashboard'. The main header identifies the repository as 'RECETOX Biomarker Analytical Laboratories', associated with 'Masaryk University and 2 more organizations'. Below the header, there are filters for 'Records', 'Members', 'Curation policy', and 'About'. The search results section shows '45 results found' and a 'Sort by' dropdown set to 'Most viewed'. Three results are displayed:

- Version:** September 5, 2024 (v3) | Other | Open
- Title:** SOP for automated on-line liquid-liquid extraction (LLE) workflow for anthropogenic profiling of human plasma samples via GC-HRMS
- Description:** Biomarker Analytical Laboratories. In this SOP we show the automated on-line liquid-liquid extraction (LLE) of human plasma samples. Prepared extracts are analysed via gas chromatography (GC) with full-scan high-resolution mass spectrometry (GC-HRMS). Presented method is used for profiling of environmental contaminants in human plasma samples. Sample preparation is often a crucial and at the same time... Part of EU Open Research Repository. RECETOX Biomarker Analytical Laboratories. Uploaded on September 5, 2024. 469 views, 367 downloads.
- Version:** November 29, 2021 (1.0.0) | Other | Open
- Title:** SOP for metabolite profiling of seminal plasma via GC Orbitrap
- Description:** Biomarker Analytical Laboratories. Seminal plasma chemical profiles provide distinct and metabolic phenotypes suited for fertility study monitoring. Profiling via GC-MS is favourable as it provides robust measures across many core primary metabolic pathways; including amino acids, TCA metabolites, carbohydrates and some lipids (e.g. steroids & fatty acid). A protocol for simple preparation of seminal plasma sampl... Part of RECETOX Biomarker Analytical Laboratories. Uploaded on November 29, 2021. 309 views, 171 downloads.
- Version:** February 3, 2024 (2.0.1) | Other | Open
- Title:** SOP for on-line sequential 2 step derivatization method creation using TriPlus RSH Sampling Workflow Editor
- Description:** Biomarker Analytical Laboratories. The TriPlus™ RSH Sampling Workflow Editor is a program which allows to easily create and test methods for running the Thermo Scientific™ TriPlus™ RSH controlled by a Thermo Scientific™ Chromatography Data System (CDS). Herein describes the automation parameters for a two stage methoximation / silylation derivatisation commonly applied for GC-MS based metabolomics... Part of RECETOX Biomarker Analytical Laboratories.

Example QA/QC of population scale studies



study 1

21 batches

- 3 source exchanges
- 2 column exchanges
- 0 filament replacements
- 2 technical services

4.5% total error rate:

