Report 2016 ENRG

Summary of activities in 2016 of the Environmental Neurology ARG

2016 was a successful year for the ENRG.

For the second time the ENRG has organized an international meeting end of the year. Its partners was the Club de Neurologie et Environnement.
This meeting had a large impact as reported in two publications:

International Conference Tackles Air Pollution, Emerging Medical Issues
Posted on January 31, 2017 By Peter Spencer and Jacques Reis
In World Neurology On line

International Meeting on Environment and Health
Air pollution, health and emerging medical issues
Kongress- Highlights in Neurologisch 2017; 1: 67-68

Financial report 2016: Nothing to disclosure

Unhappily, the ENARG has no funds and has never received any funds. That's why local partners are needed for any event.

S. Öztürk, G.Roman, J.Reis and PS Spencer

1ères Rencontres Internationales
Santé & Environnement
1st International Meeting for Environment & Health

Strasbourg 30 Novembre 2016 - 1 décembre 2016

Abstract Book

Air pollution and emerging issues

Impact on the Brain and children

Air pollution is an increasing concern for Humanity. The subject urgently needs more attention by medical scientists and society alike.

Air pollution has long been recognized as a major health threat with multiple impacts, increasing mortality and morbidity. Pulmonary and cardio-vascular diseases are well known outcomes. Brain impacts are an emergent challenge as are epigenetic changes and developmental issues. This conference will tackle these issues for the first time.

Our goal is to bring together basic researchers, epidemiologists, public health specialists and neurologists to assess current knowledge and identify key gaps that mandate further research.

Environmental Neurology Applied Research Group WFN
Club de Neurologie et Environment

Overview

Day 1 - Wednesday, November 30, 2016

Venue Council of Europe

2:00 PM Welcome addresses
J.Reis (Strasbourg), D. Christmann (UDS) and W. Grisold (MD, Prof. World Federation of Neurology, London, UK, secretary general)
Welcome on behalf of the Deputy General Secretary,
Dr Marianne Mengus COE, Strasbourg

2:20 PM Session 1: How to assess causality
Chairs Jérôme de Seze (UDS), Sandner Guy (UDS)
From miasma to the atmosphere. The worldwide concern for environmental effects on neurological function W. Grisold (Wien, Austria)
The Bradford Hill's Criteria L. Godderis (KU Leuven, Belgium)
Experimental evidence P. Spencer (OSHU Portland USA)
Health geography and the holistic approach P. Handschumacher (UDS Strasbourg, IRD)
Causal inference in randomized experiments and in observational studies using the Rubin Causal Model framework. M.A. Bind (Harvard, USA)

4:35 - 5:00 PM Break

5:00 - 6:00 PM Session 2: Lessons and consequences
Chairs: Valerie Palmer (OSHU) and Andree Buchmann (SPPPI, president OQAI)
Re-Thinking Sustainable Development in Times of Disruptive Change A. Rab (EOSD Karlsruhe, Germany)
Is there an Imperative to act? J.Reis (Strasbourg)

Venue Le PréO Oberhausbergen
8.00 PM Welcome by the mayor of Oberhausbergen
Mr Theo Klumpp

Day 2 - Thursday 1 Wednesday, November 30, 2016

Venue European Doctoral College Campus of the University of Strasbourg

8:15 AM Welcome addresses
Catherine Florentz, Vice-présidente Recherche et Formation doctorale, Université de Strasbourg UDS
Welcome on behalf of the Maire de Strasbourg,
Dr Alexandre Feltz, Adjoint chargé de la santé, Ville de Strasbourg

8:30 AM Session 3: Indoor/outdoor air pollution, what are the differences?
Chairs S. Le Calvé (UDS) and R. Baden (Luxembourg)
Characteristics of outdoor air R. Deprost (ASPA, Strasbourg)
Characteristics of indoor air N. Leclerc (ASPA, Strasbourg) and M. Ott (CHU, Strasbourg)

9:30 - 10:00 AM Break

10:00 - 12:00 AM Session 4: CVD & Stroke and air pollution
Chair: P. Clavelou (President JNLF) and JP Delabrousse Mayoux (President ANLLF)
Lessons from the French register of Dijon M. Giroud (Dijon,)
Air pollution and cardiovascular disease: a review T. Bourdrel (Strasbourg, France)
Understanding mechanisms of CVD and stroke M.A. Bind (Harvard, USA)
Microglial priming through the lung-brain axis: the role of air pollution-induced circulating factors M. Block
(Indianapolis, USA)

12:00 - 1:30 PM Lunch

1:30 - 4:00 PM Session 5: Neurodegenerative diseases & multiple sclerosis and air pollution
Chairs: H. Malibary (KAU University, Saudi Arabia Kingdom) and E. Marchioni (UDS)
Does air pollution cause multiple sclerosis relapses in France? E. Leray (Rennes, France)
Update on air-borne environmental exposures in MS, especially organic solvent exposure and tobacco smoking AM Landtblom (Uppsala Sweden)
Multiple sclerosis and air pollution in Iran, an epidemiological update M. Amiri (Shahrekord, Iran)
Multiple sclerosis and air pollution exposure: Common mechanisms toward brain autoimmunity S. Esmaeil Mousavi (Shahrekord, Iran)
ALS and bioaerosols W. Camu (Montpellier France)

4:00 - 4:30 PM Break

4:30 - 6:30 PM Session 6: Epigenetics & foetal development and air pollution
Chairs B. Enriquez (EnvA, France) and N. Sananès (UDS, Strasbourg)
Pollution and development in children (focus on lung development) I. Korten (Bern, Switzerland)
Air pollution and the Child's Brain M. Mortamais (IS Global Barcelona, Spain)
Effects of temperature and relative humidity on DNA methylation M.A. Bind (Harvard, USA)
Air pollution stress and the ageing phenotype over the life span T. Nawrot (Hasselt, Belgium)

6:30 PM Session 7: Free Communications
Chairs: D. Christmann (UDS) and Paul Pevet (CNRS, Strasbourg)
The access ways to brain A. Buguet and R. Cespuglio (Lyon France)
The Effects of Air Pollution on Neurological Diseases in Turkey S. Ayta (Istanbul, Turkey)
Short-term effects of daily exposure to Diesel exhaust during gestation on the olfactory system development in rabbits' pups E. Bernal Melendez & H. Schroeder (Nancy, France)

Oral Presentation abstracts

Session 1: How to assess causality

From miasma to the atmosphere. The worldwide concern for environmental effects on neurological function.

Wolfgang Grisold, MD, Prof.
World Federation of Neurology, London, UK, secretary general
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The World Federation of Neurology (WFN) has 119 members and advocates neurology worldwide. To promote best neurological care for patients on the basis of best training, education and neurological infrastructure are important goals of the WFN. „Fostering quality neurology and brain health world wide" summarizes these efforts.

The miasmatic theories assumed for a long time, that many diseases in neurology were caused by bad air and night air. This theories, or diluted versions reached well into the 19 the century and are still prevalent in common beliefs.

Time and knowledge and concepts of have changed since and the speed of introduction of new knowledge and insights is not only dependent on the quality insight but the many burdens of established knowledge and possibly also economic and financial obstacles. A good example is smoking, where from the dawn of a cause effect relation of smoking with several diseases to initiation of an efficient worldwide campaign, many obstacles had to be overcome. This battle is still ongoing in regard to passive smoking and the protection of children.

Environmental toxins chasing harm to the nervous system are many. The numerous historic examples reach from the ill effects of pluming, to Minamata`s disease, Dioxin and to voluntary sniffing and also the biological aerosols after harvesting brain tissue inducing peripheral neuropathies.

