AGÊNCIA PORTUGUESA DO AMBIENTE

DGS desde 1899 Direção-Geral da Saúde

20 anos FCT Fundação para a Ciência e a Tecnologia

Instituto_Nacional de Saúde Doutor Ricardo Jorge

Programme and Abstract Book

1st WORKSHOP ON HUMAN BIOMONITORING IN PORTUGAL (1st HBM-PT)

"Bridging Chemical Exposure to Human Health"

11 May 2018 | Lisboa, Portugal

Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA)

Table of contents

Welcome message

Welcome message

Dear Members of the Human Biomonitoring Community,

On behalf of the Scientific and Organizing Committee of the 1st Workshop on Human Biomonitoring in Portugal, I warmly welcome you to Lisboa and the National Institute of Health. This workshop brings together researchers, experts in environmental or occupational health, regulators, chemical industry professionals and other Portuguese stakeholders to discuss the state-of-the-art of human biomonitoring and health studies in Portugal and across Europe. Its aim is to promote the communication between scientists and authorities regarding the use of human biomonitoring data in a regulatory context and as part of a preventive strategy in environmental and occupational settings. It is in the best interest of scientists, chemical industry workers, and experts involved in risk assessment and management, among others, to know each other, network and share experiences and expectations.

We hope to have created the right environment to make this a very productive event, pioneering future developments towards environmental and occupational health promotion and protection.

João Lavinha

Ambassador of the Portuguese National Hub for Human Biomonitoring

Scientific and Organizing Committee

Scientific and Organizing Committee

AGÊNCIA PORTUGUESA DO AMBIENTE

Isabel Moura

Teresa Núncio

DGS desde 1899 Direção-Geral da Saúde

Teresa Borges

20 anos FCT Fundação para a Ciência e a Tecnologia

Marta Abrantes

Rita Cavaleiro

Instituto_Nacional de Saúde Doutor Ricardo Jorge

Carlos Dias

Henriqueta Louro

João Lavinha

José Maria Albuquerque

Maria João Silva

Paula Alvito

Ricardo Assunção

Sónia Namorado

Programme

Programme

10:00 – 10:30 REGISTRATION

10:30 – 10:45 OPENING SESSION

Welcome and introduction

Chairs: João Lavinha (INSA)
Teresa Núncio (APA)

Fernando de Almeida, INSA (Instituto Nacional de Saúde Doutor Ricardo Jorge), PT tbc

Cesaltina Correia Ramos, DGS (Direção-Geral da Saúde), PT

Nuno Lacasta, APA (Agência Portuguesa do Ambiente), PT tbc

Ana Sanchez, FCT (Fundação para a Ciência e a Tecnologia), PT

10:45 – 12:10 SESSION 1

Human Biomonitoring across Europe: contribution to health and environment policies

Chairs: Maria João Silva (INSA)
Carlos Dias (INSA)

Building European knowledge on citizens' exposure to chemicals – the HBM4EU
Greet Schoeters (HBM4EU co-coordinator), VITO (Vlaamse Instelling voor Technologisch onderzoek), BE

National Hub - Portugal (HBM NH-PT)
Rita Cavaleiro, FCT (Fundação para a Ciência e a Tecnologia), PT

The role of Adductomics and Metabolomics in Human Biomonitoring
Alexandra Antunes, IST, UL (Instituto Superior Técnico, Universidade de Lisboa), PT

Selected communications:

Maternal and pre-natal exposure to harmful substances in Aveiro region
Susana Loureiro, UA (Universidade de Aveiro), PT

Human Biomonitoring of plasticizers in obese and non-obese Portuguese Children
Maria Luísa Correia de Sá, ISEP, IPP (Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto), PT

12:15 – 13:30 LUNCH AND POSTER VIEWING

13:30 – 14:50 SESSION 2

Human Biomonitoring in Health Risk Assessment

Chairs: Teresa Borges (DGS)
Paula Alvito (INSA)

Prioritisation Strategy in Human Biomonitoring (HBM4EU)
Joana Lobo Vicente, EEA (European Environment Agency), DK

Human Biomonitoring and Risk Assessment of chemical Mixtures
Erik Lebret, RIVM (Rijksinstituut voor Volksgezondheid en Milieu), NL

Human Biomonitoring and Public Health
Henrique Barros, ISPUP (Instituto de Saúde Pública da Universidade do Porto), PT

14:50 – 15:50 SESSION 3

Human exposure and health effects

Chairs: Susana Viegas (ESTeSL*)
Ana Virgolino (FMUL**)

The quest for biomarkers of effect in Human Biomonitoring studies
António Sebastião Rodrigues, NMS-FCM, UNL (NOVA Medical School-Faculdade de Ciências Médicas, Universidade Nova de Lisboa), PT

Health Examination Surveys and Human Biomonitoring – the added value of combined studies
Sónia Namorado, INSA (Instituto Nacional de Saúde Doutor Ricardo Jorge), PT

Selected communications:

Contribution of preschool indoor air to children total exposure to polycyclic aromatic hydrocarbons
Marta Marques de Oliveira, ISEP, IPP (Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto), PT

Are Portuguese population exposed to Zearalenone? A human biomonitoring study as a contribution to the risk assessment of an endocrine disruptor
Carla Teles Martins, INSA (Instituto Nacional de Saúde Doutor Ricardo Jorge), PT

* ESTeSL – Escola Superior de Tecnologia da Saúde, Instituto Politécnico de Lisboa, PT
**FMUL – Faculdade de Medicina, Universidade de Lisboa, PT

15:50 – 16:20 COFFEE BREAK AND POSTER VIEWING

16:20 – 17:20 PANEL DISCUSSION

Needs for Human Biomonitoring in Portugal — Chair: João Lavinha (INSA)

Graça Mariano, DGAV (Direção Geral de Alimentação e Veterinária), PT

Hélder Pires, FIEQUIMETAL (Federação Intersindical das Indústrias Metalúrgicas, Químicas, Elétricas, Farmacêutica, Celulose, Papel, Gráfica, Imprensa, Energia e Minas), PT

José Rueff, NMS-FCM, UNL (NOVA Medical School-Faculdade de Ciências Médicas, Universidade Nova de Lisboa), PT

Sandra Moreira, DGS (Direção-Geral da Saúde), PT

17:20 CONCLUDING REMARKS

Maria João Silva, INSA; José Maria Albuquerque, INSA

Chairs and Speakers

Alexandra Antunes

Alexandra M. M. Antunes obtained a degree in Chemistry by Faculdade de Ciencias in 1994, a M.Sc. in Industrial Organic Chemistry and a PhD in Organic Chemistry, both by Faculdade de Ciências e Tecnologia (FCT-UNL), in 1998 and 2003, respectively. Before completing the PhD degree, she obtained a position in the lead national pharmaceutical company, BIAL. In 2006 she became Assistant Researcher at REQUIMTE. In 2008 she obtained a position as Assistant Researcher (through Ciência 2007 FCT Program) at the Centro de Química Estrutural, Instituto Superior Tecnico (CQE-IST) where she established her own research line aimed at evaluating drug-protein adducts (adductomics) as adequate biomarkers of toxicity/exposure to chronic therapies. Since 2013, she is Principal Researcher at CQE-IST, a position obtained under the FCT Investigator call and her main focus has been the development of diagnosis and prognosis tools of chemically-induced cancers and diseases induced by endogenous metabolites. In 2014 she received the LRI Award, from The European Chemical Industry Council (Cefic), one of Europe's largest research grants for early career toxicologists. In 2017, she co-founded the start-up company, Clarify Analytical, aimed at translating the knowledge in toxicology and analytical technologies into useful clinical tools to diagnose the devastating chronic auto-immune disease, Lupus.

Ana Virgolino

Ana Virgolino is a clinical and health psychologist currently working as a research fellow in the Faculty of Medicine at the University of Lisbon. She has also been collaborating with the Institute of Preventive Medicine and Public Health and with the Institute of Environmental Health of the same faculty since 2013.

Over the last few years, Ana has collaborated on several scientific projects in the areas of public, environmental and mental health, epidemiology, aging, and sexuality and gender, with various publications in these fields. More recently, she assumed the position of scientific coordinator of the HBM4EU initiative for FMUL.

Carlos Dias

Carlos Matias Dias coordinates the Department of Epidemiology of the National Institute of Health Doutor Ricardo Jorge since 2009, is Invited Assistant Professor at the National School of Public Health (NOVA University) since 2000, national representative in the European Center for Disease Control and Prevention since 2016. Leader since 2007 to present of the National Register of Congenital Anomalies affiliated of the European Register of Congenital Anomalies (EUROCAT) under the EC Joint Research Center at ISPRA.

Principal Investigator in the pilot of the European Health Examination Survey, previous EU funded project Feasibility of a Health Examination Survey in Europe and in the EEAGrants funded Health Examination Survey (INSEF 2013-2017) that collected interview and antropometric data and blood samples in a nationally representative sample of 4100 persons. Was in the Working Group on Health Statistics and in the Technical Group of the European Health Interview Survey (1998-2008) and worked in the 3rd and 4th National Health Interview Surveys, having coordinated the later. Has a degree in medicine (NOVA University-Faculty of Medical Sciences) a Master in epidemiology (University of London-LSHTM), a PhD in Epidemiology (NOVA University-National School of Public Health). Medical practitioner (1988-2000) and Public Health specialist from 1994 to present. President of the National Association for Public Health Promotion (2013-2015) now in the Board of Directors.

Erik Lebret

Erik Lebret, Ph.D. is Chief Science Officer Integrated Risk Assessment at the National Institute of Public Health and the Environmental (RIVM), Bilthoven, The Netherlands. He is professor in Environmental Health Impact Assessment at the Institute of Risk Assessment Sciences (IRAS) at Utrecht University. Erik Lebret studied environmental health sciences at the University of Wageningen, where he also did his doctorate thesis on exposure to air pollution in the Dutch housing stock. He spent a year as visiting research associate at the Harvard School of Public Health, working on errors and misclassification problems in exposure assessment and their effect on exposure-response relations. Over the years, he worked on a variety of environment and health issues and impact assessments in national and international projects. He has served on numerous expert committees and review panels in Europe and the USA. He was president of the International Society of Exposure Analysis, and associate editor of the Journal of Exposure Analysis and Environmental Epidemiology. He is past-member of the Policy Committee of the International Society of Environmental Epidemiology – ISEE. Currently, he is programme manager of the RIVM Strategic Research Programme on Integrated Risk Assessment. He is a member of the External Science Advisory Committee of the Long-range Research Initiative of CEFIC (European Chemical Industry Council). He is Workpackage leader of HBM4EU WP on Mixtures.

Graça Mariano

Degree in Veterinary Medicine at the Faculty of Veterinary Medicine of the Technical University of Lisbon in 1993 and Master in Veterinary Public Health in 2007, with a master's dissertation entitled “Assessment of the cadmium concentration in equine meat and its importance for public consumption”. Since july 2016, Deputy Director-General at the DGAV - Directorate General for Food and Veterinary. From march to june 2016, Head of Directorate for Food Safety of the DGAV. From august 2007 to january 2012 Head of Directorate of the Department of Expertise. From February 2012 to august 2015, Head of Directorate of the Department of Food Hazards and Laboratories - DRAL, of the ASAE. Lecturer and course unit coordinator of the «Epidemiology and Veterinary Medicine» course unit of the Veterinary Medicine Master’s Degree at the “Universidade Lusófona”, (october 2007 to february 2014) and was Coordinator and lecturer of the “Animal Health” course unit at the “Escola Superior de Saúde Ribeiro Sanches” (ERISA) of the “Universidade Lusófona” (from october 2005 to march 2009). From March 2005 to August 2007, Head of Unit of the Veterinary Public Health Unit of the Directorate of Veterinary Public Hygiene of the Directorate General of Veterinary. From June 2000 until February 2005 was Sanitary Inspection Coordinator, of the Oeste region, in the Regional Directorate of Agriculture of Ribatejo e Oeste. Since April 1993, has worked at the Regional Directorate of Agriculture of Ribatejo e Oeste, as a sanitary inspector in slaughter and cutting establishments.

