

Horizon 2020 - H2020-MSCA-ITN-2017



Project: 766251– NEUROSOME

Full project title:

EXPLORING THE NEUROLOGICAL EXPOSOME

D8.1 Syllabus for structured training courses

WP 8 Structured training courses

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1 1st training course: Advanced environmental and exposure science

Module	Title Environmental and exposure science in the era of exposome
Course coordinator	CSIC
Module general description	<p>Describe the advanced analytical tools for environmental and personal exposure monitoring, as well as the use of sensors (personal or environmental). In addition, they will learn about the modelling tools necessary for environmental and personal exposure assessment, so as, combined with the measured data to be able to estimate the lifelong exposure of the individuals, in accordance with the exposome concept.</p> <p>SOFT SKILLS: scientific literature review</p>
Prerequisites	None
Course learning objectives	<ul style="list-style-type: none"> - In depth understanding of the exposome approach - To learn about the instrumentation that is used for the several classes of chemicals and environmental media analysis; - To learn about sensors technologies; - To learn about environmental modelling - To learn about exposure modelling; - Develop a comprehensive understanding of integrated environmental and exposure assessment combining environmental and modeled data
Module Structure (details of sessions title/speaker/date/duration)	<p><i>Environmental and exposure science in the era of exposome</i></p> <p>Day 1</p> <ul style="list-style-type: none"> - Introduction in the exposome - Sampling and chemical analysis of water - Sampling and chemical analysis of soil - Sampling and chemical analysis of food items <p>Day 2</p> <ul style="list-style-type: none"> - Sampling and chemical analysis of ambient and indoor air (gases and particles) - Non-targeted methods for environmental screening - Multimedia environmental modelling <p>Day 3</p> <ul style="list-style-type: none"> - Definition of external exposome and life-long exposure - Exposure concepts - Assessment of oral exposure (dietary and non-dietary) - Assessment of inhalation exposure (gases and particles) - Assessment of dermal exposure


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	<p>Day 4</p> <ul style="list-style-type: none"> - Aggregate and cumulative exposure – complex exposures - Retrospective exposure trajectories - The use of sensors for personal exposure assessment - Agent Based Modeling (ABM) <p>Day 5</p> <ul style="list-style-type: none"> - Hands-on training on chemical analysis of heavy metals in soil - Exposure assessment in practice – optimal use of multiple sources of data - Hands-on training on the INTEGRA computational platform – Multimedia and exposure analysis module - Reporting chemical analysis results
Highlight soft skills that will be covered	<p>Data mining in scientific literature and exposure databases</p> <p>Reporting and plotting modelling results (see Day 5)</p>
Highlight implications for neuro-psychiatric diseases	<p>Participants will learn about the methods that are used for identifying the contamination levels in the various environmental media, related to neurotoxic compounds, as well as about the latest methods for sampling and chemical analysis. Particular attention will be paid on the use of sensors, able to provide important information about the time-dynamic profiles of neurotoxic compounds. In addition, the participants will learn how to model multimedia transfer and exposure through various pathways and routes, towards aggregate and cumulative exposure. Towards this aim, they will also be hands-on trained in the computational platform INTEGRA. Finally, the participants will learn about emerging technologies in exposure assessment such as the Agent Based Modeling.</p>
Module assessment	<p>Attendance and feedback during the lectures</p> <p>Test on the hands-on training</p>
Location	TBD
Readings	<ul style="list-style-type: none"> - Preparatory bibliography - INTEGRA tutorial – multimedia and exposure assessment module


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2 2nd training course: Human biomonitoring including –omics, genetics, epigenetics and *in vitro/in vivo* testing