Air pollution, smog at it`s worst, may not only affect the cardiorespiratory system alone, but does definitely affect the nervous system in a holistic view and at present our knowledge on the effect of air pollution, smog and other aerosol pollution is not well understood. Even more regrettably neither the extent of pathology, nor the absence thereof is currently with in the tools of modern pathogenesis of neurological disease.

To know about these effects is an important aspect of this conference, and the WFN is delighted that one of its research groups takes up the initiative to promote research in this important and growing field.

The Bradford- Hill Criteria

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Neurological disorders contribute to the global burden of disease in the European Region (11.2%). Occupational and environmental exposures may cause a substantial proportion of neurological diseases. Despite the fact that a large number of substances have been identified as potentially neurotoxic, the exact causal influence of most environmental agents remains largely unknown. Partly due to the latent nature and insidious character of many neurological disorders. Assessing a possible causal relationship between chemical exposure and disease can be a challenge. Sir Austin Bradford Hill published in 1965 nine criteria to determine causal inference from epidemiologic studies. However, in terms of prevention of new and emerging risks, epidemiological results often come too late and significant risk is only observed when a large number of individuals is affected. Moreover, millions of workers are currently exposed to thousands of agents and mixtures for which exposure and risk assessments are not available. Consequently, we should be vigilant for new and emerging neurotoxic risks of substances. Early warning or clinical watch systems (such as SIGNAAL) should be implemented on EU-level since the majority of previous new occupational diseases have first been described by clinicians (e.g. Progressive Inflammatory Neuropathy among swine slaughterhouse workers). In these systems the assessment of cases can use the Bradford Hill considerations for assessment of work relatedness. Not by applying them as hard rules of evidence, but rather using them as points of attention that can be indicative of causation. This creates a hypothesis on causation, which can be further investigated to strengthen and validate the suspicion of a causal relation between exposure and diseases. It can also alert stakeholders to implement preventive measures earlier.

Experimental evidence

Professor Peter S. Spencer
OSHU Portland USA
Email: spencer@ohsu.edu

Based on human observations and controlled animal studies, there is a solid foundation for the statement that certain chemically specific air pollutants induce toxic effects on the adult human nervous system when exposure occurs in sufficient concentration for adequate periods of time. There is widespread acceptance that airborne exposure for minutes-hours to carbon monoxide (1200 pm), *n*-hexane (1100 ppm), carbon disulfide (500 ppm) or hydrogen sulfide (100 ppm) is correctly labelled Immediately Dangerous to Life and Health. Survivors may experience persistent neurological disease (e.g. carbon monoxide and dystonia) and/or psychological disorders (carbon disulfide). Similarly, more prolonged exposure (weeks) to perhaps tenfold lower concentrations of such substances are accepted to induce a variety of overt neurological disorders such as parkinsonism (carbon disulfide/hydrogen sulfide) and peripheral neuropathy (n-hexane). It is also accepted that concurrent exposure to a second chemical may alter the response to the first, as shown by the reduced and increased peripheral nerve damage from n-hexane when workers are simultaneously exposed to toluene and methyl ethyl ketone, respectively. Much less is known about the effects on the nervous system of very low-level chronic exposure to the large number of chemicals present in urban polluted air. Since the cost of controlled studies of prolonged (years) exposure to polluted air in a suitable animal species would be prohibitive, most data will continue to be derived from epidemiological studies that by design can only identify associations between exposure and disease. Based on the foregoing, it is reasonable to predict that any neurological effects of exposure to urban polluted air will emerge slowly and insidiously, such that the probability of disease expression will increase with the advance of aging. Robust longitudinal studies with repeated measures of environmental exposures are therefore required to confirm reported associations between air pollution, stroke and neurodegenerative disease. There are also reports of adverse effects of polluted air on the developing human brain, including exposure that occurs *in utero* and/or post-natal, effects that are available for experimental verification with controlled animal studies.

Health geography and the holistic approach

Pascal Handschumacher,
Géographe de la santé,
UMR912 SESSTIM (INSERM - IRD - Université de la Méditerranée)

Summary : Characterized by a strong probabilistic dimension, the analysis of the relation between environment and health is mainly attributing the heterogeneity of the spatial distribution of an epidemiological phenomenon to the diversity of life context. This deterministic point of view however takes insufficiently in account the diversity of social management of spaces by numerous stakeholders, diversity which is modifying exposure and/or transmission in groups of population and/or subspaces. The variability of the expression of a disease or "medical profiles" cannot thus be satisfied with an identity marked only by the context and must take in account stakeholders, lifestyles and motilities in what are apparently homogeneous spaces.

Based on a diagnosis of social and spatial heterogeneities of health on various spatial and temporal scales, the geographical approach aims to analyze and understand the production and the management of health territories as a complex system. In theses health territories, environment represents a specific dimension of the complex system. The systemic approach thus is generated by the nature of the studied object itself, in fact the territory of health, which is localizing these complex determinant interactions within the framework of delimitated spaces. Such an approach will enable us to answer this recurring question of the geography "Why here and not there ", applied in this case to health inequalities.

After having defined the polysemous environment concept such as we will consider it throughout this presentation, we will discuss the relevance of the systemic approach of environment and health relations through examples of communicable and non-communicable diseases in developing countries. These examples result from interdisciplinary work about diseases presenting neurological symptoms (Mercury, malaria, HAT, etc.). They will enable us to discuss the importance of spatial and temporal scales levels in the description of health inequalities and their determinants. While characterizing the dynamics, which affect environments and territories, we will present some processes generating spaces at risk and the place of uncertainty about consequences. By putting spaces and places back in their connections network, we will show why it is advisable to exceed the limits produced by a strict environmental approach. Finally, analyzing the particular management of spaces across specific environments in a simultaneous global and specific approach will enable us to illustrate the role of the stakeholders in the production of territories leading to health inequalities in the same environment.

Eventually, we will try to propose a territorial approach of health risks associated with air pollution in order to produce holistic knowledge and understanding of the pathogenic system.

Key words: Health geography, systemic approach, environment, health territories, health inequalities, pathogenic system and developing countries.

Causal inference in randomized experiments and in observational studies using the Rubin Causal Model framework.

M.A. Bind, Harvard, USA

Causal inference is commonly viewed as a missing data problem because at most one potential outcome can be observed for each unit. The basic framework for estimating causal effects is called the Rubin Causal Model (RCM), which involved the definition of potential outcomes as functions of a random treatment assignment and the unit index. We discuss the Stable Unit Treatment Value Assumption (SUTVA) that is needed for the potential outcomes for each unit and each treatment to be well-defined functions. We first present the Fisherian and Neymanian inferences for completely randomized experiments. Then, we discuss how to approximate randomized experiments when observational data are collected using matched-sampling strategies.

Session 2: Lessons and consequences

Re-Thinking Sustainable Development in Times of Disruptive Change

Arshad Rab EOSD Karlsruhe, Germany

We all know that the only constant in life is change. But what is new is the speed and disruptive nature of change. A new political landscape is emerging rapidly in many countries, dramatic technological disruptions are fast reshaping every sector of the economy and the "always-on" society is consuming more natural resources than ever before in the human history. In times of disruptive, exponential and speedy change that is sweeping through the entire world, there is a need to sit back and look at the big picture.

In his address, Arshad Rab will present the big picture view, talk about tough choices, discuss the need to re-think sustainable development and highlight challenges and opportunities in times of disruptive change. He will advocate for holistic approach that is needed to achieve enduring human and environmental well-being and for creating a more just and more sustainable economy.