Greet Schoeters

Greet Schoeters manages the Environmental Health projects at VITO, is professor at the Public Health Institute of the University of Southern Denmark University and Professor at the Department of Biomedical Sciences of the University of Antwerp. She coordinates the Flemish human biomonitoring study (FLEHS) of the Flemish ministries of Environment and Health (2002-2020) and participated in the EU ESBIO and EU COPHES project to prepare a European human biomonitoring programme. Currently she is co-coordinator of the European HBM4EU project and leads the science policy- pillar of the HBM4EU initiative.

She is member of the Scientific Committee of the European Environment Agency (EEA) and participated in the European Scientific Committee of Health and Environmental Risks (SCHER 2013-2016) and of the CONTAM panel of the European Food Safety Agency (2003-2006). She was president of the European Society for Toxicology in Vitro (2008-2012).

Hélder Jorge Vilela Pires

Licenciado em Química Tecnológica, pela Faculdade de Ciências da Universidade de Lisboa, desde 1996. Realizou em 1992, o curso de Contabilidade Geral pelo IEFP e em 2016 um curso sobre Jornalismo, comunicação escrita, ateliês de rádio e televisão, no CENJOR - Centro Protocolar de Formação Profissional para Jornalistas. Formador Certificado na área da Segurança e Saúde no Trabalho desde 2009, com dezenas de horas de formação realizadas a trabalhadores e aos seus representantes. A segurança e saúde no trabalho é uma área pela qual tem grande interesse, tendo em especial atenção a protecção dos trabalhadores nos locais de trabalho. Em 2012, escreveu a brochura temática: "SST – Riscos Químicos", editada pela Fiequimetal em parceria com a ACT. Relacionado com a área da SST, participou entre 2008-2017 em 14 Seminários (na maioria, como orador) promovidos por diversas entidades, entre as quais a ACT (Autoridade para as Condições no Trabalho). É o representante da Fiequimetal na CNTMP (Comissão Nacional do Transporte de Mercadorias Perigosas). E o conselheiro da CGTP-IN no CAAPRP (Conselho de Apoio para Assuntos de Protecção contra os Riscos Profissionais). Desde 2010, participa anualmente nos Seminários Europeus, sobre os Riscos Químicos nos Locais de Trabalho, realizados pela ETUI (Instituto Europeu de Sindicatos). Membro do Grupo de Trabalho da Comissão Europeia sobre os Campos Electro-Magnéticos e do Grupo de Trabalho Europeu sobre as Normas ISO.

Henrique Barros

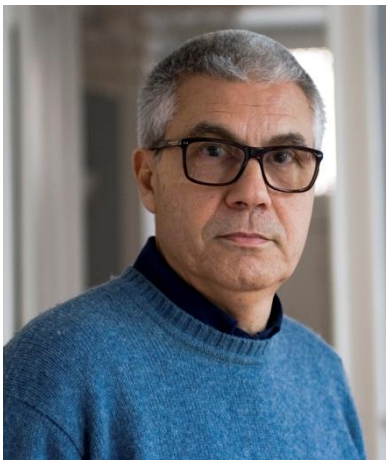
Henrique Barros was born in Porto, in 1957, and graduated in Medicine in 1981. During 1988-89 was research fellow at the Internal Medicine department of Lund´s University Hospital. In 1991 became Gastroenterology specialist and defended his PhD, with a research on the epidemiology of viral hepatitis. He is Full Professor of Epidemiology at UP since 1999. He launched the Master Programs in Public Health, Epidemiology and Sociology and Health as well as the doctoral program in Public Health at the University of Porto and the doctoral program in Global Public Health (program director), a joint program with University NOVA of Lisbon, financed by the Portuguese Research Foundation (FCT). He was member of the Scientific Council for Health Sciences Foundation for Science and Technology (2004-12), National Coordinator of the HIV/AIDS Program (2005-11) and member of the Medical Sciences (MED) Scientific Committee of Science Europe (2012-15). He is currently, member of the Executive Commission of the National Ethical Committee for Clinical Investigation (CEIC), President of the Institute of Public Health, University of Porto, Executive Board Member of ASPHER and President of the International Epidemiological Association. He has developed research in national and international projects, in areas such as clinical and perinatal epidemiology, cardiovascular, infectious and cancer diseases, which resulted in (co)authorship of more than 300 scientific publications in international journals.

Joana Lobo Vicente

Dr. Joana Lobo Vicente has a degree in Chemistry from the Faculty of Sciences of the University of Lisbon. She did her MSc in Forensic Science, and her Ph.D in Analytical Chemistry at King's College London, in the Drug Control Centre. During her Ph.D she investigated the influences of alcohol in the excretion of testosterone/epitestosterone for doping purposes. After her Ph.D, she worked has a research analyst for the 2012 Olympic & Paralympic Games, and as postdoctoral research associate at King's College London.

In 2013, she started as a Scientific Officer at DG Joint Research Centre (European Commission) where she worked with metabolomics, compound confirmation of suspected illicit substances, and detection and quantification of illicit drugs (classic and new psychoactive substances) in wastewater via LC-MS/MS. She also worked in the Food Contact Materials group, in method development and validation of contaminants in foodstuff, organisation of proficiency tests involving BPA; as well as plastic recycling compliance for food contact applications across the member states for circular economy purposes (raw materials).

Joana is currently working as a project manager in chemicals, environment and human health at the European Environment Agency Science, in the HBM4EU project. Its aims are to coordinate and advance human biomonitoring in Europe and provide better evidence of the actual exposure of citizens to chemicals and the possible health effects to support policymaking.



João Lavinha

João Lavinha (born in Sintra, 1949) is Head of the Research & Development Unit, Human Genetics Department, National Institute of Health Doutor Ricardo Jorge (INSA). He has held other positions at INSA over the years, e.g., Head, Centre for Human Genetics (2005-2008); Director-general (2000-2004); and Head, Molecular Biology Laboratory, Human Genetics Department (1993-2000). He received his Provas para Investigador Auxiliar (equivalent to PhD) from INSA (1994), and his MSc (Medical Science) from the University of Glasgow (1983), having previously graduated (BSc) in Pharmacy and Chemistry from the University of Lisboa (1969, 1977). He is (co)-author of 103 papers, 76 of which in international peer-reviewed journals. His current research interests include molecular etio-pathogenesis and epidemiology of genetic disease, genetics of disease susceptibility, public health genomics and genetics of the response to environmental stressors in human-relevant models. Between 2005 and 2012 he served in the Portuguese National Council for Environment and Sustainable Development. Between 2012 and 2015 he was appointed to the Portuguese National Council for Science & Technology. Since 2016 he is a member of the Portuguese Clinical Research Ethics Review Board. He has been elected to the board of the European Society of Human Genetics (1997-2002) and of the Sociedade Portuguesa de Genética Humana (2004-2006) and is currently a board member of APF, the Portuguese Planned Parenthood Association.

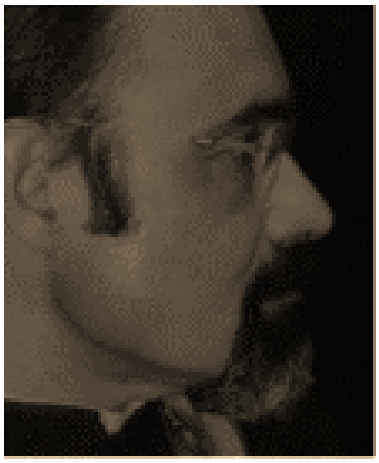
José Maria Albuquerque

Doctor José Maria Albuquerque is currently Member of the Executive Board of the National Institute of Health Doutor Ricardo Jorge (INSA), I.P., where he coordinates INSA's health research and innovation strategy, the institutional quality programme, the laboratorial certification and accreditation policy, as well as the PhD and other scholarship interchange. He co-heads WHO's Collaborating Center for Nutrition and Childhood Obesity at INSA.

From March 2007 to June 2010, he was Deputy High Commissioner for Health, Ministry of Health. He was National Focal Point and member of the drafting group of the Tallinn Charter: Health Systems for Health and Wealth, WHO. Moreover, he was temporary Advisor for the WHO regional office for Europe technical meetings on Health Systems Action to address socially determined health inequalities.

Previously, he was advisor to the R&D directorate of the Institute of Welding and Quality (2010-14; 2006) and senior researcher (2001-2005). He was a Member of the Steering Committee of the European Technology Platform on Advanced Engineering Materials and Technologies (EuMaT) (2010-12), co-authoring its current Strategic Research Agenda.

In 2005 he was appointed advisor to the Minister of Economy and Innovation, co-authoring the National Technological Plan of the XVII Constitutional Government and represented the Ministry of Economy in the Lisbon Strategy Coordinating Unit, contributing to the National Reform Program 2005/2008 and the European Council Broad Integrated Economic Policy Guidelines.



José Rueff

José Rueff is currently Professor and Chair of Genetics, Coordinator of the Genetics, Oncology and Human Toxicology area and Coordinator of the Centre for Toxicogenomis and Human Health at the Nova Medical School, Universidade Nova de Lisboa. He has graduated in Medicine in 1977 at the Faculty of Medicine, University of Lisbon, has obtained his PhD in 1984 and his Aggregation in 1990 both at the Faculty of Medical Sciences, New University of Lisbon. He also held positions as Pro-Rector of the New University of Lisbon between 1993 and 1999 and Vice-Rector of the New University of Lisbon between 2003 and 2007. He received, among other Scientific Awards, the Award 'Encouraging Excellence' from the Foundation for Science and Technology - Ministry of Science and Higher Education in 2006, as well as the Pfizer Prizes of the Society of Medical Sciences of Lisbon (in 1976 and 1978) and the Award Burdinola Molecular Genetics from the Foundation Burdinola (2001). He has more than 200 internationally published articles and was supervisor of 28 PhD thesis.

Maria João Silva

Maria João Silva is, since 1997, the Principal Investigator of the Genetic Toxicology Group, R&D Unit, Human Genetics Department of the Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA) and she currently integrates the Coordination Board of the Centre for Toxicogenomics and Human Health (ToxOmics), NOVA Medical School, New University of Lisbon, Portugal. She collaborates is several post-graduate courses, as a professor of Human Genetics and Genetic Toxicology. She serves on the Portuguese Technical Commission on Nanotechnologies (CT-194, IPQ). She graduated in Pharmaceutical Sciences at the Faculty of Pharmacy, University of Lisbon (1985), she took public access to assistant researcher (equivalent to MSc) and later to research scientist (equivalent to PhD) in Genetic Toxicology (2002), at INSA. She is an expert in Human Genetics, Ministry of Health (2011). Her research interests have been focused on the interactions between environmental stressors and the genome, as determinants of human disease. Her current research areas comprise environmental mutagenesis, nanotoxicology, mixtures toxicology, and molecular epidemiology. She has been involved is National and European Projects, the most recent ones on mycotoxins mixtures effects (Mycomix) and on nanotechnologies safety assessment (Nanogenotox and NanoReg Projects). She is currently coordinating the technical and scientific activities of INSA's team in the HBM4EU EJP and takes part in the HBM4EU National Hub.

