CUSP

The European research cluster to understand the health impacts of micro- and nanoplastics

www.cusp-research.eu
hello@cusp-research.eu

FROM EARLY LIFE TO ADULTHOOD: WHAT'S THE IMPACT OF MICRO- AND NANOPLASTICS IN THE HUMAN BODY?

The CUSP cluster is a newly funded EU initiative to answer key micro- and nanoplastics related questions on human health and provide policy-relevant scientific data.

June 11th, 2021: 75 organizations from 21 countries forming five large-scale projects came together to give birth to the *European research cluster to understand the health impacts of micro- and nanoplastics, CUSP*. Funded by the European Commission with EUR 30 million, a multidisciplinary team of scientists, industry and policymakers will collaborate in this unprecedented research effort over the next five years. Within CUSP, the different projects will investigate the complex relationship between micro- and nanoplastics (MNPs) and human health. The team will be focusing in particular on exposure routes, hazard and risk assessment, and the development of new analytical tools to measure, characterize and quantify MNPs. A large audience of stakeholders and interested citizens logged in on June 9th, to launch CUSP in an online kick-off meeting with CUSP project members and representatives from the European Commission.

Micro- and Nanoplastics are everywhere

The presence of micro- and nanoplastics (MNPs) in the environment is of great concern to society. The small plastic particles emanate from the degradation of larger plastic items, or are intentionally manufactured and added to commercial products such as cosmetics, synthetic textiles or paints. It has become clear that MNPs are part of people's lives all around the globe. We inadvertently ingest them through the food we eat and the water we drink, and we inhale them through the air we breathe. Pollutants, such as heavy metals, allergens, toxicants, and microorganisms, can latch on to these particles and may further endanger the environment as well as human and animal health. Despite the ubiquitous presence of MNPs all around us, currently we have neither the tools for measuring and characterizing them with exactitude, nor the understanding of where they end up in our bodies after exposure and the effects they have on our health.

The European Union is spearheading efforts in research on MNPs

In response to this global challenge, the European Union has committed itself to leading efforts in advancing our understanding of MNPs and their impacts on human health. This entails the development of human health hazard and risk assessment methodologies, including preliminary investigations into long-term impacts. CUSP research results will contribute to the health-relevant aims of the European Strategy for Plastics in a Circular Economy and the Bioeconomy Strategy, as well as the REACH restrictions on intentionally added MNPs to products, by providing new evidence for better preventive policies. "The current regulatory framework cannot ensure that micro- and nanoplastics present in the air, and in food and beverage products are at safe levels for the population. Furthermore, the positive effects of reduce/recycle/reuse will take a long time. That is why we need solid scientifically-based knowledge related to their potential risks and mechanisms of action.",

AURORA IMPTOX plasticheal PlasticsFatE POLYRISK

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA n° 964827, IMPTOX n° 965173, PLASTICHEAL n° 965196, PLASTICFATE n° 965367, POLYRISK n° 964766.

explained Prof. Ricard Marcos, from the Autonomous University of Barcelona and Coordinator of Plasticheal, one of the five CUSP projects. “Based on this study we plan to take action”, affirmed Paulo Da Silva Lemos, speaker from the European Commission’s Sustainable Products and Plastics Unit during the online conference, further endorsing this contribution to the reduction of the release of micro- and nanoplastics into the environment.

Carmen Laplaza-Santos from the European Commission’s Directorate-General for Research and Innovation explained that 51 proposals were submitted when they opened the call for submissions on this topic in 2018, “the highest number ever received in an environmental and health related call for proposals, which attests to the high interest of the scientific community in this topic”.

Complex phenomena, such as the global presence of MNPs in our environment, can only be dealt with effectively by uniting strengths and dealing with this issue on a large scale. Uniting five research initiatives in one large cluster will engender synergies and amplify the efforts of individual research initiatives. The CUSP team will work closely with the European Commission’s Joint Research Centre to enhance the impact of their research and to make sure there is a constant dialogue between science and policymaking. “There is unanimous opinion that there are major knowledge gaps, resulting largely from a lack of analytical methods”, stated Birgit Sokull-Kluettgen from the European Commission’s Joint Research Centre, adding that, “the measuring problem is even larger for the smallest plastic items, the nanoplastics”.