Is there an imperative to act?

Jacques REIS[1], James Longhurst[2] and Peter S. Spencer[3]
[1] Specialist in Environmental Medicine, Chargé de cours UDS-EMS, Strasbourg, France, Chair ENRG WFN, Président Club de Neurologie et Environnement
[2] Professor of Environmental Science and Assistant Vice Chancellor, Environment and Sustainability, University of the West of England, Bristol, U.K.
[3] Professor, Department of Neurology, School of Medicine and Oregon Institute of Occupational Health Sciences, Portland, Oregon, USA

Scientists and physicians are required to address key ethical questions: for example, what is our duty to the societies in which we live? What is our responsibility for humanity at large? Are the answers encapsulated in a drive for discovery and application of new and existing knowledge to health and wellness, and to the prevention, control and treatment of disease and injury? Or do we have a wider community responsibility? We bring to this debate some facts, examples and proposals relevant to the field of toxicology and, in particular, to the health effects of air pollution. We emphasize the need for proactive societal action based on intelligent factual analysis rather than relying on reactive responses to environmental catastrophes, such as the Great Smog of London in 1952. We ask why there is low political concern over the current growth of air pollution, and the growing chronic adverse health effects attributable thereto? The scientific and medical community can act to reverse this troubling trend through citizen education and biomedical research.

Session 3: Indoor/outdoor air pollution, what are the differences?

Characteristics of outdoor air

Deprost Raphaèle, ASPA, Association pour la Surveillance et l'étude de la Pollution atmosphérique en Alsace (official non-profit association in charge of air quality assessment in Alsace), Schiltigheim, France. Presenting author email: rdeprost@atmo-alsace.net

Air quality can be described as a cycle, with emissions in the air leading to concentrations in the atmosphere, resulting in population or environment exposure, with possible impacts, against which measures will be organized in order to limit the emissions in the air. The scales of outdoor air quality go from global and long term, with problematics like climate change, to local and middle or even short time problematics like exceedances of norms (2 trafic stations did not comply to NO_2 norms in Strasbourg in 2015) or like threshold exceedances (10 days of alarm for ozone in Alsace in 2015). The main outdoor air pollutants investigated are particulate matter, ozone, nitrogen oxides, benzol, ammonia, sulfur dioxide, volatile organic compounds, heavy metals or polycyclic aromatic hydrocarbons (PAHs), for their impacts on human health or on environment.

The determinants of oudoor air quality are emissions, with among them those due to energy consumption, and meteorology, that influences the energy consumption (cooling, heating) and can be responsible for pollution peaks (transport of polluted air masses, temperature inversions in winter, photochemical ozone peaks in summers, etc.). The air quality agencies are specialized to assess outdoor air quality with fixed or short time measurements (22 stations and 50 analyzers in Alsace), modeling (deterministic to probabilistic, regional to local) and energy and emission inventories.

Concerning emissions, the Alsace region contains most of the key factors in air pollution: urban areas, roads and motorways, strong industrial areas, agriculture as well as strong biogenic emissions. In Alsace according to the last released emission inventory, in 2013 44% of PM10 were emitted by the residential sector and thus mainly heating (62% for PM2.5), 25% by the agriculture, 15% by industry and 13% by the road traffic. 55% of PM10 emissions were due to energy consumption (78% for PM2.5). 47% of the black carbon was emitted by road traffic and 34% by the residential sector.

Because of the complex regional meteorology due to the Vosges Mountains and the Black Forest, the ASPA is driving for French, German and Swiss partners a common air quality modeling system over the Great Eastern of France, the Upper Rhine transboundary region and the land Baden-Wurttemberg in Germany: the PREVEST platform. This modeling platform delivers daily air quality forecasts as well as analysis data intended for reporting of surfaces and population exposures. The outdoor air quality of cities like Strasbourg, Mulhouse and Colmar is daily assessed with urban modeling. These techniques show that 1400 inhabitants in Alsace were exposed to threshold exceedances regarding the annual mean of NO_2 in 2015, and 7060 regarding the daily limit value for PM10. For ozone the exposure for the different norms is much higher.

The 26 French air quality agencies are big data producers. In 2014 they provided 20 years of outdoor air quality over France with a 2x2km resolution for the purpose of epidemiological studies to the Institut de Veille Sanitaire InVS (Bentayeb, 2014 - 1). The InVS assessed annual exposure for the place of residence of a sample of 20,327 adults working at the French national electricity and gas company EDF-GDF (GAZEL). Long-term exposure to fine particles, nitrogen dioxide, sulfur dioxide and benzene was associated with an increased risk of non-accidental mortality in France (Bentayeb, 2014 - 2). In 2017 the PATER project will finalize a high-resolution database to improve such investigations.

References

Bentayeb M., Wagner V., Stempfelet M., Zins M., Goldberg M., Pascal M. et al., Association between long-term exposure to air pollution and mortality in France: A 25-year follow-up study, Environment International, 85, 5-2014

Bentayeb M., Stempfelet M., Wagner V., Zins M., Bonenfant S., Songeur C. Retrospective modeling outdoor air pollution at a fine spatial scale in France, 1989 – 2008, Environment International, 92, 2014, 267-279

Characteristics of indoor air

Leclerc Nathalie, ASPA, Association pour la Surveillance et l'étude de la Pollution atmosphérique en Alsace (official non-profit association in charge of air quality assessment in Alsace), Schiltigheim, France. Presenting author email: nleclerc@atmo-alsace.net

In the last decades, the scientific evidences gradually highlighted that indoor air quality is a topic of major importance for public health. On one hand people, in industrialized cities, spend approximately 80 to 90 percent of their time indoors et on the other hand, the studies indicate that the indoor air (within homes and other buildings) can be more seriously polluted than the outdoor air. The different measurements campaigns and studies organized by the OQAI -French Indoor Air Quality Observatory and others partners like AASQA or researchers allow to improve knowledge concerning the specificity of indoor air quality.

The indoor air contaminants and the associated levels are the results of outdoor pollutants transfer, influence of the soil pollutions (radon, passed industrial activities), all indoor emissions sources (buildings materials, furnitures, equipments, humans activities…) and air exchange. Approaching exposition to indoor pollutants is showing to be very difficult even taking into account the contribution of outdoor pollution which is well described. The traffic related pollutants and the particles specifically seem to penetrate readily into indoor environments (from 70 to 85% of indoor PM2.5 measured, in the absence of indoor combustion devices and tobacco smoke – Yli-Tuomi, 2008). On the other hand, the reactivity of the indoor pollutants mixture can explain the drastic reduction of the ozone level in buildings with the generation of by-products (Nicolas, 2006). And all the specific indoor chemicals pollutants like volatile or semi-volatile organic compounds, the biological agents like moulds and the radon should also be added.

Face to the flow of molecules and situations, the evaluation of health impacts of indoor air quality is very difficult and filled with uncertainties. The EnVIE project has described and analysed the current Health Impacts of Indoor Air Pollution within the EU- 26 (EnViE, 2008). The EnVie results highlighted that even if the contribution of particles (PM2.5) on health impacts in the EU-26 (expressed in DALY - *Disability adjusted life year*) is major, the others contributions have to be considered.

References :

Yli-Tuomi, T., T. Lanki, G. Hoek, B. Brunekreef et J. Pekkanen, 2008, Determination of the sources of indoor pm2.5 in amsterdam and helsinki. Environ. Sci. Technol., 42 : 4440-6.

Mélanie Nicolas. Ozone et qualité de l'air intérieur : interactions avec les produits de construction et de décoration. Ocean, Atmosphere. Université Paris-Diderot - Paris VII, 2006. French.