Paula Alvito

Paula Alvito, PhD Biology (2001) and EUROTOX Registered Toxicologist ERT (2017). Integrated member of Centre for Environmental and Marine Studies, University of Aveiro, Portugal (2016). Dr. Alvito has focused her research interests on food safety and food toxicology, namely, mycotoxins mixtures occurrence, toxicity, risk assessment and bioavailability. Reviewer of peer review journals on food safety. Member of the editorial board of World Mycotoxin Journal. She participates in international associations and networks on food safety (Cost Action Infogest, ImParas), collaborates in international projects (RiskBenefit4EU, EFSA; HBM4EU, Horizon 2020; Total Diet Study Exposure, 7FP) and national ones (MYCOMIX 2012-15), teaches in MSc programs and supervises PhD and MSc Thesis. She also coordinates the organization of new national and international scientific meetings (ICFC15, 17) concerning food contaminants challenges, symposiums and summer courses within international projects.

Rita Cavaleiro

Rita Cavaleiro holds a PhD in Biomedical Sciences (2009) and an MSc in Human Molecular Biology (2000) from the University of Lisbon, and a Licenciatura degree in Applied Chemistry (1996) from the NOVA University of Lisbon. Since 2015, she is a science officer at the Department for International Relations, FCT, where she has been representing FCT in several transnational cooperation scientific networks (including European Joint Programmes, ERA-NETs and Coordination and Support Actions). Within the HBM4EU EJP project, she is the National Hub Contact Point (NHCP) for Portugal. From 2012 to 2015, she worked at the Evaluation Office, FCT, where she participated in the organization of the peer review processes within several FCT calls.

Prior to her activity in science management, Rita Cavaleiro was a biomedical researcher in the areas of immunology of HIV infection (Institute of Molecular Medicine, Lisbon) and Hematology-oncology (Portuguese Institute of Oncology, Lisbon). While PhD student, she was awarded with the 2008 Pfizer Award in Clinical Research, attributed by the Society for Medical Sciences of Lisbon. She also developed an extensive activity as a teacher, both in secondary education and in several graduate, post-graduate and Master Courses. In addition to her academic activities, she was also product support specialist and scientific advisor at the company Citomed and R&D and Innovation Junior Manager at Eurotrials Scientific Consultants.

Sandra Moreira

Sandra Moreira is specialized in occupational health and safety, environmental health and public health, areas developed in entities of the ministry of health and the ministry of environment. With Master in “Management and environmental policies” her research was on the association of green jobs and occupational health issues, as well on the effects of fine particles on human health.

Since the end of 2012, she has been a member of the Coordination Team of the “National Occupational Health Program” of the Directorate-General of Health. She is co-author of several technical documents of Occupational Health, such as the Technical Guide on "Workers exposed to carcinogenic, mutagenic or toxic for reproduction chemicals health surveillance".

Between 2007 and 2012 she worked in the “Policies and Strategies of Environment Department”, of the Portuguese Environment Agency. She was part of the Coordination Team responsible for developing the actions of the "National Environment and Health Action Plan 2008-2013".

Between 2002 and 2007 she integrated several Public Health Teams, at a local and regional level, developing actions of surveillance and monitoring of systems, structures and activities in order to eliminate or reduce environmental risk factors for human health. It is also important to highlight her work in the “Control of Infection Commission - Executive Group” and the “Regional Team of Occupational Health”.

Sebastião Rodrigues

António Sebastião Rodrigues is Assistant Professor of Genetics at the Nova Medical School/ Faculdade de Ciências Médicas, Universidade Nova de Lisboa (UNL). He has lectured also in toxicology for several years at the UNL. He has worked for several years in various projects on genetic toxicology and toxicology and published various manuscripts on exposure to xenobiotics and ionizing radiation and the use of biomarkers of exposure.

Sónia Namorado

Sónia Namorado graduated in Chemistry at Instituto Superior Técnico (Lisbon Technical University) in 2004 and got her PhD in Organometallic Chemistry at the same University in 2009. She then did post-doctoral research at the Institute of Preventive Medicine and Public Health (Lisbon Faculty of Medicine), where she acquired expertise in epidemiology, environmental health and human biomonitoring. There she worked in several population-based epidemiological surveys with a biological sampling component for human biomonitoring and including the determination of exposure to environmental pollutants, such as heavy metals, persistent organic pollutants (POPs), particles, second-hand tobacco smoke and phthalates.

In 2014 she joined the Department of Epidemiology at the National Health Institute Doutor Ricardo Jorge to work on the first National Health Examination Survey (INSEF), which collected interview and anthropometric data and blood samples in a nationally representative sample of 4911 individuals. Among other projects, she is currently working in the European HBM4EU project.

Her research activities focus on environmental and occupational health (under the dual perspective of risk analysis and impact assessment, including human biomonitoring), on health determinants, including of the physical environment (environmental and occupational, especially heavy metals, biomarkers of tobacco smoke, POPs and particles), and survey methodology.

Susana Viegas

Graduated in Environmental Health in Escola Superior de Tecnologia da Saúde de Lisboa, do Instituto Politécnico de Lisboa (ESTeSL-IPL) has also two Master degrees: Safety and Ergonomics from Universidade de Lisboa and Applied Toxicology from Surrey University, England. PhD in Public Health from Escola Nacional de Saúde Pública, Universidade NOVA de Lisboa (ENSP,UNL).

Principal research topics are occupational toxicology, exposure assessment, exposure to mixtures, risk assessment and food safety.

Previously, Dr. Viegas has worked in several industrial companies. Actually: Director and Professor of Environmental Health Degree Program in ESTeSL-IPL and researcher in Centro de Investigação em Saúde Pública (CISP), ENSP,UNL. Since September 2015, Dr. Viegas works also as a co-opted member of the Risk Assessment Committee in European Chemical Agency (ECHA) where she is involved in assessing the risk of a substance arising from the uses of a substance when an application for authorization is submitted.

Dr. Viegas research projects have been supported by government agencies and international organizations. She has authored or co-authored more than 80 scientific publications, including original articles in peer-reviewed journals, books and book chapters, special articles and full proceeding papers. As a consultant and advisor, she has provided her expertise to professional associations, major companies and collaborates with several research groups nationally and internationally.

Teresa Borges

Teresa Borges works at the General-Directorate of Health (DGS, Ministry of Health), Division of Environmental and Occupational Health, Lisbon, since 2002. Graduated in Biology (Lisbon Faculty of Science), Master Degree in Food Science and Technology (Technical University of Lisbon) and Post-Graduation in Epidemiology (Preventive Medicine Institute). Main expertise in human health toxicology and regulatory chemical risk assessment under Biocidal Products (BPR), REACH and CLP. National coordination of the human health toxicological section of the Competent Authority Reports (CAR) for biocidal active substances. Expertise in human health effects assessment with regard to the application of CLP criteria (Reg. EU 1272/2008). Member of JRC Expert Group for Endocrine Disruptors. Grant Holder at the EU JRC, Ispra, Institute of Health and Consumer Protection (IHCP), during 2013-2014, for the hand-over of the biocides review program to the European Chemicals Agency (ECHA). ECHA Memberships: Risk Assessment Committee (RAC) during 2008-2013. Since 2014, Committee of Biocidal Products (BPC) and Nanomaterial WG. DG SANTE: since 2015, member of the Scientific Committee for Health, Environmental and Emerging Risks (SCHEER). Involved in the application process of Portugal to the EJP European Biomonitoring Initiative; contributed to the creation of the Portuguese National Hub. DGS scientific contact point being responsible for providing inputs in terms of chemicals risk assessment.

Teresa Núncio

Teresa Núncio background is Economics and Psychology. She has more than 25 years of experience in public policies and public administration, in the fields of Regional Planning and Development, Environment and Water Resources, and more than 10 years of experience in private activities, both in Corporate Management and Clinic.
Teresa was advisor of Environment Government members between 1992 e 1995 and head of several public administration management departments between 2008 and 2014. Since 2014 is one of the APA Board advisors. She taught in the University of Algarve and Independent and wrote a book and some articles, about Economics and Psychology issues.

Session 1

Human Biomonitoring across Europe: contribution to health and environment policy

Building European knowledge on citizens' exposure to chemicals – the HBM4EU

G. Schoeters

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The European Joint Programme Human Biomonitoring for Europe (HBM4EU) was launched in January 2017. It is a joint effort of 28 countries and the European Commission, co-funded by Horizon 2020 to advance human biomonitoring (HBM) in Europe. It will inform European and national policy makers to take science based decisions for reducing chemical exposure of EU citizens to hazardous compounds. The HBM4EU initiative is unique as it presents a novel collaboration between scientists and chemical risk assessors and risk managers, including several Commission services, EU agencies and national representatives. Policy makers and stakeholders are involved in selecting chemical substances to be studied. New comparable HBM data will be generated in the project through a network of qualified laboratories. A quality assurance programme is being installed to generate comparable human biomonitoring data from biobanked samples or from new surveys and studies that are planned in line with protocols that are generated in HBM4EU. As HBM4EU builds strongly on existing expertise, national programs and regional studies are maximally involved. The aim is to analyse actual exposure to chemicals in 3 age groups recruited from different European regions, to evaluate spatial trends and time trends in exposure and to improve understanding of the impact of diet, life style, environmental and social factors on chemical exposure. New data will be generated but also existing datasets are being identified. Data will be shared and managed through the IPCHEM platform, Europe's Information Platform for Chemical Monitoring respecting data protection legislation and ethics requirements. As for many chemicals the health impact of exposure remains uncertain, HBM4EU will combine health information with the results of human biomonitoring in order to improve understanding of exposure response relationships including the effects of mixtures. Cutting edge technologies will be applied to search for emerging chemicals as an early warning for future concerns. HBM4EU results will feed into risk assessment and HBM4EU partners will establish a dialogue with policy makers to ensure that our results can be used to support the development of policies, to evaluate existing policies and to design measures to reduce exposure to toxic chemicals.

National Hub - Portugal

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The creation of a robust European Human Biomonitoring Platform is one of the main goals of the European Human Biomonitoring Initiative (HBM4EU), which intends to investigate how exposure to chemicals affects the human health. This will be done by establishing a National Hub for Human Biomonitoring in each participating country, on the basis of existing expertise and intending to build new capacities.

The Portuguese National Hub for Human Biomonitoring (NH-PT) is currently composed of the portuguese institutions participating in the HBM4EU project: Fundação para a Ciência e Tecnologia (FCT), I.P., Instituto Nacional de Saúde Dr. Ricardo Jorge, I.P. (INSA), Direção-Geral da Saúde (DGS) and Agência Portuguesa do Ambiente, I.P. (APA), in collaboration with Faculdade de Medicina, Universidade de Lisboa (FMUL) and Escola Superior de Tecnologia da Saúde de Lisboa (ESTeSL), Instituto Politécnico de Lisboa.

Since the beginning of HBM4EU in January 2017, the NH-PT, through its National Hub Contact Point (FCT), has been interacting with the National Hub Coordinator (Department of Health – Public Health England), who oversees the needs and outputs of the National Hubs. In parallel, the NH-PT has been responding to the requests from the HBM4EU Work Package Leaders, hoping to facilitate the collection of relevant national data on human exposure to chemicals.