- 86.2% injection failure
- 12.3% autosampler collision
- 1.5% human error

study 2

57 batches

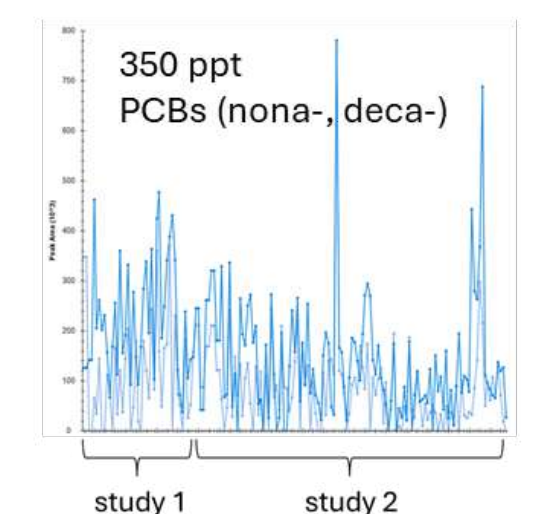
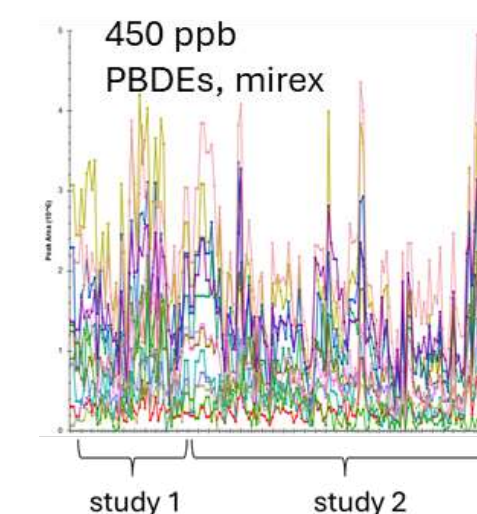
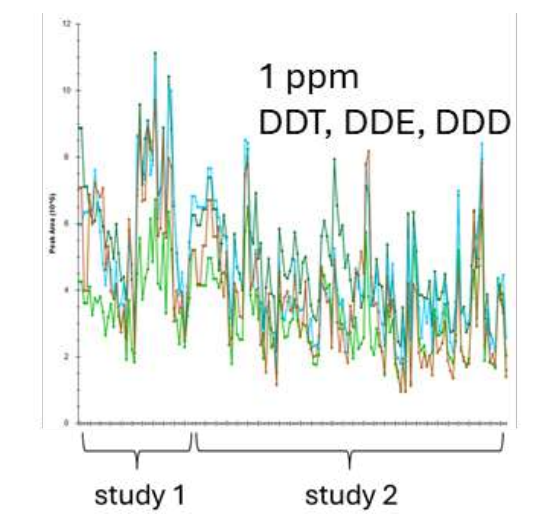
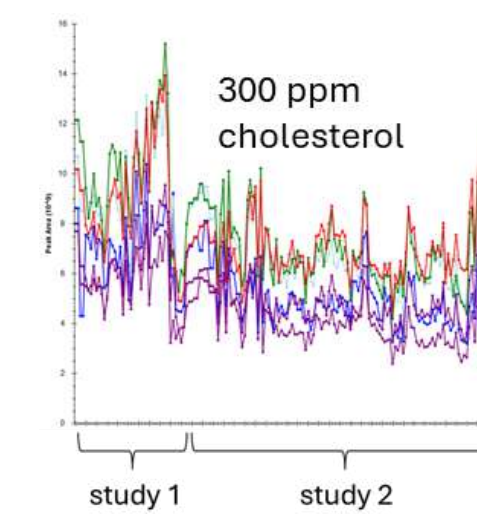
- 11 source exchanges
- 5 column replacements
- 3 filament replacements
- 2 technical services

3.7% total error rate:

- 89.0% injection failure
- 9.5% autosampler collision
- 1.5% human error

Study 1 = 850 samples
Study 2 = 3000 samples

Currently measuring individual studies of ~10,000 samples



Errors tracked. Compliance procedures, aiming for future accreditation.

FAIR data & best practice reporting

The screenshot shows the PanoramaWeb interface for the EIRENE-CZ - Biomarker Analytical Laboratories repository. The page includes a header with the PanoramaWeb logo and a navigation bar. The main content area features a description of the Biomarker Analytical Laboratories (BAL) at RECETOX, Masaryk University, and their role in the EIRENE-CZ infrastructure. It also mentions funding from the Ministry of Education, Youth and Sports, and the Operational Programme Research, Development and Innovation. Below the text are several photographs of laboratory equipment and the EIRENE RI logo. A 'Subfolders' section lists five folders: AJS 6495A, GC-EXPLORIS_ANTH ROPOGENICS, GC-EXPLORIS_M ETABOLITES, TSQ1_PROTEINS, and TSQ2_PROTEINS. A 'Create New Subfolder' button is also visible.

- Non-sensitive data is publicly deposited
- **All raw data is deposited under FAIR principles**, with access terms
- All open access publications and accompanying supplementary records are disseminated from the group

Human Exposome group & Biomarker Analytical Laboratories F

Institution: Masaryk University
Department: Research Centre for Toxic Compounds in the Environment (RECETOX)

Overview

About the lab

Edit

We aim to understand human metabolism and the influence of exposure to environmental chemicals on human health. We focus on mass spectrometry to measure proteins, metabolites and chemical agents in clinical studies and population cohorts. We promote Open Science and FAIR data principles.

Zenodo Community: <https://zenodo.org/communities/rcx-balri>
GitHub: <https://github.com/RECETOX>
Galaxy: <https://eirene.usegalaxy.eu/>
X: https://x.com/RCX_Exposome

Czech Node of the European Environmental Exposure Assessment Research Infrastructure (<https://www.eirene-ri.eu/>).



