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nano Solutions

HAZARD MECHANISMS, BIOKINETICS, AND VULNERABLE POPULATIONS

NANOSOLUTIONS

Coordinators: prof. Savolainen and prof. Alenius

Cluster Review, Brussels 10-11 Dec

Prof. Harri Alenius

Background

- Key challenges today are that **available tools for the assessment of the safety of ENM** are **often inappropriate**, or so **laborious** that adequate safety assessment remains highly problematic.
- **Current resources or test methods** are **not likely to enable safety assessment of the numerous novel nanomaterials** that are emerging at an ever increasing pace.
- This means that **new safety assessment paradigms need to be developed** during coming years to solve this problem.

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Nanosolutions contribution

- The objective of the NANOSOLUTIONS consortium is to determine the "biological identity" of ENM, and based on that, to develop a **computational predictive tool for the assessment of ENM safety, i.e. ENM SAFETY CLASSIFIER.**
- **SAFETY CLASSIFIER - WHAT IS IT?** Computer algorithm capable to predict the safety of ENMs based on a minimal but most informative set of features selected across multiple data layers.

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31 carefully selected and designed materials including core materials and their surface functionalization

Material	TiO2 particles 10-20 nm	CuO particles 10-20 nm	Au particles 3-5 nm	Au particles 10-20 nm	TiO2 rods 1:5 ratio	Ag particles 10-20 nm	CdTe particles 3-5 nm	Nano-diamonds 3-5 nm	MWCNTs 1:100 ratio
Provider	PC	PC	UB1	UB1	PC	UB1	PC	PC	UNIMAN and NANOCYL
Core	523,85	935,155	0	0	200	0	0	0	429,55
NH3+	172,85	484,15	1	1	200	1	222,65*	479,65	100
COOH	223,85	233,15	1	1	200	1	273,65	482,65	100
PEG	173,85	183,15	1	1	200	1	223,65	178,65	0.5
TOTAL	**1094,40**	**1835,61**	**3**	**3**	**ca. 800**	**3**	**719,95**	**1140,95**	**629,55**

Physical chemical properties, biocorona, multiple OMICs data layers, and toxicological phenotypic data (immunotoxicity, genotoxicity, cytotoxicity) will be available for each ENM

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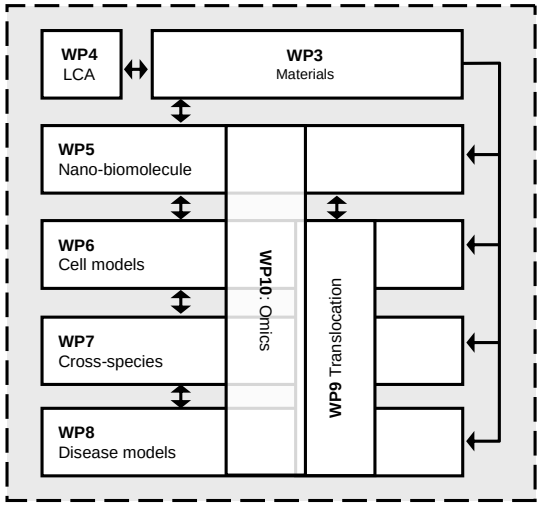
WP3-10

Generation of data on biological effects of ENM by state-of-the-art *in vitro* and *in vivo* techniques and by omics methodologies



Data generation

WP11

Novel systems biology-systems toxicology approaches to provide mechanism-based correlations of material properties and hazard profiles

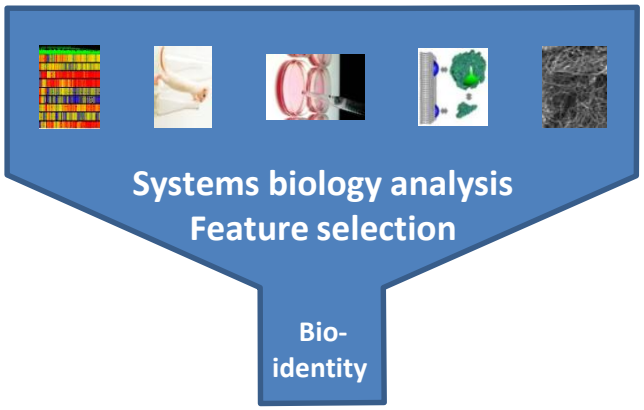
Omics technologies

In-vivo toxicology

In-vitro toxicology

Bio-corona formation

Phys-chem properties



Data analysis and feature selection

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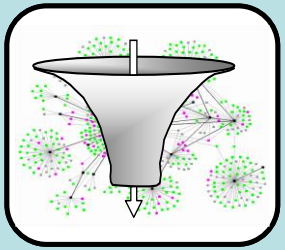
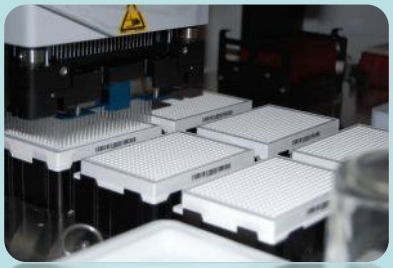
WP11-12