It is an important objective of the current NH-PT to pave the way for the creation and development of a national platform of human biomonitoring, where it could be ensured the influence of relevant national research institutions, regulators, industry and other Portuguese stakeholders.

The work developed by the National Hub in each country is fundamental for the harmonization of the human biomonitoring initiatives in the participating countries, so that comparable European data on human exposure to chemicals are generated. The knowledge that will be acquired is expected to help in the design of measures to reduce exposure to toxic chemicals.

The role of Adductomics and Metabolomics in Human Biomonitoring

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Exposome studies must explicitly translate how humans respond to environment pressures, including epigenetic changes and mutations, as well as the complex chemistry resulting from the biochemical reactions that sustain our lives. Therefore, a full picture of exposome can only be obtained upon integrated Omics studies.

It is widely accepted the cumulative exposure to chemical agents from environmental, diet and endogenous processes leads to a wide range of deleterious health outcomes, including adverse drug effects, cancer and autoimmune diseases. However, we cannot disregard the fact that bioactivation is a frequent event at the onset of chemically-induced toxicity. Indeed, chemicals are frequently metabolized to reactive (primarily electrophilic) species capable of reacting with biomacromolecules to afford covalent protein and DNA adducts that may elicit direct cell toxicity, trigger an immune response, and/or initiate mutagenicity/carcinogenicity. Additionally, exposome can also interfere with the metabolism of endogenous chemicals, leading to dysregulation of biological processes which thereby can be on the onset of multiple diseases.

A multidisciplinary approach, founded mainly on solid synthetic and analytical skills (adductomics and metabolomics), is currently being used in our research group to address the roles of bioactivation and covalent adducts formation in the onset of chemically-induced toxic events. In fact, adductomics and metabolomics studies constitute an huge opportunity for the development of biomarkers of exposome that are anticipated to have a profound impact on human lives, as effective tools for diseases diagnosis/prognosis.

Maternal and pre-natal exposure to harmful substances in Aveiro region

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Aveiro region presents urban and industrial areas with different potential sources and emissions of contaminants, such as potentially harmful elements (PHEs) and polycyclic aromatic hydrocarbons (PAHs). Therefore, human exposure to different environmental contaminants in this area is likely to occur and needs to be evaluated, particularly in sensitive windows of development such as the prenatal period. In order to assess maternal and pre-natal exposure to contaminants in this region, 50 parturient–newborn pairs from the Aveiro district were studied in collaboration with the Obstetrics and Gynecology Department of Infante D.Pedro Hospital (Centro Hospitalar Baixo Vouga, Aveiro). Several PHEs, in particular mercury (Hg), and 4 PAHs equivalents were quantified in different biological matrices, including parturient hair and blood, placenta and umbilical cord. A questionnaire was filled by parturient in order to investigate the potential influence variables (sociodemographic factors, smoking habits and lifestyle) contributing to maternal and fetal exposure to these contaminants during pregnancy.

Maternal hair presented total Hg levels with a mean value of 900 ng/g, which is lower than the USEPA and WHO acceptable threshold. However, according to the safety limit established by US EPA, 32% of all individuals analyzed were above 1000ng/g and 6% were higher than Hg levels considered acceptable by WHO (2000 ng/g). Furthermore, higher Hg content in placental tissues were found in comparison to previous reports from other European countries.

Higher levels of other PHEs in placenta, such as aluminium, chromium, cadmium and nickel were associated with parturient resident in rural areas of Aveiro district. The element aluminium presented significantly higher levels in parturient from Estarreja county. Relatively to PAHs exposure, increased levels of naphthalene and phenanthrene equivalents in placenta were associated with parturient exposure to vehicle exhaust in their area of residence, while high levels of benzo[a]pyrene equivalents were associated with exposure to tobacco smoke at work.

In general, newborns anthropometry (length, weight, cephalic perimeter) did not appear to be influenced neither by PHEs nor by PAHs levels observed in this study.

This work provided an overview on the exposure to PAHs, Hg and other PHEs and allowed to have a more complete picture of the expossome for the studied population. However, Portugal still has limited information about intrauterine exposure to environmental contaminants. Further research should be conducted in order to prevent fetal exposure to harmful substances and their potential adverse effects on health.

Human Biomonitoring of plasticizers in obese and non-obese Portuguese Children

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Several compounds used in plastic manufacture, to which humans are ubiquitously and continuously exposed, are being linked with adverse health outcomes e.g. obesity. Some phthalate plasticizers (both low and high molecular weight) are being regarded as endocrine disruptors. Consequently, public and scientific concerns regarding phthalates have been raised which has led to increasing use of alternative plasticizers, in particular di-(iso-nonyl)-cyclohexane-1,2-dicarboxylate (DINCH).

According to the available data, children seem to be a population of special concern as urinary metabolite levels are generally higher in children than in adults, although for DINCH data is still scarce.

In this work, a population of 112 Portuguese children (age 4-18 years old), living in North and Central region of the country, was studied for their exposure to phthalates and DINCH[1, 2]. The children were divided in two groups: the regular diet group (n=43) comprised healthy normal weight/underweight children with no dietary control; the healthy diet group (n=69) comprised children diagnosed for obesity/overweight that were set on a healthy diet for weight control.

Several urinary metabolites for phthalates and DINCH were analyzed after enzymatic hydrolysis via on-line HPLC-MS/MS with isotope dilution quantification.

Median concentrations of all phthalates were generally lower in the healthy diet group, except for MEP. Multiple logistic regression analyses revealed significantly lower daily intakes for nearly all phthalates in the healthy diet group compared with the regular diet group. Risk assessments for individual phthalates and the sum of the anti-androgenic phthalates did not indicate reason for concern. Additionally, DINCH metabolites were detected in all analyzed samples. The higher urinary median concentrations were observed for OH-MINCH, followed by oxo-MINCH and for cx-MINCH. No significant differences were detected between the two child-groups.

In conclusion, the results indicate that obese/overweight children following a healthy diet composed of fresh food and less packaged/processed food can considerably reduce their intake for most phthalates and DINCH and can consequently have lower intakes than regular weight/regular diet children.

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Session 2

Human Biomonitoring in Health Risk Assessment

Prioritisation Strategy in Human Biomonitoring (HBM4EU)

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The Human Biomonitoring for the European Union (HBM4EU) project will build bridges between the research and policy worlds to deliver enhanced chemical safety by providing a robust interpretation of human biomonitoring data, chemical risk assessment and the possible impact of chemical exposure on human health. This initiative contributes directly to the improvement of health and well-being for all citizens.

It represents a novel collaboration between scientists, chemical risk assessors and risk managers. Running from 2017 to 2021, HBM4EU is a joint effort of 28 countries, the European Environment Agency and the European Commission, co-funded under Horizon 2020.

In developing priorities for the first annual work plan, the consortium implemented an exercise to prioritise substances for action, taking into account both national and EU level policy needs for knowledge on chemical exposure and health outcomes. As a first step, substances for which knowledge is needed to support current EU policy making were identified through close dialogue with an EU Policy Board. Input from the national level was fed in through a Steering Committee and established to guide the preparation of this proposal.

An initial set of criteria was produced, including if a substance is of concern to human health, whether there is evidence of human and/or environmental exposure at EU level and whether there are open policy questions.

This first prioritisation exercise resulted in the nine substance groupings that will be the focus of HBM4EU activities in 2017 and 2018. The list includes: phthalates and Hexamoll® DINCH, bisphenols, per-/polyfluorinated compounds, flame retardants, cadmium and chromium VI, PAHs, aniline family, chemical mixtures, and emerging substances.

Information was compiled on substance classification, policy-related research questions and research objectives, with the results captured in scoping documents for the prioritised substances. These scoping documents formed the basis for the development of activities for inclusion in the 2017 action plan for the HBM4EU.

Two additional rounds of prioritisation will be conducted during the five years of the project, one from 2017 to 2018 and one from 2019 to 2020.

HBM4EU partners will effectively communicate results to policy makers, ensuring their exploitation in the design of new chemicals policies and the evaluation of existing measures. Data used and produced under HBM4EU will be made accessible via IPCHEM – the Information Platform for Chemical Monitoring. IPCHEM is the European Commission's reference access point for searching, accessing and retrieving chemical occurrence data collected and managed in Europe.

This collaborative approach ensures that our research will generate new knowledge that addresses genuine societal concerns.

Human Biomonitoring and Risk Assessment of chemical Mixtures

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One of the main objectives of the HBM4EU Work Package on Mixtures is to develop summary indicators to describe the exposure and body burden of chemical mixtures, with an emphasis on defining priority mixtures and identifying the drivers of mixture toxicity. To this end, we will re-evaluate existing HBM data on mixtures, as well as collecting new human biomonitoring data on mixtures, with the aim of identifying real-life exposure patterns to mixtures.

Practical approaches to identify and assess the potential health risks and impacts of mixtures will be further developed and applied. The work in this WP is broken down in three tasks:

15.1 Re-analysis of existing HBM data on mixtures from earlier HBM studies using a key set of summary indicators

15.2 Joint survey on HBM mixtures in 3-5 countries, using pesticides mixtures as example

15.3 Identification of mixture health effects ; case studies

Many previous HBM studies and programmes have collected multiple chemicals (or metabolites thereof) in the same individuals. Typically, the results are reported as distribution of chemicals or families of chemicals (e.g. phthalates). Rarely the correlation structure among HBM values within the same individuals are analysed and reported. In 15.1, we collect existing HBM data to study co-existence of chemicals, as a step to assess the actual exposures and body burdens to mixtures.

In 15.2 a joint survey on HBM of pesticides in 3-5 countries is in the preparatory phases. Pesticides are chosen for several reasons: 1) EFSA's Cumulative Assessment Group approach on pesticides as conceptual model to address mixture effects; 2) the lack of HBM pesticide mixture data in potentially high exposed populations; and 3) societal questions about and political interests in the risks of repeated and combined exposures to a series of pesticides through local applications and diet.

In 15.3, we develop case studies to better assess the health effects of mixtures. Different approaches will be tested in three different case studies. In the days, preceding the Portuguese National Hub meeting, the development of these cases studies will be discussed in a workshop hosted at INSA. Results will be presented at this National Hub meeting.

Human Biomonitoring and Public Health

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Session 3

Human exposure and health effects

The quest for biomarkers of effect in Human Biomonitoring studies

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Biomarkers can be defined as indicators of measurable changes at the molecular, biochemical, cellular, physiological, pathological, or behavioral levels in response to xenobiotics, and have been classified as biomarkers of exposure, effect, and susceptibility. The purpose of Human BioMonitoring is to document the extent and impact of exposure of humans to xenobiotics. BioMonitoring aims to assess this exposure by detecting and quantifying the amounts of the substances or their metabolites in biological fluids or tissues such as blood or urine. The assessment of levels of exposure of human populations is a sine qua none condition to evaluate risk of adverse effects. In the last years, technological advances have substantially reduced the limit of detection of xenobiotics and metabolites in biological samples. Also, omics technologies are increasingly being used to assess adverse responses, underlying toxicity mechanisms, and key toxicity pathways that have the potential to be used in risk assessment. However, the detection of ever lower levels of xenobiotics does not necessarily imply adverse effects. Moreover, different exposure levels can elicit different responses, some of which may be toxic while others may be adaptive. Thus, it is essential to develop and validate biomarkers that reflect specific exposures or are quantitatively linked to adverse outcomes in humans to enable their use in risk prediction.