Featured research (7)

Edit

Automated Sequential Derivatization for Gas Chromatography- [Orbitrap] Mass Spectrometry-based Metabolite Profiling of Human Blood-based Samples

Full-text available Article Mar 2025

2 Recommendations

Quantum Chemistry-Based Prediction of Electron Ionization Mass Spectra for Environmental Chemicals

Full-text available Article Jun 2024

Data processing workflows



A screenshot of a GitHub repository named 'galaxytools' by user 'hechth'. The repository is public and has 77 branches, 7 tags, 7 watchers, 14 forks, and 13 stars. The main content shows a list of files and their commit history, including '.github', 'tools', '.gitignore', '.tt_skip', 'LICENSE', 'README.md', 'setup.cfg', and 'test_biocontainers.sh'. The README section is visible, titled 'Galaxy tools for Untargeted Mass Spectrometry Analysis', and includes information about the project's DOI, chat, and testing status. The right sidebar shows repository statistics and a release history for version v0.5.0.

- Galaxy cloud infrastructure for **FAIR data processing**
- **Open code development**
- **Contribute towards 37 software resources**

The Galaxy Community. The Galaxy platform for accessible, reproducible and collaborative biomedical analyses: 2022 update, *Nucleic Acids Research*, Volume 50, Issue W1, 5 July 2022, Pages W345–W351. <https://doi.org/10.1093/nar/gkac247>

Example - Galaxy ecosystem sharing

Galaxy UMSA Workflow

GC workflow (Galaxy training materials) Tools and Current History

1014.85 MB

search datasets

Dataset

- 44: matchms output formatter (get-thresholded-data) on data 43
- 43: CosineGreedy scores of data 42 and data 39
- 42: Reference spectra (RCX metabolites 20210817)
- 39: RI using kovats of Mass spectra from RAMClustR on data 31
- 36: Mass spectra from RAMClustR on data 31
- 35: Spec Abundance of data 31
- 34: Reference compound list (alkanes)
- 33: intensity table (xcms fillChromPeaks)
- 32: metadata table (xcms fillChromPeaks)
- 31: filled peaks (xcms fillChromPeaks)
- 30: intensity table (xcms groupChromPeaks)
- 29: metadata table (xcms groupChromPeaks)
- 28: Density plot (2nd grouping)
- 27: grouped peaks (xcms groupChromPeaks - 2nd time)
- 26: Time deviation plots
- 25: corrected peaks (xcms adjustRtime)
- 24: Density plot

44: matchms output formatter (get-thresholded-data) on data 43

35 lines, 1 comments
format: **tsv**, database: ?

1.query	2.reference	3.matches	4.score
query	reference	matches	score
C001	Uridine_4TMS isomer 1	81	0.7870108353155918
C004	Asparagine_3TMS	56	0.9097767959597624
C012	Myo-inositol_6TMS	29	0.6889601235553525
C016	Acetylglutamine_3TMS	36	0.626807029456144