Module	Title Analytical exposure biology for exposome studies
Course coordinator	ISS
Module general description	<p>Describe the advanced analytical tools used in exposure biology to identify the (a) the exposure biomarker levels of the compounds of relevance in NEUROSOME (plasticisers, heavy metals etc.) (b) the biochemical changes across various levels of biological organization expressed as omics responses and (c) mechanistic confirmation of the findings in human studies with <i>in vitro/in vivo</i> testing.</p> <p>SOFT SKILLS: scientific literature review</p>
Prerequisites	None
Course learning objectives	<ul style="list-style-type: none"> - In depth understanding of the role of analytical exposure biology in the exposome context and the importance of analyzing the full range of omics - Learn about the state of the art instrumentation that is used for the different types of exposure biomarkers and omics analysis; - To learn about selection of proper biosample material; - To learn about chemical and biochemical analysis techniques; - To learn about data pre-processing for further use on bioinformatics;
Module Structure (details of sessions title/speaker/date/duration)	<p><i>Analytical exposure biology for exposome studies</i></p> <p>Day 1</p> <ul style="list-style-type: none"> - The role of analytical exposure biology in the exposome context - Selection of proper biomaterial for the various type of analytical exposure biology - Sample aliquoting, labelling, and storage - biobanking <p>Day 2</p> <ul style="list-style-type: none"> - Analysis of exposure biomarkers in blood samples - Analysis of exposure biomarkers in urine samples - Analysis of exposure biomarkers in hair, nail and exhaled breath condensate - Non-targeted methods for identifying chemical signatures of exposure <p>Day 3</p> <ul style="list-style-type: none"> - Analysis of transcriptomics in human samples – incl. extraction and sample preparation - Analysis of transcriptomics in <i>in vitro</i> samples – incl. extraction and sample preparation - Analysis of transcriptomics in <i>in vivo</i> samples – incl. extraction and sample preparation - Pre-processing of transcriptomics analysis data


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	<p>Day 4</p> <ul style="list-style-type: none"> - Sample preparation and analysis of metabolomics using blood and urine samples in various platforms <ul style="list-style-type: none"> o HPLC-QToF, o Orbitrap, o NMR) - Sample preparation and analysis of metabolomics from <i>in vitro</i> samples - Sample preparation and analysis of metabolomics from <i>in vivo</i> samples - Preprocessing of metabolomics analysis data <p>Day 5</p> <ul style="list-style-type: none"> - Sample preparation and analysis of epigenetics - Preprocessing of epigenetics data - Sample preparation and analysis of genome-wide profiling - Preprocessing of single-nucleotide polymorphism profiling data
Highlight soft skills that will be covered	Data mining in metabolomics annotation databases
Highlight implications for neuro-psychiatric diseases	Participants will learn how to identify the exposure biomarker levels in various type of biological samples and what is the proper/optimal analytical technique based on the selected material and type of compound to be identified. In addition, they will learn the methods for cross-omics analysis, including the stage of extraction and sample preparation for human, <i>in vivo</i> and <i>in vitro</i> samples. For metabolomics they will learn the use of multiple analytical platforms, as well as the advantage of employing multiple platforms and biological matrices in their analysis. Finally, they will learn how to pre-process the data for providing input to further bioinformatics and systems biology analysis. All the above type of analysis are the starting point for identifying the relation among exposure to chemicals and the biochemical changes in biological systems, accounting for genetic and epigenetic components.
Module assessment	<p>Attendance and feedback during the lectures</p> <p>Test on theoretical aspects on analytical methods</p>
Location	TBD
Readings	<ul style="list-style-type: none"> - Preparatory bibliography - Online tutorials


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3 3rd training course: High dimensional bioinformatics and *in silico* toxicology