Biomarkers of effect, defined as measurable biochemical, physiologic, behavioral, or other alterations in an organism that, depending on the magnitude, can be recognized as associated with an established or possible health impairment or disease, are thus essential, in parallel to biomarkers of exposure, to assess risk of adverse outcomes. Nevertheless, given their pre-clinical nature, the validation of biomarkers of effect is hampered by the lack robust data of their clinical effects. In particular recently assessed omics outcomes, e.g. alterations in gene expression of methylation, may reflect nonspecific responses or overlapping/interacting molecular processes. Furthermore, inter-individual responses to exposure may vary to such a degree as to limit the usefulness of these biomarkers; conversely they can be used to identify sensitive populations. Finally, greater emphasis should also be placed on the evaluation of risk from cumulative exposure scenarios and also prolonged exposure to xenobiotics.

The aim of this presentation is to discuss these issues and underline the need for biomarkers of effect in parallel to biomarkers of exposure and susceptibility in order to attain a more robust risk assessment.

Health Examination Surveys and Human Biomonitoring – the added value of combined studies

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Health Examination Surveys (HES) are health surveys where information collected by questionnaire is complemented with information obtained through physical measurements, such as blood pressure and anthropometric measurements, and through clinical analysis of biological samples. Between 2000 and 2017, 15 European countries have conducted a national HES and in many countries smaller, regional or disease specific surveys have been carried out. Portugal is one of the countries that has recently conducted a first National Health Examination Survey (INSEF), which collected interview and anthropometric data and blood samples in a nationally representative sample of 4911 individuals aged between 25 and 74 years old.

Human Biomonitoring (HBM) is a scientific approach used to assess individual human exposure to environmental chemicals by measuring substances, their metabolites or reaction products in biological specimens. Many countries have established HBM programs to monitor the chemical exposures of their populations.

HES and HBM studies are very similar in terms of the infrastructure and procedures necessary for their implementation, as in either type of studies data is collected through fieldwork, which constitutes one of the largest expenditures for such studies. Combined studies could then result in more cost-effective ways to conduct health and environmental monitoring.

Some countries, like the USA, Canada, Germany, Belgium and France have already recognized the potential to combine these two types of studies and have successfully implemented surveys with both components. However, in practice, the opportunity for adding an HBM module to a health study and vice versa is rarely used. Reasons for this may be multifarious and may differ from country to country, and between different study settings.

Within the HBM4EU project the advantages and obstacles of combined studies are being evaluated and feasibility studies will be conducted in order to identify practical/logistic, financial and scientific benefits and short comings.

Contribution of preschool indoor air to children total exposure to polycyclic aromatic hydrocarbons

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Children are a sensitive group because their cardio-respiratory and immune systems are not fully developed [1]. Since children spend a significant period of their time at schools, there is interest in characterizing these microenvironments. Children exposure to polycyclic aromatic hydrocarbons (PAHs) occurs through inhalation, ingestion, and dermal routes, reason why biomonitoring has a crucial role. In this work, preschool children environmental exposure to PAHs was characterized and the impact of indoor air to levels of urinary monohydroxyl PAH metabolites was also evaluated.

Eighteen PAHs were monitored in the gas and total suspended particulate matter (TSM) phases of indoor and outdoor air of two preschools during 50 days; simultaneously six PAH biomarkers of exposure [1-hydroxylnaphthalene (1OHNap), 1-hydroxylacenaphthene (1OHAce), 2-hydroxylfluorene (2OHFLu), 1-hydroxylphenanthrene (1OHPhe), 1-hydroxylpyrene (1OHP), and 3-hydroxybenzo[a]pyrene (3OHB[a]P)] were determined in urine samples of selected children [2].

Levels of total PAHs (∑PAHs) in the total indoor air (gas and TSM) of preschools were higher than the concentrations observed in the outdoor school's yard (34.4 versus 31.1 ng/m3 and 16.3 versus 4.80 ng/m3). Gaseous and TSM-bound PAHs accounted with 93-95% and 5-7% of ∑PAHs in total indoor air, respectively. Carcinogenic (possible/probable) PAHs represented 26-45% of ∑PAHs, being naphthalene and dibenz(a,h)anthracene the compounds that contributed the most. All biomarkers were detected in more than 82% of urine samples, except 3OHB[a]P which was not detected. Airborne PAHs at both preschools and children urinary biomarkers presented a similar distribution. Urinary 1OHNap + 1OHAce accounted with more than 78% of total PAH biomarkers (∑OHPAHs), followed by 2OHFlu, 1OHPy, and 1OHPhen. Moderate to strong correlations were found between the urinary levels of ∑OHPAHs and the concentrations of ∑PAHs in the total indoor air of preschools. Therefore, preschool indoor air strongly contributed to children total exposure to PAHs.

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Are Portuguese population exposed to Zearalenone? A HBM study as a contribution to the risk assessment of an endocrine disruptor

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Zearalenone (ZEN) is a mycotoxin that occurs widely in food commodities with particular incidence in cereals. Due to chemical structures similar to the endogenous oestrogen 17-β-estradiol, ZEN and its metabolites exert estrogenic toxicity. Therefore, it is crucial to assess ZEN exposure among the population and biomarker-driven research is a promising method to assess the human exposure. For this reason, ZEN metabolites such as α-zearalenol (α-ZEL), β-zearalenol (β-ZEL), α-zearalenal (α-ZAL), β-zearalenal (β-ZAL), zearalanone (ZAN) (phase I) and the glucuronides ZEN14GlcA, α-ZEL14GlcA and β-ZEL14Glc (phase II) were identified in biological fluids. With a potency factor of 60 relative to ZEN, α-ZEL is the most relevant metabolite in terms of human health. ZEN is characterized by a fast metabolism and excretion, therefore urine is the matrix commonly used to assess the exposure to this mycotoxin and its metabolites. To date, in Portugal, there is a lack of human studies to assess biomarkers of exposure to ZEN.

Within the Scope of National Food, Nutrition, and Physical Activity Survey of the Portuguese General Population (2015-2016), 24h-urine samples and non-consecutive dietary assessments (two 24-hour recalls, 8-15 days apart) from 94 participants were included in the present study. Following a salt-assisted matrix extraction, urine samples were analyzed using LC-MS/MS for the simultaneous determination of ZEN, α-ZEL, β-ZEL, α-ZAL, β-ZAL, ZAN and ZEN14GlcA. ZEN and ZEN-14-GlcA were detected in 52% (36/69) and 14% (10/69) of the analyzed samples, with a mean concentration of 1.2 and 6.9 µg/L, respectively. The metabolites α-ZEL, β-ZEL, α-ZAL, β-ZAL, ZAN were not detected in the urine samples. Considering the 24h-urinary volume, the mean dietary excretion of ZEN and ZEN-14-GlcA was 1.5 and 7.8 µg/day, respectively. These data will allow the determination of Probably Daily Intake of zearalenone with more accuracy since it reflects the internal exposure of participants.

The present biomonitoring study generates reliable data regarding the exposure of the Portuguese population to ZEN. These data are crucial to perform a more realistic risk assessment, contributing to the knowledge of determinants of this exposure.

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Poster communications

P1 - Human Biomonitoring for Europe (HBM4EU): the role of Escola Superior de Tecnologia da Saúde de Lisboa (ESTESL-IPL)

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Background: ESTeSL is a public higher education institution with the mission to prepare highly qualified health care professionals to intervene in health care and public health services. ESTeSL is a linked third party of INSA. Since 2006, ESTeSL has developed relevant studies in Occupational Health using human biomonitoring to assess exposure to chemical agents and to identify health effects related with exposure to carcinogenic agents in the workplaces. In particular cases, HBM was also used to better understand the different biologic responses to the same environmental exposure by the use of susceptibility biomarkers. Additionally, the use of biomarkers in specific occupational settings allowed the recognition of chemical agents as significant occupational risk factors, even when only known as food contaminants. Methods: ESTeSL is involved in WP 5 and 8 (Task 5.3 - Inclusion of HBM data in risk assessment/health impact assessment strategies and Task 8.4 - Targeted occupational studies with EU added value) with the following aims: provide an updated strategy for occupational risk assessment, gather data on work-related exposures in critical occupations using harmonized methods and questionnaires. The data will be used to estimate the exposure, risks, and evaluate and identify good practices to control the exposure. In the scope of Task 8.4, a first study intending to study occupational exposure to Cr(VI) will be developed, and ESTeSL will participate actively. This specific study has as main objectives the following: to support recent regulatory measures (REACH and CMD) related to occupational exposure; to create representative EU-wide data on the occupational exposure to Cr(VI) in Europe; to give a more accurate picture on Cr(VI) exposure by using specific biomarkers for Cr(VI) exposure, Cr-Red Blood Cells (RBC) and Cr-Exhaled Breath Condensate (EBC), and to provide recommendations on the use of different biomarkers for the assessment of occupational exposure to Cr(VI). Conclusions: ESTeSL participation, besides the contribution for a better understanding of which chemicals we are exposed to in our work and daily lives, will allow to access to new networks and alliances, share expertise and access to equipment, data and facilities in different countries.

P2 - The relevance of effect biomarkers in human biomonitoring

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A fundamental goal of environmental/occupational health policy is to reduce and, whenever possible, prevent human exposure to chemical substances that may lead to mobility or mortality. Human biomonitoring (HBM) allows the assessment of the levels of certain substances in the body, through the analysis of biomarkers of exposure (chemical substances, metabolites) and it has been considered as an extremely important tool in public health. A great strength of HBM is that it provides unambiguous indication that both exposure and absorption have occurred. On the other hand, measuring uniquely exposure biomarkers does not provide information on preclinical effects that may allow establishing a link between exposure and health effects.

This work aims summarizing the most used biomarkers of effect and give evidence of the importance of these biomarkers in HBM and public health protection, based on recently published data. Briefly, these biomarkers consist of biochemical alterations in urine or blood, endocrine changes, cytogenetic alterations [micronuclei, chromosomal aberrations, translocations, sister chromatid exchanges and DNA repair] or interactions with macromolecules such as DNA, RNA and proteins through the recent –omics technologies.

The inclusion of biomarkers of effect in HBM studies contributes to bridge the gap between exposure and health effects, because they give information on early biological alterations before the onset of disease. Given that these biomarkers reflect reversible alterations in the organism, the effects detected are likely to be prevented, if exposure to the critical substance (or mixture of substances) is reduced or ceased. Thus, the joint information gathered from biomarkers of exposure and effect in HBM can be used to improve health risk assessment and reinforce the scientific basis to implement preventive policies in occupational and environmental settings.

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P3 - Sensitivity of two biomarkers for biomonitoring exposure to fluoride in children and women: A study in a volcanic area

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Background: The natural enrichment of water with fluoride is related to natural sources such as volcanic activity, with it being documented that fluorosis, an endemic and widespread disease in volcanic areas, is associated to the ingestion of high levels of fluoride through water.

Objective: This study aimed to define the fluoride concentration in drinking waters of volcanic origin and compare the sensitivity of urine and nail clippings as biomarkers for fluoride exposure in adults and children.

Methods: Samples of drinking water from four villages in Sao Miguel Island (Azores) were used and the fluoride concentration was determined, as well the fluoride content in urine and toenails clippings from 66 children and 63 adults from these villages. A validated diet questionnaire, assessing sources of fluoride, was recorded for each participant. The fluoride determination in urine and nail clipping samples was made using a fluoride-specific electrode.