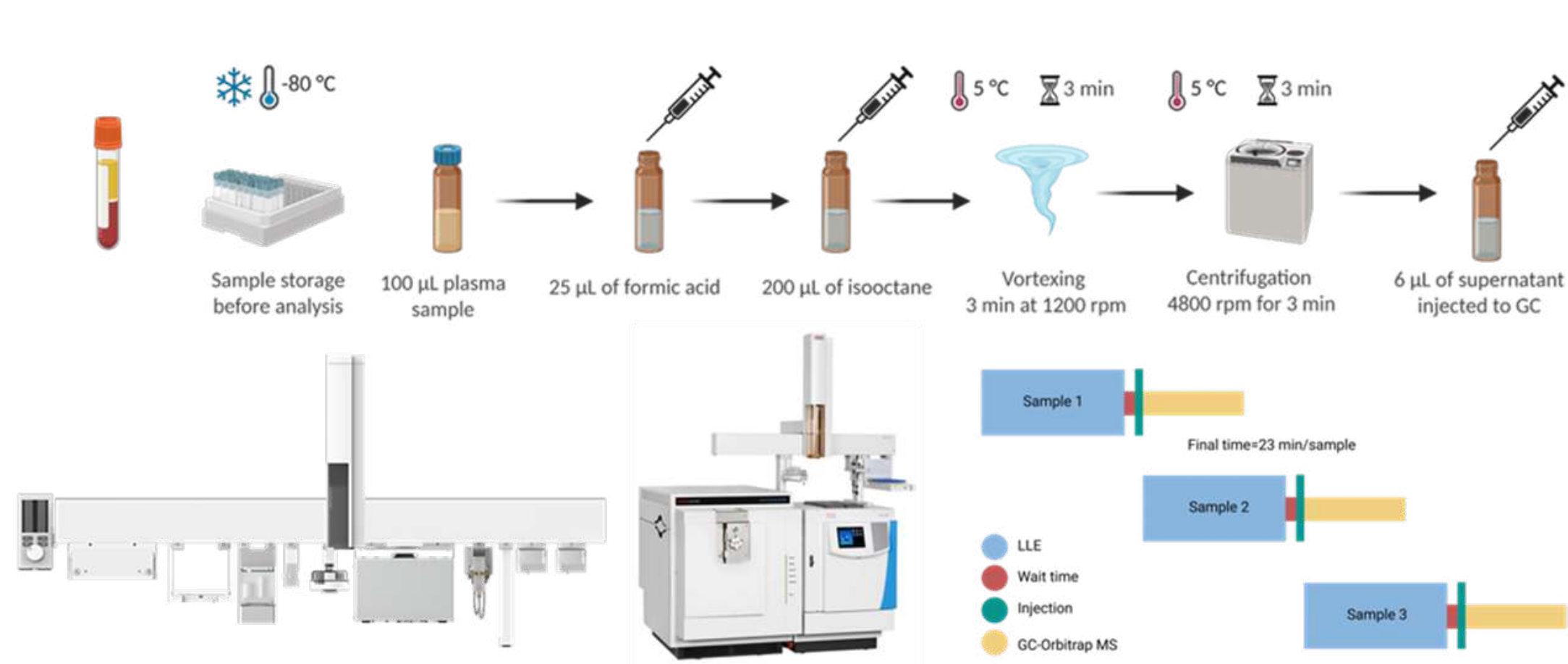
43: CosineGreedy scores of data 42 and data 39

JavaScript Object Notation (JSON)
format: **json**, database: ?

```
2023-02-20 15:10:35,355:WARNING:matchms:add_precursor_mz:No precursor_mz found in metadata.  
2023-02-20 15:10:35,355:WARNING:matchms:add_precursor_mz:No precursor_mz found in metadata.  
2023-02-20 15:10:35,356:WARNING:matchms:add_precursor_mz:No precursor_
```

```
{ "__Scores__": true, "similarity_function": { "__Similarity__": "CosineGreedy", "tolerance": 0.03, "mz_power": 0.0, "intensity_power": 1.0 }  
type": "Centroid", "formula": "C18H30N2O2Si2", "inchikey": "BITJWWNGDAOCT-UHFFFAOYSA-N", "inchi": "", "smiles": "C[Si](C)(C)Oc1cc2c(cc1n  
GC Orbitrap GC-MS/MS", "instrumenttype": "GC-EI-Orbitrap", "ionization": "EI+", "license": "CC BY-NC", "comment": "", "peak_comments": { "7  
, "76.01821": "Theoretical m/z 76.018724, Mass diff 0 (0 ppm), Formula C5H2N", "78.03387": "Theoretical m/z 78.034374, Mass diff 0 (0 ppm  
al m/z 81.069878, Mass diff 0 (0.52 ppm), SMILES C1C[C+]2CCC12, Annotation [C6H9]+, Rule of HR True", "89.03854": "Theoretical m/z 89.0391
```

Automation of sample preparation workflows



- Multi-site replication in 5 countries
- Application notes, webinars, posters and talks in collaboration with vendors
- Industry cooperations for workflow developments

CTC Analytics

ThermoFisher SCIENTIFIC



PAL SYSTEM Ingenious sample handling

biocrates The future of research and health

GC/MS Application Note

Automated Direct Derivatization and GC/MS Analysis

A Robust Method for Comprehensive Metabolomic Profiling of Dried Blood Spots, Serum, and Plasma