EnVIE Co-ordination Action on Indoor Air Quality and Health Effects – 2008 Project no. SSPE-CT-2004-502671

Medical Indoor Environment Counsellor

Martine Ott, UDS

Since 1991, the University Hospital of Strasbourg (Department of Pneumology) proposed to visit the home of patients who suffer from respiratory symptoms in relation to indoor environment pollutants.
This new activity, Medical Indoor Environment Counsellor (MIEC) is devoted to secondary prevention of allergic and non-allergic respiratory diseases related to indoor environment.
These symptoms can be asthma, rhinitis, conjunctivitis, or other symptoms correlated with indoor environment pollutants. These pollutants can be: allergens from mites, cats, dogs, cockroaches, formaldehyde and other chemical pollutants.
In Alsace, the MIEC collaborates with the association (Atmo Grand Est) to measure the outdoor pollution. This collaboration performs an intervention plan: Intair'agir.
At home the MIEC measures different biological pollutants. Atmo Grand Est measures the chemicals. Then we advise how to reduce the pollutants.
This new activity is evaluated by a multicenter study. The paper about this study is published in the European Journal of Allergy: Allergy (February 2003).
Since 2004, an inter-university diploma was created to train new MIEC.

Session 4: CVD & Stroke and air pollution

Lessons from the Dijon Stroke Registry: air pollution and heart and cerebral ischemic diseases

Maurice Giroud[1], Yves Cottin[2], Marianne Zeller[2], Yannick Béjot[1]
  1. Dijon Stroke Registry. University Hospital of Dijon and University of Burgundy and Franche-Comté. France
  2. Registry of Myocardial infarct of Côte d'Or. France

Air pollution is an emerging risk factor for stroke and myocardial infarct despite some controversies due to several factors as well as heterogeneous mechanisms, causes and stroke subtypes, vascular risk factors, stroke and myocardial triggers numerous air pollutants, and the role of geomagnetic storms.

We propose to develop the results of 2 population-based studies, the first one conducted in Dijon, a city of 150 000 inhabitants demonstrating an association between de novo and recurrent ischemic stroke and myocardial infarct and short-term ozone pollution levels.

The second one demonstrates from 6 population-based studies the relationship between geomagnetic storms and increased risk of stroke.

The consequences is that prevention of stroke and myocardial infarct must include the problem of air pollution and geomagnetic storms as a trigger of ischemic cerebral and myocardial diseases in patients at risk.

Air pollution and cardiovascular disease: a review

T. Bourdrel, Strasbourg, France

Background: Air pollution is a mixture of PM and gaseous components. Gaseous pollutants are nitrogen oxides (NOx), including nitrogen dioxide (NO2) and NO, ozone (O3), sulphur dioxide, volatile organic compounds and carbon monoxide. PMs are classified in coarse particles (PM10: <10µm diameter ≥2.5µm), fines particles (PM2.5: <2.5 diameter ≥0.1µm) and ultrafine particles (UFP: <0.1µm).

Methods: we performed an extensive review of epidemiological and experimental studies regarding the cardiovascular effects of air pollution.

Results: Epidemiological studies reported a pooled effect of an 11% increase in cardiovascular mortality for a 10 µg/m3 increase in long term exposure to PM 2.5. An increase of 10 µg/m3 in short term exposure to PM 2.5 was associated with a 1% increase in cardiovascular mortality. Compared to coarse particles, fine and ultrafine particles had the most important impact on cardiovascular mortality.

Cardiovascular mortality was also increased after long- term and short-term exposure to NO2 while the effect of 03 exposure was lower. Acute myocardial infarction was strongly associated with long-term and short-term exposure to PM 2.5 and NO2. Air pollution and traffic exposure can be considered as the most important triggers of acute coronary syndrome at the population level. Heart failure and stroke have also been strongly linked with air pollution and traffic exposure. In the Escape study, the risk of stroke was increased of 19% per 5µg/m3 increase in PM2.5, with an increased risk even with an exposure below the current European recommendations. Interventional controlled studies have demonstrated that air pollution cause a major oxidative stress reaction, endothelial dysfunction and pro-thrombotic state. That effect appears to be predominately mediated by combustion-derived nanoparticles but gaseous exhaust components was also involved in oxidative stress reactions.

Conclusion: At the light of the epidemiological and clinical studies, air pollution is a strong and independent risk factor of cardiovascular disease.

Air pollution and gene-specific methylation in the Normative Aging Study: Association, effect modification, and mediation analysis

M.A. Bind Harvard, USA

The mechanisms by which air pollution has multiple systemic effects in humans are not fully elucidated, but appear to include inflammation and thrombosis. This study examines whether concentrations of ozone and components of fine particle mass are associated with changes in methylation on tissue factor (*F3*), interferon gamma (*IFN-ɣ*), interleukin 6 (*IL-6*), toll-like receptor 2 (*TLR-2*), and intercellular adhesion molecule 1 (*ICAM-1*). We investigated associations between air pollution exposure and gene-specific methylation in 777 elderly men participating in the Normative Aging Study (1999–2009). We repeatedly measured methylation at multiple CpG sites within each gene's promoter region and calculated the mean of the position-specific measurements. We examined intermediate-term associations between primary and secondary air pollutants and mean methylation and methylation at each position with distributed-lag models. Increase in air pollutants concentrations was significantly associated with *F3*, *ICAM-1*, and *TLR-2* hypomethylation, and *IFN-ɣ* and *IL-6* hypermethylation. An interquartile range increase in black carbon concentration averaged over the four weeks prior to assessment was associated with a 12% reduction in *F3* methylation (95% CI: -17% to -6%). For some genes, the change in methylation was observed only at specific locations within the promoter region. DNA methylation may reflect biological impact of air pollution. We found some significant mediated effects of black carbon on fibrinogen through a decrease in *F3* methylation, and of sulfate and ozone on ICAM-1 protein through a decrease in *ICAM-1* methylation.

Microglial priming through the lung-brain axis: the role of air pollution-induced circulating factors

Block M.L.
Department of Anatomy and Cell Biology, The Stark Neuroscience Research Institute, Indiana University School of Medicine, Indianapolis, IN 46202.

Urban air pollution exposure has recently been linked to increased risk of several central nervous system diseases and conditions, including cognitive decline and Alzheimer's disease. The mechanisms mediating these effects are poorly understood. Our recent findings indicate that the brain's innate immune cells, microglia, detect and respond to inhaled pollutants, where pulmonary damage may signal to the brain through circulating factors (The Lung-Brain Axis). Here, we will begin to explore the signals from the lung to the brain with air pollution exposure, discuss their effects in a murine Alzheimer's disease model, and begin to explore how aging may impact this process. These findings provide insight into the mechanisms underlying how pulmonary damage and inhaled toxicants can deleteriously impact central nervous system health.

Session 5: Neurodegenerative diseases & multiple sclerosis and air pollution

Does air pollution cause multiple sclerosis relapses in France?

E. Leray, EHESS, Rennes, France

Little is known on the triggers of relapses among patients affected with multiple sclerosis. However, seasonal variation of relapses suggests that season-dependent factors, such as meteorological parameters or air pollution, may play a role. Furthermore, the systemic inflammatory response induced by airborne particulate matter is increasingly documented. We investigated the triggering effect of particulate matter of aerodynamic diameter < 10 µm (PM_{10}) on multiple sclerosis relapses. A total of 536 patients affected with relapsing multiple sclerosis from the Strasbourg (France) Metropolitan Area were included, accounting for 2,052 relapses over the period 2000-2009. Air pollution data were modeled on an hourly basis at the census block level, and patient exposure was that of her/his census block of residence. A bidirectional time-stratified case-crossover design was used with cases defined as the days of relapse and controls being selected in the same patient at plus and minus 35 days from the case. Exposure to PM_{10} was compared between the days preceding cases and those preceding controls with different lag tests (from 0 to 30 days) to find the most significant one(s).