Results: A positive correlation was found between the fluoride daily intake and fluoride content in children urine (rs ¼ 0.475; p< 0.001) and in their nail clippings (rs ¼ 0.475; p< 0.001), while in adult women, the fluoride daily intake correlated positively with fluoride content nail clippings (rs ¼ 0.495, p< 0.001).

Conclusions: The study revealed that nail clippings are more reliable as biomarkers of chronic exposure to fluoride than urine for populations of different ages (children vs. adults). Furthermore, nail clippings are more suitable than urine fluoride levels to assess long-term exposure to fluoride in areas where the exposure to fluoride in drinking water is within, or slightly above, the recommended legal values.

P4 - Use of biomarkers in occupational exposure - Experience of Escola Superior de Tecnologia da Saúde de Lisboa (ESTeSL)

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Biological monitoring of workers has as main goals the individual or collective exposure assessment, health protection, and occupational health risk assessment. It consists of standardized protocols aiming to the periodic detection of early biological signs which are indicative, if compared with adequate reference values, of an actual or potential condition of exposure, effect or susceptibility, possibly resulting in health damage or disease. These signs are referred to as biomarkers. ESTeSL has developed several studies in occupational settings using biomarkers to assess workers exposure to specific substances and also to identify genotoxic effects linked with occupational exposures to genotoxic substances. Biomarkers of exposure have been use in the case of occupational exposures to mycotoxins. Occupational exposure to mycotoxins is characterized by being multi and simultaneous to several mycotoxins and this implies the use of a multibiomarker approach which can demonstrate that workers are exposed simultaneously to several mycotoxins resulting from different contexts and exposure routes.

Regarding biomarkers of effect, it was applied two genotoxicity biomarkers in two case-control studies in two different occupational settings – formaldehyde exposure in anatomy and pathology laboratories and cytostatics exposure in hospitals during preparation and administration of these drugs. The biomarkers of effect used were the cytokinesis-block micronucleus assay (micronuclei, nucleoplasmic bridges and nuclear buds) and the comet assay. It is important to note that these cytogenetic and cytological biomarkers of chromosome damage can detect the genotoxic effects via a multitude of mechanisms and therefore tend to have the advantage of being very sensitive and capable of integrating the effects of multiple interactions and molecular genotoxic events on genome stability. The comet assay identifies injuries which are still reparable, such as single and double-strand DNA breaks, providing information about recent exposures. The use of enzymes, which recognizes and cuts specifically oxidized DNA bases allows for the evaluation of oxidative DNA damage. It is one of the most used methods in biomonitoring studies of genotoxicity on blood lymphocytes, and is widely used to evaluate the genotoxic effects of exposure to specific antineoplastic drugs in several in vitro and in vivo studies. Both studies, suggested an increase of genotoxicity biomarkers in the exposed groups in comparison with the respective control groups. It is important in human biomonitoring to take in account all the possible confounding factors such as age, gender, tobacco and alcohol consumption, and diet since they may modify the levels of DNA damage, thus modifying individual cancer risk.

P5 - Micronuclei in oral epithelial cells as sensitive and non-invasive biomarkers of occupational exposure to low doses of ionizing radiation

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Background: Ionizing radiations are well-recognized mutagens and carcinogens. The evaluation of cytogenetic damage resulting from exposure to ionizing radiation in humans has been widely performed in peripheral blood lymphocytes.

Objective: We evaluated the association of exposure to ionizing radiation with biomarkers of early genotoxic damage in oral epithelial cells of medical personnel, to assess the biomarkers value as non-invasive and sensitive biological dosimeters.

Methods: The frequency of micronucleated cells (MNC) and of cells with other nuclear anomalies (ONA; pyknosis, karyolysis, and karyorrhexis) were evaluated in oral epithelia collected from 42 medical professionals occupationally exposed to ionizing radiations and 39 non-exposed individuals by the micronucleus assay. Association between MNC (or ONA) and occupational exposure to ionizing radiations were estimated by negative binomial regression.

Results: The frequencies of MNC and ONA per 2000 cells were significantly higher in the exposed group (5.26 and 146.62, respectively), than in the non-exposed group (1.33 and 88.46, respectively). Significant correlations were observed between MNC or ONA and the Annual Surface Dose, showing that exposure to ionizing radiation is a risk factor for DNA damage. Occupational exposure to low doses of ionizing radiations was associated with an 80% relative increase in the frequency of MNC (RR= 1.8; 95% CI: 1.1, 2.8) and of ONA (RR= 1.8; 95% CI: 1.1, 2.8).

Conclusions: Occupational exposure to low doses of ionizing radiation resulted in an elevated risk for genotoxic damage. Since micronuclei in oral epithelial cells revealed to be a sensitive biomarker, the use of this non-invasive method is recommended for biomonitoring workers occupationally exposed to low doses of ionizing radiation.

Key-words: DNA damage, epithelial cells, ionizing radiation, micronuclei, genotoxicity, occupational exposure.

P6 - Firefighters' biomonitoring: impact of fire combat on levels of urinary monohydroxyl metabolites of polycyclic aromatic hydrocarbons

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Firefighters, one of the most hazardous occupations, are regularly exposed to complex mixtures of pollutants during fire combat. Polycyclic aromatic hydrocarbons (PAHs) are distributed between the gaseous and particulate phases of air: they are one of the most health-relevant pollutants released during fires because of their genotoxic, mutagenic, and carcinogenic properties [1]. This work aims to assess the impact of firefighting activities on firefighters' total exposure to PAHs.

Spot urine samples were collected in healthy and non-smoking firefighters before and after fire combat activities. Six urinary PAH metabolites (1-hydroxynaphthalene (1OHNaph), 1-hydroxyacenaphthene (1OHAce), 2-hydroxyfluorene (2OHFlu), 1-hydroxyphenanthrene (1OHPhen), 1-hydroxypyrene (1OHPy), and 3-hydroxybenzo[a]pyrene (3OHB[a]P)) were quantified by liquid chromatography with fluorescence detection [2-3].

Urinary 1OHNaph and 1OHAce were the predominant biomarkers of exposure in both non-exposed and exposed firefighters, accounting with 63-98% of total levels of PAH biomarkers (∑OH-PAHs). 2OHFlu, 1OHPhe, and 1OHPy contributed with 1-17%, 1-13%, and 0.3-10% of ∑OH-PAHs, respectively. The PAH biomarker of carcinogenicity (3OHB[a]P) was not detected. Overall exposed firefighters presented levels of ∑OH-PAHs that were 2-35% higher than for non-exposed subjects. Urinary 2OHFlu seems to be the compound with the most pronounced increments in exposed firefighters. Urinary 1OHPy levels were always lower than the benchmark of 0.5 µmol/mol creatinine proposed by the American Conference of Governmental Industrial Hygienists. More studies assessing PAH biomarkers of exposure but also biomarkers of effect and susceptibility are needed to evaluate the impact of fire emissions on the health of firefighters.

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P7 - Human Biomonitoring of Phthalates in obese and non-obese Portuguese Children

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Phthalates are dialkyl or alkyl esters of the ortho-benzene dicarboxylic acid (phthalic acid). These compounds are not chemically bound to the polymer, so are constantly released. The dietary source is considered the main source of population exposure to high molecular weight (HMW) phthalates. For low-molecular weight (LMW) phthalates other lifestyle-dependent exposure pathways seem to be more relevant. As a result, the general population is widely and continuously exposed to phthalates. Some phthalates, such as DnBP, DiBP, BBzP, DEHP and DiNP are developmental and reproductive toxicants.

In this study [1] we analyzed one of the most comprehensive sets of 21 urinary phthalate metabolites representing exposure to 11 parent phthalates (DEP, DMP, DiBP, DnBP, BBzP, DEHP, DiNP, DiDP, DCHP, DnPeP, DnOP) in first morning urine samples of 112 Portuguese children (4–18 years) sampled in 2014/15. The study population consisted of two groups: group 1 with normal weight/underweight children (N = 43) following their regular diet and group 2 with obese/overweight children (N = 69) following a healthy diet (with nutritional counselling).

Most of the metabolites were above the limits quantification (81–100%) except for MCHP, MnPEP and MnOP. Compared to Portuguese children sampled in 2011/2012 [2], median urinary metabolite levels decreased by approximately 50% for DEHP, DnBP, DiBP and BBzP. In the healthy diet group the median concentration of the DEHP metabolites was significant lower, while all phthalate metabolites except MEP tended to be lower compared to the regular diet group. Multiple log-linear regression analyses revealed significantly lower daily intakes for all phthalates in the healthy diet group compared to the regular diet group.

The results indicate that obese children but following a healthy diet composed of fresh and less packaged/processed food can considerably reduce their intake for most phthalates and can have lower phthalate intakes than regular weight/regular diet children.

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P8 - Biomonitoring of arsenic, cadmium and lead in urine of school-aged children from the Portuguese region of Tâmega

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Human biomonitoring (HBM) is defined broadly as the measurement of biomarkers in human biological fluids or tissues. HBM measures the internal dose of a chemical resulting from integrated exposures from all exposure routes. It has been used increasingly as a tool for quantifying human exposure to chemicals in order to inform public health, risk assessment, and risk management decisions. Exposure to environmental pollutants occurs through different routes, such as inhalation, ingestion, and dermal absorption. Thus, the body burden of a specific pollutant is determined by several factors, such as the pollutants concentration, their physical and chemical properties and time of exposure, as well as individual factors, such as uptake, metabolism and excretion rates. The present biomonitoring study was conducted to assess children´s exposure to arsenic (As), cadmium (Cd) and lead (Pb) through urine analysis from a representative sample (n=525). This is a cross-sectional study of a random representative sample of children (6-12 years) from one NUTS III region of northern Portugal (Tâmega). We have used a multi-stage complex sampling method, with clusters in three levels (county, group of schools and classes). The urine levels of As, Cd and Pb were measured by inductively coupled plasma-mass spectrometry (ICP-MS) according to the CDC method 3018.3. This is the first study simultaneously analyzing those three elements in urine from Portuguese children. The median levels (µg/L) were 0.14 for Cd, 0.47 for Pb and 29.11 for As. In general, the urinary concentrations of these toxic metals were below international reference limits (<2 µg/L for Cd, <4 µg/L for Pb and <35 µg/L for As), however concentrations of As were higher than 35 µg/L in 35% of children. These preliminary results reinforce the relevance for more detailed toxicological studies in school-aged children.

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P9 - Development of a screening methodology for detection of venlafaxine, fluoxetine and trazodone in hair

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The ingestion of licit drugs such as alcohol, tobacco and pharmaceuticals has been rising in Portugal. This trend seems to be related to the period of economic crisis and the increase of unemployment that the country experienced, originating an exponential growth in the number of pharmaceutical prescriptions for depression, anxiety and other mental disorders.

Routine clinical exams for the detection of toxic or illicit drugs are usually carried out using blood and urine samples. However, even though they are easy to obtain, blood collection follows invasive procedures while urine has a high risk of adulteration. Moreover, both matrices have a detection window of only a few days for analysis and do not allow distinguishing acute from chronic drug use.

Hair is an alternative biological matrix for toxicological analysis that can also provide a retrospective history of an individual's drug use. This means that, if a urine specimen is positive for the presence of drugs, hair analysis can discriminate between a single exposure and long-term use. These properties are particularly important in different situations including doping control in athletes, driving license renewal, drug-facilitated crimes, postmortem investigations and/or forensic analysis and therapeutic monitoring.