Module	Title <i>In silico</i> toxicology and bioinformatics – advancing risk and health impact assessment
Course coordinator	AUTH
Module general description	Develop hypothesis on the mechanisms of toxicity based on multi-omics data, get familiar with the systems biology models and the adverse outcomes pathways, understand the role of internal dosimetry modelling and the link between external exposure and tissue dose, assimilation of biomonitoring data through exposure reconstruction SOFT SKILLS: scientific literature review
Prerequisites	None
Course learning objectives	<ul style="list-style-type: none"> - To learn the main bioinformatics approaches towards pathway analysis; - To learn the principles of systems biology models; - To learn how to use internal dosimetry modelling in modern risk assessment; - To learn how to use <i>in silico</i> approaches such as QSARs, using advanced machine learning techniques for data poor chemicals.
Module Structure (details of sessions title/speaker/date/duration)	<p><i>In silico</i> toxicology and bioinformatics – advancing risk and health impact assessment</p> <p>Day 1</p> <ul style="list-style-type: none"> - Basic of toxicokinetics - Physiology based biokinetic models structure - Blood brain barrier and in utero exposure - Mixtures interaction <p>Day 2</p> <ul style="list-style-type: none"> - Assimilation of human biomonitoring data – exposure reconstruction - Expanding the applicability domain of PBBK models using quantitative structure activity relationships (QSARs) - Linking environmentally relevant exposure levels with in vitro testing - Application of internal dosimetry models in risk assessment <p>Day 3</p> <ul style="list-style-type: none"> - Omics data processing (clean up, filtering, quality control, annotation) - Statistical algorithms used in bioinformatics - Cross omics joint pathway analysis


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	<p>Day 4</p> <ul style="list-style-type: none"> - Adverse outcome pathways (AOPs) - Systems biology models - Modeling dose response analysis and quantitative AOPs - Integration of PBBK modeling and AOPs <p>Day 5</p> <ul style="list-style-type: none"> - Metabolomics annotation database search (primary and secondary literature) - Hands on training on the Agilent GeneSpring platform for cross-omics pathways analysis - Hands on training on the INTEGRA computational platform – internal dosimetry module - Reporting and plotting modelling results
Highlight soft skills that will be covered	Reporting and plotting modelling results (see Day 5)
Highlight implications for neuro-psychiatric diseases	<p>Participants will understand how the various plasticisers, heavy metals and PAHs are distributed in human body upon exposure, the processes of metabolism, distribution in the various tissues and the concept of biologically effective dose and how this relates to in vitro testing.</p> <p>Moreover, they will learn how to use the cross-omics data to identify the biological perturbations that result in adverse effects in in vitro and <i>in vivo</i> (or even human) data, using the proper bioinformatics tools, as well as to build systems biology models based on adverse outcome pathways. In addition, they will learn how to link the various computational tools for deriving quantitative models based on cross-omics responses.</p>
Module assessment	<p>Attendance and feedback during the lectures</p> <p>Test on the hands-on training</p>
Location	TBD
Readings	<ul style="list-style-type: none"> - Preparatory bibliography - Agilent GeneSpring workflow tutorial - INTEGRA tutorial – physiology based biokinetic module


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4 4th training course: Genome-environment wide health association studies.

Module	Title Gene-environment interaction analysis and genome-environment-wide health association studies
Course coordinator	BURLO
Module general description	Gene-environment interaction analysis and genome-environment-wide-health association studies SOFT SKILLS: scientific literature review
Prerequisites	None
Course learning objectives	<ul style="list-style-type: none"> - Environment-health associations: examples of studies and tools; - Brain development and the environment; - Molecular biology applied to gene-environment interactions, with specific focus on neurodevelopmental processes - Cohort studies, longitudinal studies, incl. data analysis. - Risk assessment, environmental –health associations and environmental health impacts, policy instruments.
Module Structure (details of sessions title/speaker/date/duration)	Environment-health associations, with a specific focus on child neurodevelopment Day 1 and 2 <ul style="list-style-type: none"> - Brain development: gene, environment and critical periods. How the brain develops, from conception to old age The concepts of plasticity, vulnerability and resilience: gene x environment interaction. The etiology of neurodevelopmental disorders - Tools for assessment of child neurodevelopment at different ages - Molecular biology applied to gene-environment interactions Day 2 and 3 <ul style="list-style-type: none"> - Examples of genome-environment-wide health association studies and tools - Cohort studies, longitudinal studies incl. data analysis; - Selection of the outcome: typical vs atypical neurodevelopment, test sensibility Day 4 <ul style="list-style-type: none"> - Environmental health impacts - Risk assessment and communication of risk - Policy instruments