Multivariate conditional logistic regressions were used and exposure was considered first as a quantitative variable and second as a binary variable according to a PM_{10} concentration threshold of 50 μg/m³. Analyses were adjusted for meteorological parameters on the same lags as PM_{10}, as well as school and public holidays. Subgroups analyses on gender, age at multiple sclerosis relapse, and socioeconomic level of census block were also made. The natural logarithm of the average PM_{10} concentration lagged from 1 to 3 days before relapse onset was significantly associated with relapse risk (OR = 1.40 [95% confidence interval 1.08-1.81]) in cold season, and not far from the significance in hot season (1.26 [0.92-1.73]). Consistent results were observed when considering PM_{10} as a binary variable, even if not significant in cold season. The strongest associations were observed in less than 30 years, women, and in the most and the less deprived zones. The present study highlights the effect of fine particulate matters on the risk of relapse in patients affected with relapsing multiple sclerosis with an appropriate study design and robust ascertainment of both neurological events and exposure. The mechanism underlying the association between air pollution and relapse occurrence require further investigations, as well as the potential interactions between PM_{10}, socio-economic level of the area, and demographics of patients.

Air-borne environmental exposures in MS, especially organic solvent exposure and tobacco smoking

Anne-Marie Landtblom,
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Exposure to *organic solvents* (OS) is connected with increased risk of multiple sclerosis in some studies, but not in all. We performed a meta-analysis demonstrating a mean risk of about OR=2 (Landtblom et al 1996). We also studied the MS risk from OS exposure by anaesthetic vapours in nurses, indicating an excess risk (Landtblom, Flodin, Tondel 2003, 2006). Later, in 2012, a meta-analysis by Barragan-Martinez showed an impact of OS exposure in several autoimmune diseases, including MS, with results corresponding to our previous meta-analysis. Recently a Swedish population based case-control study, EIMS, reported results supporting such an excess risk, as well as a potential interaction with HLA risk alleles and tobacco smoking (Hedström, Alfredsson oral communication ECTRIMS 2015).

The risk of *tobacco smoking* for developing MS has been reported in epidemiological studies by several investigators (Riise 2003). In another autoimmune disease, rheumatoid arthritis, patrolling antibodies against citrullinated autoantigens in the lungs have been proven to cause damage elsewhere, i.e. in the joints. In analogy, MS also can be suspected to appear after inflammatory activation in the lungs. Smoking increases such an inflammatory activation in the airways and in MS, CNS autoantigenic cells in the lung may become activated to harm the CNS (Hedström 2016). In EAE, a well-known experimental animal MS model, encaphalitogenic cells get licensed in the lung for migration indicating possible immune attacks in the CNS.

Also, T-cells specific for myelin basic protein (MBP – potential autoantigen in MS) present in the lung have been shown to cause EAE after antigenic attacks from the lungs (Odoardi 2012). In the Swedish epidemiological study EIMS, smoking has been demonstrated to give increased effect in HLA risk alleles (Hedström 2015). The multinational epidemiologic study EnviMS concluded recently that the risk from smoking is present in all investigated countries. Interestingly, in this study, there is a competing antagonism with Epstein Barr virus exposure, a well-known risk for MS, where the two risk factors compete to affect the outcome (Björnevik 2016).

Multiple sclerosis and air pollution in Iran: an epidemiological update

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Background: Multiple sclerosis (MS), as the most common neurologic disorder of the central nervous system (CNS), with growing incidence and prevalence worldwide and in the Middle East, is increasingly becoming a major health problem among women worldwide. Deaths of 23000 people was attributed to air pollutants in Iran with a cost of 11 billion US $ in 2009. This study aimed to find out the potential relationship between MS and air pollution in Iran.
Methods: By assessing the published articles on MS and air pollution in Iran until October 2016, the situation of MS as well as air/soil pollution in Iran was clarified. Then, studies on air pollution and its potential effect on Iranian MS patients were checked.
Results: The MS prevalence is distributed across Iran provinces with highest rates in Isfahan, located in the center of Iran. The higher rates of MS in Isfahan and Tehran (the Metropolitan) might be due to industrial pollution of these cities. Based on published atlas of MS in Iran, it seems that there is a high-risk 'belt' from northwest to southeast.
Conclusion: The potential of MS might be air pollution considering Isfahan and Tehran. However, Chahar Mahal and Bakhtiary Province, with non-industrial nature, has the second highest MS rates, which does not follow this hypothesis.
Key words: Multiple Sclerosis, Air Pollution, Epidemiology, Iran

Air pollution and Multiple Sclerosis: Common mechanism toward brain autoimmunity

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Multiple sclerosis (MS) is an autoimmune inflammatory disease with complicated unknown etiology. Dramatical increasing of MS prevalence is a serious concern that coincides with the growth of air pollution in cities such as Isfahan and Tehran in Iran during the last decades. Performed studies suggest that exposure to high level of air pollutants chronically has a considerable potential to establish adverse health effects and feedback leading to the neurodegenerative disorders. Additionally, it was revealed there is a considerable correlation between the frequency and severity of MS relapse and ambient air quality. To represent neurological and immune mechanisms caused by air pollution exposure contribute to MS pathogenesis and exacerbation, the occurrence of brain autoimmunity using a collection of the demonstrated events including inflammation, oxidative stress, blood brain barrier breakdown, mitochondrial dysfunction, intestinal microbiome alteration, and vitamin D deficiency was theorized in an integrated system considering their interactions. With regard to the interactions between the involved mechanisms it can be inferred that events related to MS pathogenesis such as barrier disruption, neuroinflammation, neurodegeneration, and finally demyelination can be related to inflammatory- oxidative cascades caused under air pollution exposure. To control the rising rate of MS prevalence and relapse in the high polluted area, it must be collapsed self-sustaining mechanisms that lead to decrease self-tolerance and disrupt usual immune responses through overproduction of inflammatory factors and free radicals. Therefore, a diet full of antioxidant components, design of anti-inflammatory medications and antioxidant therapy can cause more effective outcomes.

ALS and bioaerosols

W. Camu (Montpellier France)

The origin of Amyotrophic lateral sclerosis remains largely unknown. Since the description of the Guam of ALS, linked to BMAA toxin intake, searches have started worldwide to identify the presence of the toxin in other areas. In marine areas most works have demonstrated its presence. We identified a focus in southern France, in a place where oyster and mussel consumption is intense. Those molluscs produced in the area do contain BMAA. Additionally the toxin was identified in diatoms. It has been demonstrated that winds may disperse organisms at the surface of the sea inducing aerosolisation, ending thus in the inhalation of BMAA. The same mechanism has been demonstrated in the Gulf, where sand as well as sand-containing organisms may be inhaled, potentially explaining the high incidence of ALS in Gulf war veterans.

We believe that such a mechanism together with feeding intake of toxin-containing molluscs, may explain the cluster in our region.