The patient's health belief that depression is not a condition needing drug treatment, the lack of knowledge about antidepressants and the fear of side effects during treatment originate frequently poor compliance towards prescribed medication.

In this context, a screening methodology for detection of antidepressants (venlafaxine, fluoxetine and trazodone) in hair was developed based on solid-liquid extraction followed by high performance liquid chromatography with fluorescence detection (HPLC-FLD) or ultra-performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). Considering the goals of the study, namely the use of hair analysis for therapeutic monitoring, patients under psychiatric treatments with antidepressants were selected to supply hair samples.

The developed procedure is particularly interesting for routine therapeutic monitoring as it uses relatively inexpensive analytical methodology, simple, sensitive and selective to detect the presence of antidepressants in the patients' hair. Segmental hair analysis can provide a more accurate record of drug consumption and be used to indicate the history and frequency of drug intake.

P10 - RESPIRA Project: Understanding the role of environmental contaminants in respiratory diseases

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In the last century, there was a shift from an outdoor to an indoor lifestyle and presently we spend 80-90% of our lives inside buildings. This artificial habitat has unique features (e.g. insulation, humidity) that promote the accumulation of not only biological agents (e.g. bacteria, fungi) but also chemical contaminants; therefore, it is a prime interface between such agents and humans. However, humans are not evolutionary prepared to deal with such an artificial habitat and scientific evidence suggests that the increasing incidence of Non Communicable Diseases (NCDs) in western societies may be a consequence of the ubiquitous exposure to environmental contaminants. Respiratory diseases are a paradigmatic case study, as they are deeply responsive to environmental contaminants. Furthermore, the economic burden of respiratory diseases is overwhelming, exceeding 380 billion € in Europe, with asthma and chronic obstructive pulmonary disease (COPD) representing the greatest portion with over 200 billion €. The study of indoor environmental quality as well as the development and progression of chronic respiratory diseases have received a great deal of attention in the past few years. However, most of those surveys focus on single contaminants exposure. RESPIRA project aims to contribute towards a better understanding of the role of multiple stressors in respiratory diseases by providing a multidisciplinary approach to the environmental determinants of health. We will evaluate indoor contamination by metals and organometals in the domestic environment of patients with COPD and matched controls by analysing the levels of the selected contaminants in house dust samples and corresponding human samples. Furthermore, the microbial indoor community will also be evaluated in air and dust samples from those houses. This case control study is being developed in collaboration with the pulmonology department of Estarreja public hospital and will characterize 50 patients and 50 matched controls. The goal of RESPIRA project is to unravel possible associations between the indoor contaminants and the exacerbations symptoms in patients with respiratory diseases. Guidelines regarding the minimization of exposure can then be proposed to reduce the number/severity of exacerbations and prevent new cases, which ultimately will be translated into better respiratory health status of patients with chronic respiratory disease and of the general populations. In this presentation, the project rationale and the study protocol will be described, and the ongoing work will be explained.

P11 - Mercapturates of cysteine-S-disulfides in kidney dysfunction in HIV-infection

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Background: Chronic kidney disease (CKD) is still more prevalent in human immunodeficiency virus (HIV)-infected patients than in general population due to a combination of traditional, HIV-related factors and continuous exposition to antiretrovirals.

Aims: We aimed to evaluate the elimination of mercapturates of endogenous cysteine-S-disulfide conjugates (CysSSX) in urine of patients as markers of cysteine disulfide stress in renal tubule.

Material and Methods: A 1-year prospective nested case-control analysis was performed in a cohort of 105 HIV-infected patients. Urine samples were collected at admission (T0) and at 12 months of follow-up (T12). Estimated glomerular filtration rate (eGFR) was calculated by CKD EPI equation, using serum creatinine, expressed in mL/min/1.73m2. Patients were stratified according to their eGFR baseline values: normal control (NC)≥90, early kidney dysfunction (EKD) 60≤eGFR<90 and CKD<60; and eGFR evolution: non-progression (NP) with stable eGFR during the entire study; progression (P) with decreasing kidney function≥10% from baseline (T0). Urinary N-acetyl-cysteine (uNAC) moiety of mercapturates of CysSSX were quantified by HPLC-FD.

Results: The majority of HIV-infected patients included were men (68%), Caucasian (75%) and were on tenofovir (TDF)-containing combined antiretroviral therapy at T0 (63%). Patients were aged 50 [44-58] years old and the median eGFR was 88 [76-98] at T0 and 81 [67-90] at T12 (p=0.007). Regarding eGFR T0-based stratification, a total of 49 patients were NC, 46 were EKD and 10 were CKD. Additionally, 52% of patients were P. uNAC was lower in P vs. NP, particularly for EKD (p<0.05) and CKD (p<0.001) patients (Two-way ANOVA). Among NP group, CKD patients had the highest increase in uNAC (149±18% of T0, p=0.018). Among NC-NP patients, TDF containing cART had no influence on uNAC while NVP had a negative influence (Mann Whitney U-test, p=0.042).

Conclusions: Decreased uNAC was associated with kidney disease progression, independently of baseline eGFR values. These results suggest the participation of endogenous cysteine-S-disulfides conjugates in the pathophysiological mechanism of kidney dysfunction. uNAC might represent a novel marker of kidney disease progression in this population. Moreover, biomonitoring of urinary mercapturates of cysteine-S-disulfides might be a tool for risk assessment of exposure-related kidney disease.

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P12 - The Harmful effects of plastics in Human Health

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Plastics have brought huge social benefits. However the influx of complex materials and additives during the manufacturing process represents several perils, and great concern about toxic impacts to human health.

Continuous daily interaction allows exposure to chemical components, known as plasticizers inducing endocrine disruption, carcinogenesis, Neurobehavioral effects in infants that are threatening our fertility, intelligence and survival.

Also the presence and effects of plastic debris, Micro and Nano-plastics could potentially induce physical damages through the particles itself, or leaching additives. To understand the impacts on human health, it's crucial to biomonitoring populations, and study the fate of plastic particles in human bodies.

Mirpuri Foundation is creating awareness with a worldwide campaign, of the potential hazard to plastics exposure contamination and human health. As the principal sustainability partner of Volvo Ocean Race a Portuguese boat is carrying the message of "Turn the Tide on Plastic". MF has been present with medical presentation in all Ocean Summits in Alicante, Cape-Town, Auckland, Hong-Kong and more to come.

We have seen lots of progresses and involvement to our movement of all local authorities with signing pledges to turn-off the plastic tap and achieve our final goal.

However further actions are needed as education for health, development for extracting plastics from biological material, evaluation of current data to identify the knowledge gaps and future research priorities.

P13 - Impact of DINCH® in human cells: evaluation of its potential cytotoxic and genotoxic effects

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The chemical Di-(iso-nonyl)-cyclohexane-1,2-dicarboxylate (DINCH) has been applied as a non-aromatic plasticizer and substitute for other phthalate plasticizers such as di-(2-ethylhexyl) phthalate (DEHP) and di-(iso-nonyl) phthalate (DINP), that have shown to have adverse effects. Since DINCH detected in indoor dust has increased after the market introduction of this plasticizer in 2002, the human exposure is a concern. Health-related guidance values have been derived for children and adults, namely 3 mg/L and 4.5 mg/L of DINCH metabolites in the urine, respectively (Apel et al., 2017). Recently, the exposure of Portuguese children to DINCH was reported, in spite the low levels detected in children's urine, which were below the established health guidance levels (Correia-Sá et al., 2017). Conversely, few studies have addressed the potential toxicity of DINCH but in vivo studies suggest its bioavailability, leading to concerns in respect to systemic exposure or longer term consequences of its use, namely to liver or kidney cells (Beltifa et al., 2018).

To contribute to the hazard characterization of DINCH, its potential cytotoxicity and genotoxicity was investigated in human liver cells, following the exposure of HepG2 cells to a range of concentrations of this chemical agent. The methodology included the MTT assay for cytoxicity determination, the comet assay for the detection of DNA damage and the micronucleus assay for determination of chromosomal damage, based on the OECD TG 487 guideline (2016).

The results showed that concentrations ranging from 1 to 500 µg/mL were neither cytotoxic following 24h exposure of HepG2 cells, nor had impact on DNA or chromosome damage. Underway studies focus on the effects under the presence of exogenous liver metabolic enzymes (S9 fraction) and on the detection of oxidative DNA damage. Further ongoing investigation is addressing the potential nephrotoxic effects of DINCH using kidney cells.

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P14 - HBM? yes! but where to start? optimizing biomonitoring by pinpointing areas of high exposure risk

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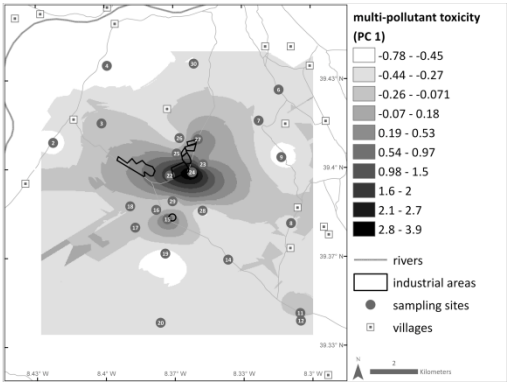
When decision-makers look for potential high risk target populations or background populations to submit to HBM, the best decision is not easy. Particularly if there is a low level of confidence of where in the vicinity of the emission sources the chemicals are more intensely deposited, where are the areas not affected (background or controls) and what to do if instead of one there is a mixture of pollutants. Atmosphere is a major pathway for transport and deposition of pollutants in the environment. In industrial areas, organic compounds are released or formed as by-products, such as polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F's). Inorganic chemical elements, including lead and arsenic, are also part of the pollutants mixture, and even in low concentrations may potentially be toxic and carcinogenic.

Pollutant concentrations were measured in the environment, from biomonitors (lichens - organisms that integrate multi-pollutants), enabling interpolation and mapping of contaminant deposition within the study region. Based upon the ability of lichens to concentrate pollutants such as PCDD/F and chemical elements, we developed a semi-quantitative multi-pollutant toxicity exposure index (TEQ-like), derived from risk estimates, in an attempt to correlate several atmospheric pollutants to human exposure levels.



The result was this TEQ-like index that provides a spatial representation, not from absolute accumulation of the different pollutants, but from the accumulation weighted by their relative risk. The assessment of environmental human exposure to multi-pollutants through atmospheric deposition may be applied to industries to improve mitigation processes, or to health-stakeholders to target populations for a comprehensive risk assessment, epidemiological studies and health recommendations.

Serrano et al. 2017. J Toxicol Environ Health A. 80:710–718. DOI: 10.1080/15287394.2017.1286930.