Dr. Tanja Ćirković Veličković from the Faculty of Chemistry at the University of Belgrade, who chairs the CUSP cluster this year and coordinates IMPTOX, one of the five CUSP projects, hopes that their research will help, “to better assess the risks of micro- and nanoplastics, and create a scientific basis for future EU guidelines and early warnings to safeguard human health.”

The five founding projects of CUSP

The five multidisciplinary research consortia that brought to life the CUSP cluster mainly comprise universities and research institutions as well as small- and medium-sized enterprises, NGOs, non-for-profit organizations, industry, and governmental institutions. They will focus on investigating different aspects related to MNPs and health, such as the possible harmful impact of MNPs on pregnancy and early life; the relationship between MNPs, allergic diseases and asthma; the impact of MNPs on the human intestinal tract and the immune system; as well as the development of a comprehensive measurement and testing program. For more details on the individual projects, please consult the attached factsheet.

Science to Policy

The online conference – a partner event of this year’s EU Green Week - featured speakers from the European Commission as well as the coordinators of the five research projects. In a lively panel discussion where the audience contributed with questions and comments, scientists addressed in particular how we are exposed to micro- and nanoplastics; what kinds of risks they may pose once inside the human body; and which methodological challenges scientists are facing to find out. “We need to produce results that are comparable”, stated Dr. Rudolf Reuther Scientific-Coordinator of PlasticsFatE from Environmental Assessments in Germany. He added, “There is a wealth of studies

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA nº 964827, IMPTOX nº 965173, PLASTICHEAL nº 965196, PLASTICFATE nº 965367, POLYRISK nº 964766.

going on, but the results cannot be compared because of a lack of harmonized methods. This will be something we hope to avoid among the five CUSP projects."

Prof. Tanja Ćirković Veličković pointed out that, "MNP surfaces may attract and retain hazardous contaminants, such as metals, allergens, pathogenic bacteria and toxins, and deliver them into the body. Little is known so far on how MNPs and their pollutants influence allergic diseases and asthma."

"In the five different CUSP projects, we focus on generating the scientific evidence that is essential to carry out a detailed risk assessment", explained Prof. Roel Vermeulen, from the University Medical Centre Utrecht and the coordinator of AURORA, in an online networking event organized by the 2021 EU-Green-Week on June 3rd. "The risk at the moment is very uncertain but scientifically plausible and could affect future generations, which is why we should be filling this knowledge gap urgently", stated Dr. Heather Leslie from VU Amsterdam and Co-Coordinator of POLYRISK.

The CUSP team met again on June 10th for their first internal annual meeting, where they discussed how to coordinate research efforts among CUSP partner organizations over the coming years.

For more information:
Join the CUSP Community
www.cusp-research.eu
https://www.linkedin.com/company/cusp-research/
https://twitter.com/CuspResearch

AURORA IMPTOX plasticheal PlasticsFatE POLYRISK

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA n° 964827, IMPTOX n° 965173, PLASTICHEAL n° 965196, PLASTICFATE n° 965367, POLYRISK n° 964766.

CUSP

The European research cluster to understand the health impacts of micro- and nanoplastics