Session 6: Epigenetics & foetal development and air pollution

Pollution and development in children (focus on lung development)

Insa Korten
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Air pollution exposure has increased extensively in recent years and there is large evidence of adverse health impacts of air pollution exposure during the prenatal period. This is especially concerning, as it can impair organogenesis and organ development, which can lead to short and long-term complications. Exposure to air pollution during pregnancy may affect different birth outcomes. Higher infant mortality, lower birth weight, early alterations in immune development, impaired lung development and increased later respiratory morbidity have all been linked directly or indirectly to prenatal air pollution exposure. As organogenesis of the lung continues throughout pregnancy and beyond, compared to other organs the maturational process of the lung takes place over a relatively long time period. The lung is thus especially vulnerable to harmful effects of prenatal exposure to air pollutants. As lung disease is a leading cause of morbidity and mortality worldwide, the effect of air pollution on lung health is of great interest. The mechanisms of how prenatal air pollution affects development of foetal organs in general and of the lungs in particular are not fully understood, but likely involve interplay of environmental and epigenetic effects. To be able to assess cause-effect relationships and to distinguish between the impact of pre- and postnatal exposure as well as to define the vulnerable time window in pregnancy for different pollutants, a standardized approach to assess air pollution is clearly needed. In any case, rigorous actions must be taken to reduce air pollution exposure and thus long-term morbidity and mortality.

Air pollution and the child's brain

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Brain maturation during the first years of life is very intensive. This period of life is considered an important window for brain development, but is also particularly vulnerable to environmental insults that may interfere with the cascade of neurodevelopmental processes. Traffic-related air pollution, a global public health threat, may be one of these neurodevelopment disruptors. All around the world, air pollution exposure has indeed been associated with adverse effects on mental development and on behavioural functions such as attention, with a reduced global IQ, with a decrease in memory and academic performance, and with a higher prevalence of Attention Deficit Hyperactivity Disorder (ADHD) and autism. Animal studies have shown that inflammation and oxidative stress, identified as common and basic mechanisms through which air pollution causes damage on the cardiovascular system, may also affect the central nervous system (CNS). However, studies about the potential damages on growing brain induced by chronic exposure to air pollution are still scarce.

Here, we will describe the influence of air pollution polycyclic aromatic hydrocarbons (PAHs) exposure on the basal ganglia, a cerebral structure potentially involved in the attention deficit hyperactivity disorder (ADHD) pathophysiology in the MRI sample of the BREATHE project. In 242 primary schoolchildren aged between 8 and 12 years, we observed that exposure to benzo[a]pyrene, and PAHs in general, is associated with subtle and subclinical changes on the caudate nucleus, even below the legislated annual target levels established in the European Union. Extending the use of neuroimaging may help to yield insights on underlying mechanisms of the reported associations in epidemiological studies of air pollution and adverse effects on cognition in children.

Temperature and relative humidity are associated with DNA methylation in the Normative Aging Study

M.A. Bind (Harvard, USA)

BACKGROUND: Previous studies have related differences in DNA methylation according to various environmental contaminant exposures, but the association with weather has not been examined. Since temperature and humidity have been related to mortality even on non-extreme days, we hypothesized that temperature and relative humidity may impact methylation.

METHODS: We repeatedly measured methylation on long interspersed nuclear elements (*LINE-1*), *Alu*, and nine candidate genes in 777 elderly men participating in the Normative Aging Study (1999-2009). This study investigates whether ambient temperature and relative humidity are related to methylation on *LINE-1* and *Alu*, as well as on genes controlling coagulation, inflammation, cortisol, DNA repair, and metabolic pathway. We examined intermediate-term associations of temperature, relative humidity, and their interaction with methylation using distributed-lag models.

RESULTS: Temperature or relative humidity levels were significantly associated with methylation on tissue factor (*F3*), intercellular adhesion molecule 1 (*ICAM-1*), toll-like receptor 2 (*TRL-2*), carnitine O-acetyltransferase (*CRAT*), interferon gamma (*IFN-γ*), inducible nitric oxide synthase (*iNOS*), and glucocorticoid receptor (*GCR*), *LINE-1*, and *Alu*. For instance, a 5°C increase in temperature and a 10% increase in relative humidity (3-week average exposures for both temperature and relative humidity) were related to a 9% increase (95%CI: 3% to 15%) and a 5% decrease (95%CI: -8% to -1%) in *ICAM-1* methylation, respectively. The relative humidity association with *ICAM-1* methylation was significantly stronger in hot days compare to mild days.

CONCLUSIONS: DNA methylation may reflect biological impact of temperature and relative humidity. Temperature and relative humidity may also interact and produce stronger adverse effects.

Air pollution stress and the ageing phenotype over the life span

Tim Nawrot
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Ageing is a complex physiological phenomenon. The question why some subjects grow old why remaining free form disease whereas others prematurely die remains largely unanswered. We focus here on the role of air pollution in biological ageing. The trajectory from healthy to unhealthy aging often comprise the microcirculation and a few studies addressed a role of air pollution on the microcirculation. Hallmarks of ageing can be grouped into three main categories: genomic instability, telomere attrition, and epigenetic alterations leading to altered mitochondrial function and cellular senescence. Recent data in twins indicate that at birth, the initial telomere length of a person is largely determined by environmental factors, while genetic influence is considerable during adulthood.

Telomere length shortens with each cell division, and exposure to air pollution as well as low residential greenness results in shorter telomere length. Recent studies show that the estimated effects of particulate air pollution exposure on the telomere mitochondrial axis of ageing may play an important role in chronic health effects of air pollution. The exposome encompasses all exposures over the entire life. As telomere can be considered as the cell memories to exposure of oxidative stress and inflammation, telomere maintenance may be a proxy for assessing the "exposome" over the life. If telomeres are causally related to the ageing phenotype and environmental air pollution is an important determinant of telomere length, this might provide new avenues for future preventive strategies.

Session 7: Free Communications

Access pathways to the brain: a microbiological model for air pollution penetration to the brain

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Pollutants are known to disrupt the immune system. More recently, they have been involved in psychological and neurological disturbances. Alterations in brain functioning due to oxidative stress and blood-brain barrier (BBB) breakdown were hypothesized to induce developmental impairment in children and accelerated brain aging in adults, triggering cognitive impairment, behavioral changes, sensory processing deficits and even silent stroke.

The access pathways of pollution to the central nervous system (CNS) are presented in light of CNS microbiological invasion. We chose to analyze more specifically two models: human African trypanosomiasis (HAT) and the 2009-2010 influenza A H1N1 virus pandemic.

Pollutants may enter the CNS through systemic pathways. This is the case for HAT, characterized by narcolepsy-like events and disrupted circadian rhythms during the neurological state. Trypanosomes have long been thought to enter the CNS through the BBB. However, when injected into the brain parenchyma, they do not induce CNS infection. Intraperitoneally injected trypanosomes are found in the cerebrospinal fluid (CSF), but not in the brain parenchyma. They do not cross the BBB but rather the blood-CSF barrier. However, trypanosomes may penetrate the meninges through the Virchow-Robin space and invade the CNS, thus bypassing the BBB (Mogk et al. 2016). Furthermore, the re-infection of blood or so-called relapse may reside in the recirculation of trypanosomes through the newly described glymphatic system (Iliff et al. 2012) that connects meningeal space to the lymphatic system.

Air pollution may also enter the brain through the neurons of the olfactory epithelium, as in mice infected nasally by H1N1 influenza virus (Tesoriero et al. 2015). The virus progresses through the CNS and reaches the neurons involved in sleep-wake regulation. The end-result may explain the China epidemic of influenza virus-induced narcolepsy in children in 2009 and 2010, and also the narcolepsies induced by the corresponding vaccination in Europe and other countries. The syndrome was not observed in the USA, focusing on the role of adjuvants to boost the immunological response following an antigen-sparing strategy promoted by the WHO.