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P15 - Proteomic assessment of occupational secondhand smoke exposure

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Background: Second hand smoke (SHS) exposure has been linked to cancer, respiratory and cardiovascular diseases and diabetes. However, the associated underlying molecular mechanisms remain to be elucidated. The objective of this proteomics study is to uncover putative key molecules involved in these mechanisms that can be used to predict and monitor diseases risks associated with occupational SHS exposure in non-smokers. Methods: In total, 25 Lisbon restaurants were enrolled in this study. Nasal epithelium and urine samples were collected from their employees (n=52) for proteomics analysis and cotinine evaluation of SHS exposure, respectively. The subjects were classified as never smoker (N), former smoker (F) and smoker (S), exposed (NE=11; FE=10; SE=4) or non-exposed (N=11; F=8; S=8) to SHS. All subjects were healthy and showed no significant differences in parameters like age, time in the workplace, tobacco smoking habits and spirometry evaluation of pulmonary function. Urine cotinine levels showed significantly elevated in the exposed subjects compared to non-exposed, confirming SHS exposure. Nasal epithelium samples were analyzed by mass spectrometer. The generated MS raw data was submitted to “PatternLab for Proteomics” and the differentially expressed proteins analysed by the ‘Database for Annotation, Visualization and Integrated Discovery” (DAVID) and “Reactome Pathway Database” bioinformatics platforms. Results: In NE subjects, the Folding of actin by CCT/TriC was the most enriched pathway by the proteins identified differently expressed in this group as associated with SHS exposure. CCT chaperonins activity is essential for assembly BBSome, a complex protein involved in cilia biogenesis. Knockdown of CCT results in Bardet-Biedl syndrome, a ciliopathy with severe consequences. The CCT/TriC associated TCP1 protein was found 12 fold increased in NE compared to N. In FE subjects, the number of enriched pathways was larger including Microtubule-dependent trafficking of connexons from Golgi to the plasma membrane, Post-chaperonin tubulin folding pathway and RHO GTPases activate. Low abundance of several tubulins ($\bar{x}$= -2.36 fold change) was identified in FE compared to F that may impair microtubule-dependent connexons trafficking to function as gap junctions in cell membrane. Tobacco use disorder” was identified as enriched by SHS-associated proteins detected in both smokers and non-smokers, exposed. Whereas “Diabetes Type II” was the top 1 disease more enriched by proteins differentially expressed in non-smoker exposed, NE and FE. Conclusions: Proteome of nasal epithelia seems to be highly modulated by SHS exposure and further validation studies will be necessary to better understanding the associated mechanisms as risk factors for development of tobacco smoke associated diseases.

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P16 - Biomonitoring of aflatoxin M1 in human breastmilk

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Mycotoxins are secondary metabolites of fungi that have toxic effects on both humans and animals. Aflatoxin M1 (AFM1) which can be transmitted to newborns via breast milk, is a hydrolyzed metabolite of Aflatoxin B1 (AFB1) that is ingested along with contaminated food. AFM1 is classified as “possibly carcinogenic agent for Human” (group 2B IARC). Despite the potential hazard of AFM1 to breastfed babies, there is a lack of studies of exposure evaluation in Europe and a complete absence of reports in Portugal.

The present study aimed to determine the occurrence of AFM1 in maternal milk and the degree of exposure of infants to this toxin. The correlation between the concentration of AFM1 and basic sociodemographic factors and the consumption of certain categories of food was also aimed. Thus 67 milk samples from nursing mothers living in Portugal were collected, between 2015 and 2016, and analyzed using a competitive commercial ELISA kit, in order to determine the presence of AFM1.

Twenty-two samples (32.8%) contained levels of AFM1 above the detection limit (5 ng/L), ranging between 5.1 and 10.6 ng/L (7.4 ± 1.9 ng/L). In the observed exposure pattern, AFM1-positive milk samples were associated with summer collection, lower mother's educational level, early lactation phase and the maternal consumption of rice and chocolate. No other studied determinants, whether sociodemographic (age, weight, height, number of children, characteristics of breastfeeding, the infants' weight) or dietary (frequency of food consumption) showed a significant statistical influence. Assessment of AFM1 estimated daily intake (EDI) revealed a higher exposure of younger babies (<7 kg; EDI 1.06 ng/kg b.w./day) in relation to older ones (7 kg; 0.86 ng/kg b.w./day), and the proposed value of TDI (0.2 ng/kg b.w.).

Thus the results of this study suggest the need to reinforce surveillance of AFB1 occurrence in food, as a protective and control measure, not only for adults, but ultimately for lactating infants exposed through maternal breast milk. Although AFM1 presents an inferior carcinogenic potency, it is noteworthy that when compared with adults, infants feature a lower capacity of carcinogen biotransformation, a fairly restricted diet and a higher consumption in relation to body weight.

P17 - Mixtures health effects: mycotoxins in food

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In recent years, the risk assessment paradigm has shifted from the single-exposure and single-chemical adverse effect scenario to the one of multiple exposures and combined adverse effects. The present work describes the in vitro combined toxicity of mycotoxins at the renal level, as a case study. Mycotoxins are often present in food and feed, as secondary metabolites of contaminating fungi and human co-exposure mainly occurs though diet. Even though predictions about the toxic effects of mycotoxins mixtures can be based on their individual toxicities, experimental data is still limited to allow a reliable hazard assessment. This study aimed at characterizing the combined cytotoxic and genotoxic effects of ochratoxin A (OTA) and fumonisin B1 (FB1), in a kidney human cell line.

The toxicity of several combinations of OTA and FB1 was compared with their individual toxicities (MTT assay) and interactions were ascertained using the reference models of concentration addition and independent action. A synergistic pattern for combinations of FB1 with the lower doses of OTA was detected, shifting to antagonism at higher dose levels, irrespectively of the reference model applied. Neither OTA nor FB1, individually or in combination, were genotoxic.

In conclusion, this study revealed that, OTA and FB1 exert a synergistic toxic effect at the lowest dose levels, which are the most realistic ones in terms of human co-exposure. This finding emphasizes the relevance of assessing the combined toxicity of mycotoxins to allow the development of qualitative/semi-quantitative or probabilistic models for the hazard assessment of combined human exposure to these food contaminants.

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P18 - H2BioNet– the integrative approach to Human Biomonitoring and Health effects

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Environmental cues can have a direct biological effect, so it is not surprising that the profound environmental changes triggered by man in the last century and its subsequent exposure to ubiquitous chemical pollutants, have been correlated with adverse human health outcomes. With this concern, H2BioNet (Human Biomonitoring and Health Network) presents an integrative and multidisciplinary research approach to this problematic. Resorting to specific and complementary skills and accessibility to relevant infrastructures and necessary equipment it aims to measure human exposure to environmental chemicals, as well as to assess their health effects.

The network focus on three main thematic lines (TLs), i.e. TL1 - environmental chemicals analysis and development of detection methods, with identification and quantification of biomarkers of exposure and/or effect and/or susceptibility (e.g. GC-MS/MS; GC-ECD; LC-MS/MS) and development of new analytical methodologies for the detection of biomarkers in several human matrices (blood, plasma, serum, urine and adipose tissue (AT)); TL2 - evaluation of their biological effects, through the assessment of exposure impact on human health (e.g. general population, obese, diabetic) and/or resorting to experimental and mechanistic approaches (animal and in vitro models) and; TL3 - data management and statistical analysis, namely in study design and sampling in human population. The TLs are strongly aligned with the major priorities defined for Human Biomonitoring research in Europe and designed to maximize the research interactions and complementarities of expertise.

Within our extended work, we assessed the human health risks posed by exposure to persistent organic pollutants [1-4]. We developed new detection methods for AT and plasma that allowed us to begin evaluating the extent of contamination and assess its putative association with metabolic parameters (human, animal and in vitro studies). Our work allowed us to highlight the importance of storage in AT to the development of metabolic dysfunction, reinforcing their recognition as metabolism disrupting chemicals. Overall, the above described methodology provides a highly transversal research approach that enables the evaluation of the human external/internal exposure to chemical pollutants and its effects.

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P19 - The burden of mycotoxin exposure in Portugal – contribution of the human biomonitoring data for a prioritization approach

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Mycotoxins are natural fungal metabolites, whose presence in feed and food crops cannot be completely avoided (Kuiper-Goodman, 1995). Exposure to mycotoxins result in various pathophysiological effects, nevertheless the foremost concern relates to chronic effects at low levels of exposure, and several mycotoxins have been classified by the International Agency for Research in Cancer as human carcinogens or potential human carcinogens. Given the above, there is a stringent need of exposure and risk assessment of mycotoxins.

Even though in Portugal the climatic conditions are favorable to mycotoxigenic mold development, and therefore to a higher mycotoxin production risk, there is a lack of investigations. This stands out as a large fault, for several reasons: the Portuguese diet, in line with the traditional Mediterranean diet, presents a high consumption of cereals. Furthermore, the worldwide occurrence of mycotoxins and the wide range of foods susceptible of being contaminated is important, even more so when considering that not all the foodstuffs consumed in Portugal are produced nationally, and some of the extra-EU imports come from countries with no statutory and actions levels, nor awareness of mycotoxin contamination (Duarte et al., 2010).

Given that, if properly validated, data on human biomonitoring (HBM) provide the ultimate evidence that exposure has taken place (Thuvander, 2001), this work aims to review the data gathered in reported human biomonitoring studies conducted in Portugal, to ascertain and update the risk exposure estimation of the Portuguese population and thus contribute for a prioritization approach.

In the scope of mycotoxins, HBM in Portugal applied analytical methodologies that varied from high performance liquid chromatography coupled with fluorescence (OTA; FBs), or MS/MS (OTA; FBs; Enniatin B) detectors, up to enzymatic immunoassays (ELISA: AFB1, AFM1). HBM has been performed essentially though biomarkers of exposure, whether in urine (ochratoxin A, OTA), blood (OTA; Aflatoxin B1, AFB1; Enniatin B) or breastmilk (aflatoxin M1, AFM1). HBM studies on fumonisins (FBs) selected the most consensual biomarker of effect, the sphinganine-sphingosine ratio (Sa/So ratio).

Although the majority of the published surveys enrolled biological samples representative of the entire population, and proved that exposure is transversal to the entire population, some sampled specific groups and identified major determinants of exposure, namely rural populations, workers in occupational settings (AFB1, Enniatin B and OTA) and pregnant women (AFM1), and consequently breastfed infants. The association of the biological surveys with sociodemographic and/or semi-quantitative food questionnaires, allowed the identification of further determinants.

P20 - A pilot study on lead effects on sperm quality among exposed workers

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Male reproductive health injury associated to lead exposure at both environmental and occupational settings were reported with impact on reproductive hormonal axis, control on spermatogenesis, DNA damage, and oxidative stress1-3. Strong evidences confirm spermatogenesis disruption and poor semen quality on Pb-exposed workers4,5 although some records are inconsistent.

This work reports data from a pilot study conducted in cooperation with Clinical Center of Occupational Medicine of Aveiro, where volunteers male workers exposed to plumbiferous environments from a metallurgical company and its control group were enrolled from September 2006 to June 2007. Collected semen samples were complemented by questionnaire (age, body mass index, medical history, and lifestyle). Evaluation of semen quality (morphology, motility, vitality, hypoosmolarity, concentration, and other semen properties (liquefaction, volume, color, pH, odor and viscosity) was done according to WHO guidelines.

Some changes in motility were observed on sperm from workers exposed to lead compared to the control group. The percentage of spermatozoa with progressive motility decreased significantly ($P < 0.01$) in Pb-exposed workers. In addition, there was a significant increase ($P<0.05$) in the percentage of non-progressive motility spermatozoa, compared to the control.

Morphological sperm anomalies from workers exposed to lead were observed with greater frequency. Although no significant changes in vitality, and concentration were noted in this work, other studies reported on sperm parameters decay by lead6.

In conclusion this pilot study showed that the occupational exposure to lead induced negative impact on sperm motility. Semen analysis is also an important benchmark in addition to the routine matrices (eg. blood, urine, hair). Health promotion and increasing reproductive health literacy in human biomonitoring surveys is relevant in the workplace, requiring a continuous and multiple efforts to protect male fertility.

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