Identification of minimal but sufficient number of hazard features that can be used as framework for ENM classification and for hazard prediction

Hazard profiling tool: ENM SAFETY CLASSIFIER



HIGH-THROUGHPUT SCREENING based on selected features



DEVELOPMENT OF INNOVATION

WP12

Testing of the hazard prediction potential of hazard profiling tool in collaboration with ENM companies, to achieve safety-by-design

NanoMILE

ENM eNanoMapper

AMPLIFICATION OF THE IMPACT OF THE INNOVATION

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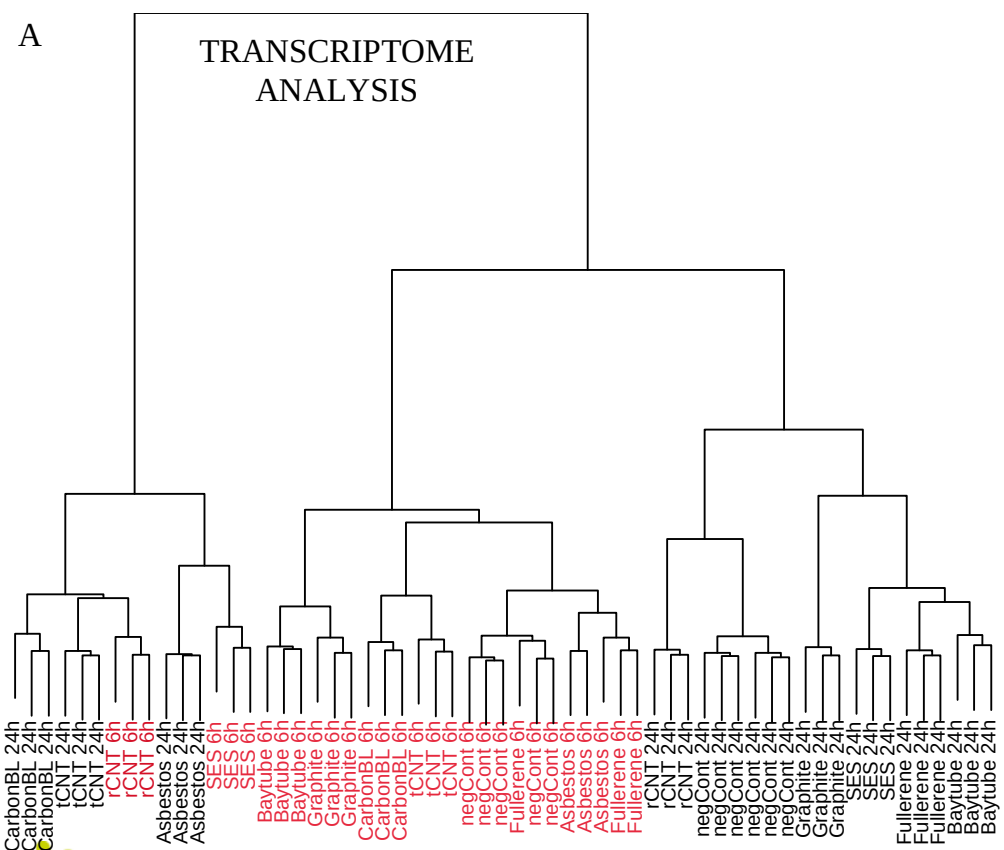
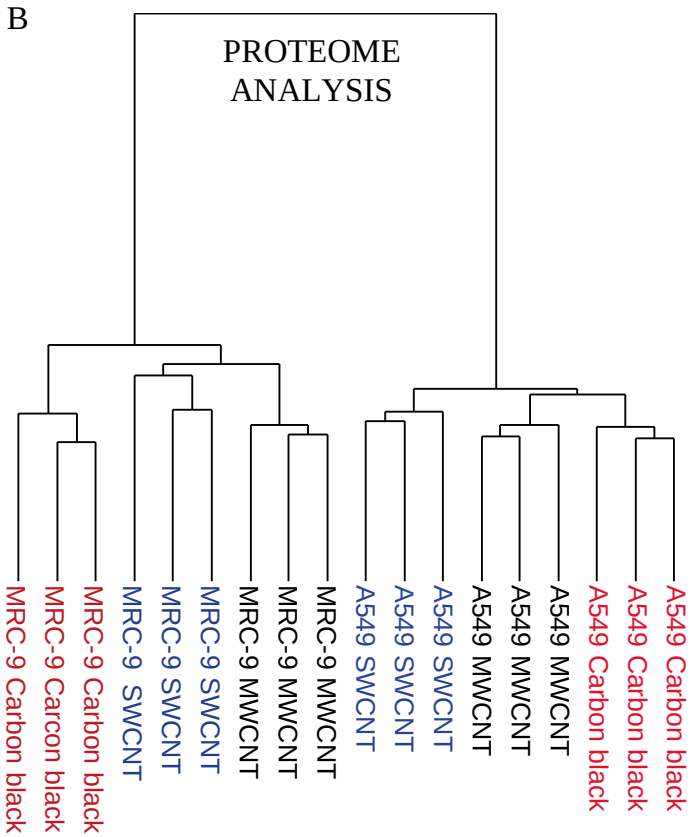
Biological data driven ENM grouping
– possibilities for collaboration with NSC