www.cusp-research.eu
hello@cusp-research.eu

FACTSHEET

THE FIVE CUSP PROJECTS

AURORA

"In AURORA, we are developing novel tools for measuring micro- and nanoplastics in human tissues, and we will then scale up these analytical methods so that we can detect plastic particles in placentas, blood and umbilical fluid – if they are present. This will allow us to assess human health impacts on the developing fetus that are linked to micro- and nanoplastics exposures", explains the project's coordinator, Prof. Roel Vermeulen from the University Medical Center Utrecht in the Netherlands. "*Through toxicological test systems varying from simple cell systems to full perfused placentas we will explore if micro- and nanoplastics can cross-the placental barrier and if they elicit adverse biological responses. By combining these molecular-level insights with our human health impact studies we hope to shed light on the risks of micro- and nanoplastics in early-life health*" indicates Dr. Virissa Lenters, co-coordinator of the AURORA project. A unique aspect of AURORA is an intervention study on food packaging. Roel Vermeulen: *"Plastic packaging is ubiquitous, but some consumers are avoiding it by choosing alternative packaging materials. We will study their exposure to plastic particles and compare them to levels in people that are not explicitly avoiding plastics"*.
With its 11 partners from 8 European countries – Belgium, the Czech Republic, Finland, Germany, the Netherlands, Spain, Switzerland, the United Kingdom – and one partner from the United States, AURORA is an international and interdisciplinary project that will run for 5 years. More:

www.auroraresearch.eu
https://www.linkedin.com/company/auroraresearch/
https://twitter.com/AuroraProjectEU

IMPTOX

ImpTox is an innovative analytical platform that unites 12 partners from 8 European countries to investigate the impact of micro- and nanoplastics combined with environmental contaminants on food safety and human health, focusing on allergy and asthma. "In the Imptox project, we will study, for the first time, the effects of environmental or dietary exposure to MNPs on allergy and asthma, using different preclinical models and clinical studies in allergic children," says Imptox Project Coordinator, Tanja Ćirković Veličković from the Faculty of Chemistry at the University of Belgrade in Serbia. "We don't know yet what the risks of MNPs are on allergic disease", adds Imptox partner Michelle Epstein, an allergist and immunologist who will study the effects of MNPs in allergic asthma and food allergy models at the Medical University of Vienna in Austria. "Furthermore, we don't understand how MNPs interact with allergens in our environment and with our immune system", affirms Imptox partner Marianne van Hage, Prof. of Clinical Immunology at Karolinska Institutet. Imptox, which will run over the next four years, is led by the Faculty of Chemistry, University of Belgrade and comprises a multidisciplinary team from universities, research institutions and small and medium-sized enterprises in Serbia, Belgium, Austria, Sweden, France, Croatia, Italy and Switzerland. For more information please visit:

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA n° 964827, IMPTOX n° 965173, PLASTICHEAL n° 965196, PLASTICFATE n° 965367, POLYRISK n° 964766.

www.imptox.eu
https://twitter.com/imptox
https://www.linkedin.com/company/imptox

PLASTICHEAL

PLASTICHEAL project aims to develop new methodologies and reliable scientific evidence for regulators to set the knowledge basis for adequate risk assessment of MNPs. It will investigate the impact and consequences of MNPs on human health, drawing a variety of experimental human models and measuring potential health effects under short and long-term conditions.

"*We want to study the long-term impact on the general population and also on the most vulnerable groups, not only among the people most exposed to MNPs, but also among those with health conditions that could make them more vulnerable to potential adverse effects*", explains Plasticheal Project Coordinator, Ricard Marcos. "*One of Plasticheal singularities is that it will adopt a multiomics approach to identify candidate biomarkers with the potential to be applied for a more rapid, accurate and affordable generation of the necessary data for MNPLs hazard prediction*", adds Alba Hernández, co-coordinator of the Project. Both coordinators are professors at the Department of Genetics and Microbiology at the Autonomous University of Barcelona.

The data generated will be processed by integrative analysis methods to obtain MNPs mechanistic insight, and to identify key events with potential to be consolidated as novel biomarkers of MNPs long-term effects. The knowledge gained and the methodology developed in PLASTICHEAL will permit the identification and management of safety issues related to human exposure to incidental MNPs.