The Effects of Air Pollution on Neurological Diseases in Turkey

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The main factors that cause air pollution in Turkey are coal thermal power plants, vehicles, other fossil fuels used in heating systems, and various industrial areas. Particulate matters, ozone, nitrogen dioxide, sulfur dioxide are the most important toxic substances in polluted air. According to World Health Organization's (WHO) data from 2011, unfortunately in 12 of our cities, the levels of fine particulate matter (PM2.5) have been discovered to be at least three times more the acceptable number. It has been proved that PM2.5 increases the risk of death caused by inflammation and thrombosis in cardiovascular system. Exposure to air pollution also raises the chance of stroke and cognitive decline. In addition, observations showed that, the number of migraine or epilepsy patients who applied to hospitals showed a significant rise in times of increased air pollution. In order to minimize these health issues, renewable energy resources should take the place of fossil fuels.

Short-term effects of daily exposure to Diesel exhaust during gestation on the olfactory system development in rabbits' pups

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Introduction: Although airborne pollution is known to negatively affect the adult brain through adverse impacts on the olfactory system, the neurotoxic effects of a gestational exposure to air pollution are questioned and poorly investigated.

Objective: The present work aims to study the effects of a controlled gestational exposure to diesel exhaust (DE), at levels closely reflecting those of the urban human population, on the olfactory system development in rabbits.

Materials and Methods: Pregnant rabbits were exposed nose-only to a clean air or to a diluted (1mg/m3) filtered DE from gestational day 3 (GD3) to day 28, 2h/d, 5d/w. At GD28, 12 females (5 controls and 7 exposed) were sacrificed to collect foetal olfactory mucosa (OM) and bulb (OB) for anatomical and chemical measures.

At postnatal day 2 (PND2), 62 control and 55 polluted pups from 18 litters (9 controls and 9 exposed) were examined for their odor-guided behavior in response to the presentation of the rabbit mammary pheromone 2-Methyl-3-butyn-2-ol (2-NBT).

Results: Electron microscopy analysis of OM and OB revealed in exposed foetuses the presence of nanosize particles (20-48nm) in the olfactory sensory neurons and the glomerular layer of the OB, along with cellular and axonal hypertrophy. OB of exposed animals exhibited a higher level of serotonin and lower levels of dopamine and its metabolites. Finally, the behavioral response to 2-NBT at PND2 was altered in exposed rabbits.

Conclusions: The present gestational exposure to DE affects the neuro-olfactory development of the rabbit offspring, and altered early olfactory-based behaviors.

Because of the known anatomical and functional continuum between the olfactory system and the rest of the brain, such early alterations could be indicative of disturbances in higher integrative structures.

Masoud Amiri

Masoud Amiri is graduated from the Isfahan University (B.Sc.) and the Shiraz University of Medical Sciences (M.Sc.); he earned a Ph.D. in Epidemiology, at Erasmus MC, Rotterdam, The Netherlands in 2010. Since 2012 he is the Head of Social Health Determinants Research Center, Shahrekrod University of Medical Sciences, Shahrekord, Iran. Prof Amiri is involved in several societies, published more than hundred articles and book chapters. He belongs to many editorial boards and is th founding Editor-in-Chief of International Journal of Epidemiologic Research

Semih Ayta

Semih Ayta is graduated from Istanbul University (IU), Cerrahpaşa Medical School in 1980. I worked as a general practitioner after university. Then, I finished my neurology training. In the following years, I completed the program of Master of Science in clinical neurophysiology (EEG-EMG) at IU, Institute of Health Sciences. In the early 2000s, I worked as a fellow at IU, Istanbul Medical School, Department of Neurology, Division of Child Neurology. Currently I'm working as a child neurologist at Istanbul Haseki Training and Research Hospital. My special interests are epilepsies and headaches of children and adolescents, their EEGs, developmental problems and neurological aspects (autism spectrum disorders, ADHD, speech language disorders, learning difficulties, etc), demyelinating diseases, and environmental neurology.
I'm also a member of Turkish Neurological Society, Turkish Chapter of International League Against Epilepsy, Turkish Society of Clinical Neurophysiology EEG-EMG, and The Society of Child and Adolescent Neurology.

Dr. Marie-Abele Bind

Dr. Marie-Abele Bind earned her joint Sc.D. degree in Environmental Health and Biostatistics at the Harvard School of Public Health. Subsequently, she worked as a postdoctoral Ziff Fellow at the Harvard University Center for the Environment with Prof. D. Rubin and estimated causal effects of extreme weather exposures on health under the Rubin Causal Model. Dr. Marie-Abele Bind is a Research Associate in the Statistics Department at the Faculty of Arts and Sciences, Harvard University. Her research focuses on transporting classical experimental insights into the field of environmental epidemiology, as well as developing new causal inference methods to address causality when examining the effects of environmental exposures (e.g., air pollution and extreme weather) on health in complex settings (e.g., missing data and big data).

Michelle L. Block,

Michelle L. Block, Ph.D. is associate Professor at the Department of Anatomy & Cell Biology in the Indiana University School of Medicine, The Stark Neuroscience Research Institute Neuroscience Research in Indianapolis, IN, USA. I have several years' experience investigating the interacting effects of microglial activation and environmental toxicants, including the consequences for neuron damage. My laboratory's research focuses on identifying the triggers (environmental and endogenous) that initiate deleterious microglial activation and applying these findings toward the development of therapeutic compounds capable of halting the progression of neurodegenerative diseases. My long-standing interest in understanding how air pollution affects the brain has shifted my lab's focus to understanding how circulating signals derived from the periphery regulate CNS health. I have multiple publications on the mechanisms of how air pollution may activate microglia and the consequences for neuronal survival, which includes a recent manuscript outlining what we call the Lung-Brain Axis in *FASEB J*.
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Dr. Thomas Bourdrel

Radiologist physician graduated of the Free University of Brussels.
Founded a non-profit, non-governmental organization in 2014 helping to inform physicians and public authorities about the health impacts of air pollution.
Presented his findings before the senatorial committee in 2012.
Has been conducting for the past two years a literature review that is to be published, on the effects of air pollution, chiefly cardiovascular.

Pr. Buguet Alain

M.D., Ph.D., Professeur agrégé du Val-de-Grâce. Scientific activity: 589 written publications (160 international, 73 national, 6 books, 58 chapters, 5 University or scientific memoirs, 98 abstracts published in international reviews, 189 reports).
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Pr. Wolfgang Grisold

Prof Wolfgang Grisold is a specialist for neurology and psychiatry. Since 1989, he has been heading the department of neurology of the KFJ hospital in Vienna, Austria.

His special interests apart from general neurology are neuromuscular disease and neurooncology, palliative care and education in neurology. His has particular expertise in neuromuscular disease in regards to clinical findings, electrophysiology, neuropathology and imaging. He has participated in two EU projects on paraneoplastic syndromes, and in 2 ECCO- EU projects on oncologic video education. His focus in the past years was the effect of cancer on the peripheral nervous system.

He attended 3 AAN Advocacy -Palatucci courses and chaired three joint AAN – WFN Palatucci Teaching courses at world federation meetings.

Patient days at the prior EFNS congresses and then the WFN congresses (Vienna 2013, Santiago 2015) were initiated on his initiative.

He currently published 600 publications among them 4 books (Atlas of neuromuscular disease, 2 editions) and has presently 219 Pubmed quoted publications, 330 Abstracts and presented over 1400 lectures.

The neurological department in Vienna is an affiliated teaching hospital of the university of Vienna (MUW).