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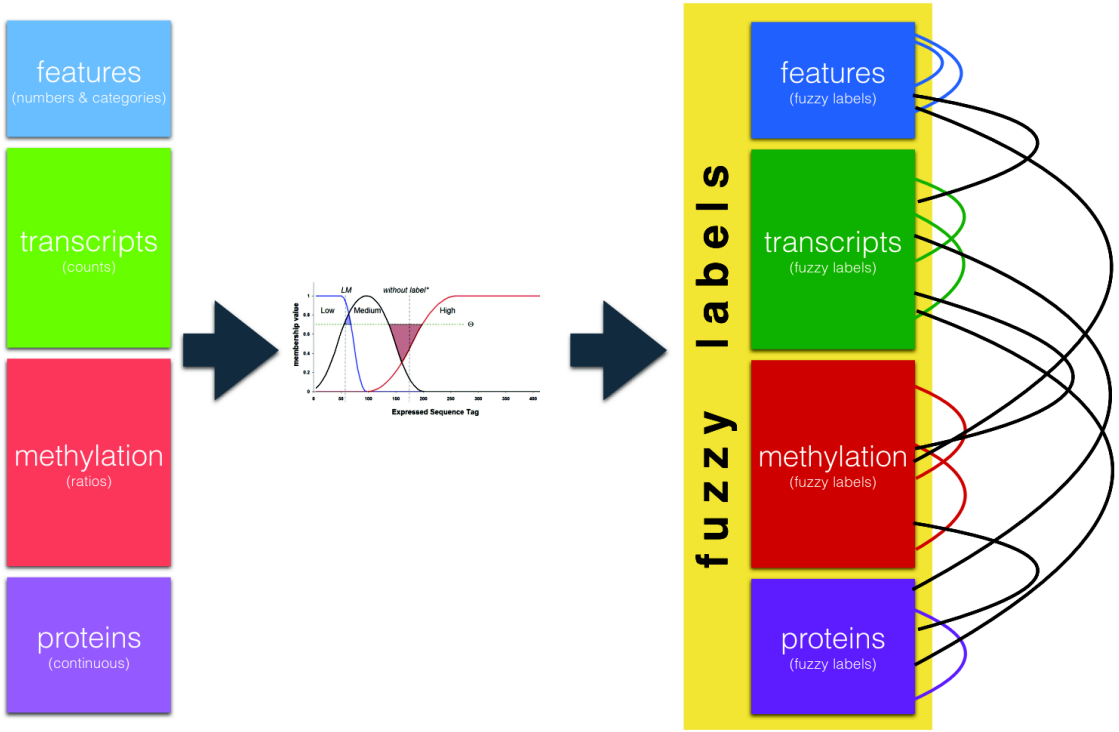
Novel tools for data integration
– possibilities for collaboration with NSC