PASTICHEAL, led by the Autonomous University of Barcelona, has received 6 million euros of from the European Commission and has the participation of 11 universities and research centres from 7 EU countries: The Netherlands, Finland, Denmark, France, Spain, United Kingdom and Germany.

https://twitter.com/plasticheal
https://www.linkedin.com/company/plasticheal/

PLASTICSFATE

PlasticsFatE (Plastics Fate and Effects in the human body) aims to improve our present understanding of the impact of micro- and nano-plastics (MP/NP) and associated additives/adsorbed contaminants (A/C) in the human body. PlasticsFatE scientific coordinator Rudolf Reuther from ENAS (DE) says: "To get a better science-based understanding on the type and extent of human hazard and exposure to micro-and nano-plastics and the associated risks for human health, we need to develop and use validated methods that can create the robust and reliable data we need to take decisions on both the regulatory and industrial level".

The 48-month project brings together the significant expertise of 28 partners from 11 European countries to develop a panel of well characterized MNP test and reference materials; establish validated methods to measure MNPs in complex matrices and assess relevant exposure levels/sources and the fate of MNPs and at the same time develop in vitro/in vivo models to study effects of MNPs in the human body. The generated new data and methodology will be integrated into a new human and environmental risk assessment and management strategy for MNPs and their feasibility demonstrated by case studies under real conditions. The produced new scientific knowledge will help to get the needed better understanding of the impact of plastic particles on human health and so contribute to the implementation of relevant EU strategies and international standardisation.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA nº 964827, IMPTOX nº 965173, PLASTICHEAL nº 965196, PLASTICFATE nº 965367, POLYRISK nº 964766.

PlasticsFatE Project Coordinator, Mark Morrison from Optimat (UK), commented: "PlasticsFatE and the other projects in the CUSP cluster will afford us the knowledge and tools to better understand the range of micro and nano plastics, and associated contaminants, that people are exposed to and the impacts they have on human health. In turn, this will help support companies developing and using plastics in products to make informed, safer-by-design choices". The project will run from the 1st April 2021 to 31st March 2025.

www.plasticsfate.eu
https://twitter.com/plasticsfate

POLYRISK

POLYRISK aims at unravelling the risks of microplastic and nanoplastic particles (MNP) that are ubiquitous in our environment and are likely to be entering the human body via inhalation and ingestion. The most bioavailable low-micron and nano-sized MNP pose the biggest analytical challenges or today's analytical chemists. Existing knowledge about the adverse pro-inflammatory effects of airborne particulate matter and nanoparticles, combined with pro-inflammatory evidence of MNP exposure observed in animal models and in vitro pilot tests with human immune cells, suggests that MNP may cause immunotoxicity in humans. Occupational exposure of workers to fibrous MNP can indeed lead to granulomatous lesions, causing respiratory irritation, functional abnormalities and flock worker's lung. Currently, human health risk assessment protocols specific to MNP are not available and key data is missing. This hampers science-based decision making.
"POLYRISK's human risk assessment strategy will combine highly advanced sampling, sample pre-treatment and analytical methods to detect microplastic and nanoplastic particles, MNPs, in complex matrices, up-to-date fit-for-purpose hazard assessment technologies and multiple real-life human exposure scenarios. We will focus on key toxic events linked to several chronic inflammatory diseases", said Dr. Raymond Pieters from the Utrecht University, Institute for Risk Assessment Sciences.

The consortium uniquely brings together 15 partners from 7 countries with interdisciplinary experience and know-how on quality-controlled chemical analyses of MNP and additives, intestinal and respiratory toxicity models, human exposure epidemiology, immunotoxicology and real-life high-exposure studies. POLYRISK's novel human risk assessment strategy is based on mechanistic reasoning and pragmatically accommodates the complexity of the MNP toxicant class. Building with ground-breaking science, stakeholder engagement and strong communication, POLYRISK aims to rapidly reduce current MNP risk uncertainties and support EU efforts to ensure public health is adequately protected from the potential risks of MNP pollution.

https://polyrisk.science/
https://twitter.com/PolyriskScience

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreements AURORA n° 964827, IMPTOX n° 965173, PLASTICHEAL n° 965196, PLASTICFATE n° 965367, POLYRISK n° 964766.