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	<p>Day 5</p> <p>SOFT SKILL: Scientific Literature Review</p> <ul style="list-style-type: none"> - Database search (primary and secondary literature) - Search tools - Practical training on literature database search - Systematic reviews and meta-analysis - Methodological quality assessment
Highlight soft skills that will be covered	SCIENTIFIC LITERATURE REVIEW (see Day 5)
Highlight implications for neuro-psychiatric diseases	<p>Participants will acquire skills in genetic analysis methods, understand methods for genome –wide association studies (association mapping), interpretation of results, in particular with regards to genes involved in the association between environmental exposure and child neurodevelopment.</p> <p>Participants will learn how to translate data and information from genome –wide association studies in health policies on mother and child environmental exposure.</p>
Module assessment	<p>Attendance and feedback during the lectures</p> <p>Test</p>
Location	TBD
Readings	Preparatory bibliography

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5 5th training course: Soft skills

Module	Title Development of soft skills
Course coordinator	URV
Module general description	Soft skills development for the participants, including the development of research skills, personal skills, understanding the EU policy interface as well as interpersonal skills
Prerequisites	None
Course learning objectives	<ul style="list-style-type: none"> - To learn how to carry out a systematic literature review - To learn how to write a scientific paper and the overall publication ethics - To learn how to prepare a research grant - To learn how to effectively communicate their results to different audiences and interested stakeholders - To understand the positioning of exposome and NEUROSOME within the EU policy interface - To develop interpersonal skills
Module Structure (details of sessions title/speaker/date/duration)	Development of soft skills Day 1 <ul style="list-style-type: none"> - Methods for systematic literature review - Molecular biology applied to gene-environment interactions - Tools for assessment of child neurodevelopment at different ages Day 2 <ul style="list-style-type: none"> - Writing a paper starts well in advance of the actual writing. Scientific Paper structure. IMRAD format - Abstract, introduction sections - Methods, results, discussion and conclusion sections - Create informative tables and figures - Submission of scientific manuscripts and Open access to research data Day 3 <ul style="list-style-type: none"> - Grant proposals rationale - State of the art and beyond - Description of work - Impact - Management

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	<p>Day 4</p> <ul style="list-style-type: none"> - Presentations to scientific audience - Presentation to policy makers and other non-scientific experts - Attractive CVs and job interview recommendations <p>Day 5</p> <ul style="list-style-type: none"> - Working is a team – leading a team - Creating and developing scientific network - Develop multicultural awareness
Highlight soft skills that will be covered	<ul style="list-style-type: none"> - Scientific manuscripts and grants - Presentations - Develop communication skills
Highlight implications for neuro-psychiatric diseases	Participants will learn how to deliver a systematic review on the specific topic.
Module assessment	<p>Attendance and feedback during the lectures</p> <p>Write a scientific paper</p>
Location	TBD
Readings	<p>Recommended reads and videos:</p> <ul style="list-style-type: none"> - 11 steps to structuring a science paper editors will take seriously by Dr. Angel Borja. https://www.elsevier.com/connect/11-steps-to-structuring-a-science-paper-editors-will-take-seriously - Six things to do before writing your manuscript by Dr. Angel Borja. https://www.elsevier.com/connect/six-things-to-do-before-writing-your-manuscript - Open access: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm - https://researcheracademy.elsevier.com/writing-research/fundamentals-manuscript-preparation - https://researcheracademy.elsevier.com/research-preparation/funding/secure-funding-ecr-edition - https://researcheracademy.elsevier.com/research-preparation/funding/successful-research-grant-applications-getting-right - https://researcheracademy.elsevier.com/guide-reference-managers-effectively-manage-references - https://www.mendeley.com/reference-management/reference-manager/