data integration by fuzzy logic



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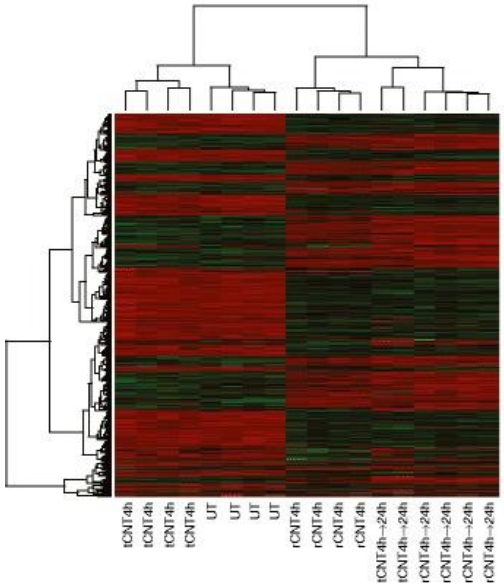
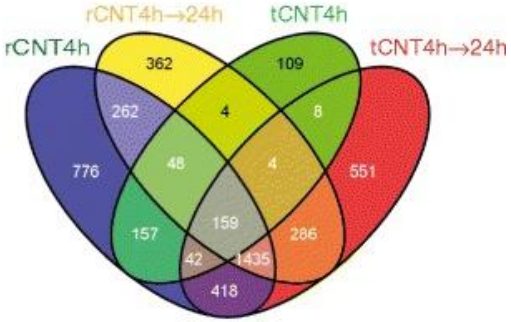
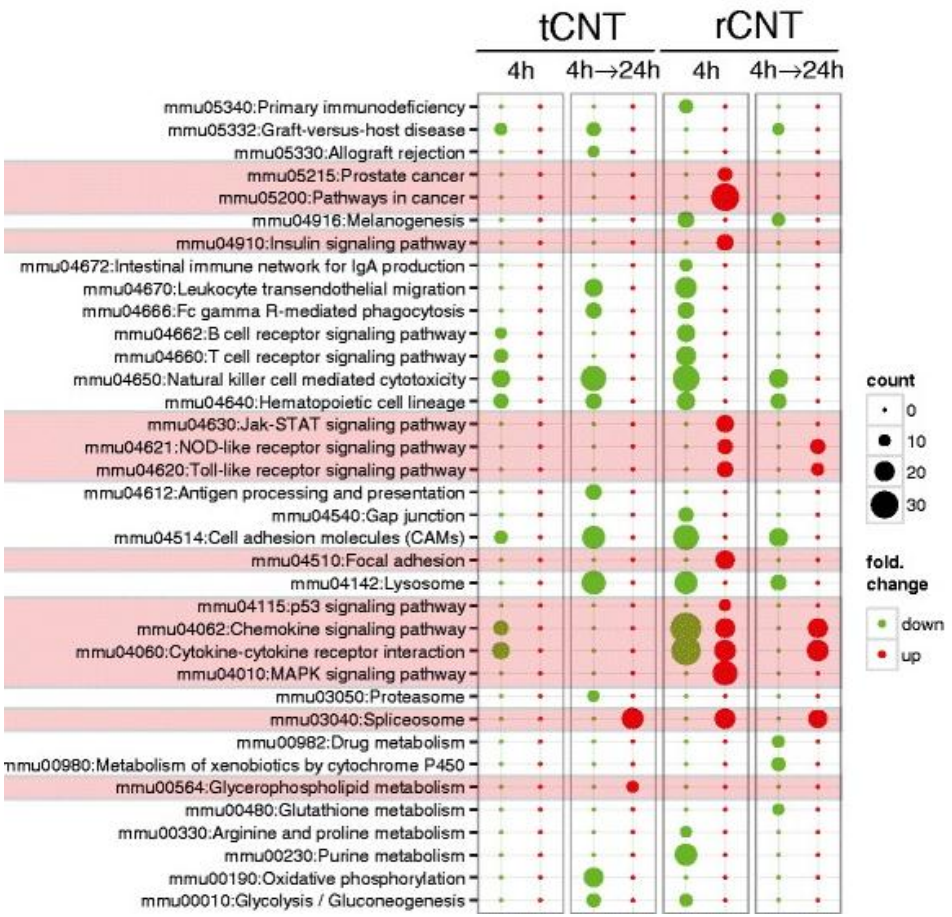
Hazard mechanisms
– possibilities for collaboration with NSC







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NANOSOLUTIONS and NSC
Possibilities and challeges

- Interaction with other NSC projects (eg. with NANOMAIL, eNanoMapper etc.)
  - Scientific collaboration
    - Huge potential for win-win situation
    - IPR issues need to be clarified
  - Organizing workshops, forums, conferences etc.

- Possibility to share selected ENMs for testing
  - Characterization must be properly done
  - Quantity and quality issues must be taken into account

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NANOSOLUTIONS and NSC
Possibilities and challeges

- Sharing knowledge about SOPs
  - ENM dispersion protocols
  - *in vitro* and *in vivo* experiment protocols
  - RNA/DNA/PROTEIN isolation and storge protocols
  - etc.

- Sharing data storage formats and the data
  - Possibility to develop further SAFETY CLASSIFIER by using the suitable data form other projects
  - Possibility to validate/test results from the one project with the data from other project.
  - Quality and robustness of the data is higly important

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Thank You!