He has been involved in education from the aspects of CME and CPD (EFNS, UEMS, WFN), residency training (Austrian society of neurology and UEMS), board examinations (Austrian society and UEMS/EBN), patient and caregiver education and European and international department visits (UEMS/WFN). He has chaired the education committee of the EFNS from 2002 until 2007, has been the co-chair of the education committee of the WFN, where he also chaired the teaching course committee until 2015.

From 2000 to 2002, he was the founding president of the Austrian Society of Neurology. He is the secretary general of the WFN from 2013 to 2016.

He was president of the UEMS/EBN (past president), and the EANO (European Association of neurooncology). Within ECCO he chairs the ACOE (accreditation body for CME) and is a member of the UEMS EACCME CME governance board.

In Vienna he is a member of the KAV ethics committee and also a member of the higher medical council of the city of Vienna.

Apart from his hospital and scientific work he runs a private neurology office in Vienna, where combines clinical work with neuromuscular disease and electrophysiology.

Pascal Handschumacher

Pascal Handschumacher, PhD, is a researcher in health geography and spatial epidemiology, for IRD (French Research Institute for Development). His researches are dedicated to the diagnosis and understanding of the production of social and spatial health inequalities and health territories in developing countries and mainly in West Africa, Madagascar and South America. He is currently coordinator for two international and interdisciplinary research program. The first about unequal consequences of sanitation in an urban context in Madagascar and the second about the way and path of zoonoses host diffusion in Senegal. His teaching activities are conducted as invited professor for numerous universities in developing countries, and as associate professor for the university of Strasbourg and Marseille. He is member of boards of expert (French and international) and editorial boards.

Insa Korten

I received my medical degree from the University of Leipzig, Germany, and worked afterwards as a resident in the pediatric department of the University hospital Halle (Saale), Germany. Since 2014, I am doing a PhD in the study group of the pediatric pulmonology department of the University hospital Bern, Switzerland. My research is focused on early life predictors on respiratory health and lung development. A key aspect of my studies are pre- and early postnatal effects of air pollution on neonatal outcomes and early child development, especially concerning postnatal lung development and respiratory health.

Pr. Anne-Marie Landtblom

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Marion Mortamais

Marion Mortamais is an epidemiologist with an interest in cognition and neuroimaging. Afterwards a doctorate in Veterinary Medicine (VetAgro Sup, Lyon, France) and a MSc in Biostatistics and Epidemiology (Montpellier University, France), she did her PhD thesis at the French National Institute of Health and Medical Research (Inserm) on the relationship between cerebral white matter hyperintensities detectable on MRI scans and the risk of dementia in elderly (U1061, Montpellier). She currently holds a Marie Curie fellowship in the Barcelona Institute for Global Health (Barcelona, Spain) where she is involved in the BRain dEvelopment and Air polluTion ultrafine particles in scHool childrEn (BREATHE) project.

Sayed Esmaeil Mousavi

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Tim Nawrot

Tim Nawrot studied environmental health sciences at Maastricht University and Vermont Medical School, US. In 2005, he obtained his Ph.D. degree in medical sciences from the University of Leuven, Belgium. Nawrot currently works as a full professor of environmental epidemiology at Hasselt University and part time (20%) associate professor at Leuven University. His research focus on health effects of environmental pollutants on ageing including effects in early life. He has published over 150 scientific research papers including top medical journals as Lancet and British Medical Journal. He served as advisor on national and international panels in the field of environmental health including the World Health Organization and Canadian Health Administration. In 2008 and 2012, he was laureate of Belgian Academies of Medicine for his work on biological ageing and environmental epidemiology, respectively. In 2013, he was awarded a prestigious starting grant from the European Research Council (ERC).

Martine OTT

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Since 1991 I have been working at the Department of Pathology Thoracic at the University Hospital of Strasbourg. I received my social worker diploma at the University of Strasbourg in 1988.
I am handling home visits for patients with respiratory diseases related to indoor pollutants. I measure their indoor environment and advised them how to improve it with every day actions.
This new activity created in Strasbourg with Professor Frederic de BLAY was validated by a multi-centric study published in the Journal Allergy (1)
I help coordinating the Inter-University Diploma of Respiratory Health and Habitat proposed by the University of Strasbourg for the training of future Medical Indoor Environment Counselors.

Arshad Rab

Mr. Arshad Rab is known world-wide for his landmark achievements and many significant contributions in promoting sustainable development across the globe. He has led numerous groundbreaking initiatives in the field of green enterprise development, clean energy and programs for initiating transition to sustainable economy. Mr. Rab has made major contributions to the field of education for sustainability. He has brought together over 400 educational institutions from around the world and led the transformational change to make education responsive to the 21st century challenges.

In the field of sustainable banking and finance, Mr. Rab is the architect of Karlsruhe Sustainable Finance Awards that honor financial institutions and organizations with significant contributions to the field of sustainable banking and finance. He plays a key role in stimulating financial institutions to embrace sustainability and make it an integral part of their organizational DNA. His ongoing research interest includes disruptive innovation in the financial services industry. Mr. Rab envisages a strong, fair and resilient financial services sector that works for the betterment of the communities it serves and works in harmony with its natural environment. To that end, one of his current global initiatives is about innovating financial services for creating a robust, inclusive and sustainable economy.

Having his academic background in business administration, extensive work experience with private, public and multilateral organizations and wide-ranging in-depth knowledge, expertise and experience in the field of sustainability sciences, Mr. Rab today is a powerful voice on innovating for a sustainable future and leading with responsibility in times of disruptive change. He serves as the CEO of the European Organisation for Sustainable Development (EOSD), which is a dedicated body that has in its unique charter the purpose of developing strategies, programs and initiatives and undertaking projects that contribute in implementing the EU Strategy for Sustainable Development.

Dr. Henri Schroeder

Dr Henri Schroeder (URAFPA, INRA UC340, Université de Lorraine, Nancy, France) has many years of experience in the field of developmental neurotoxicology and behavioral neurobiology in relation with early-life insults with a special interest for the developmental neurotoxicology of Polycyclic Aromatic Hydrocarbons in animal models of exposure through the ingestion of contaminated food or the inhalation of polluted atmosphere.

He is recently interested in the developmental neurotoxicity of a brominated flame retardant of high concern, HexaBromoCycloDoDecane, and published the first study dedicated to the short-term behavioral toxicity of an early exposure to the HBCDD a-isomer. Henri Schroeder is an expert to the French Agency for Occupational and Environmental Health (ANSES) and is more implicated in the health risk assessment of chemical exposure and endocrine disruption. Currently, he is the coordinator of the ANSES research program "BrainAirPoll" on the developmental neurotoxicity of a gestational exposure to diesel exhaust particles and co-chairs with his colleague Dr Christine Baly from the National Institute for Agricultural Research (INRA) the PhD of Estefania Bernal Melendez as a part of this program.

Peter Spencer

Peter Spencer, PhD, FANA, FRCPath is senior scientist, Oregon Institute of Occupational Health Sciences and professor of Neurology, Oregon Health & Science University (OHSU), where he was founding director of the OHSU Center for Research on Occupational and Environmental Toxicology and the OHSU Global Health Center. Dr. Spencer's more than 40 years of research has focused on cellular and molecular mechanisms of a wide range of substances with neurotoxic potential, animal and tissue culture models of neurotoxic disease, and on the role of manmade and natural chemicals in human neurodegenerative and other disorders. He has wide local, national and international teaching experience, more than 200 papers in peer-reviewed journals, and a similar number of reviews, chapters and books. Dr. Spencer's federally supported research has been recognized with numerous national and international awards and named lectureships, and he holds honorary faculty appointments on three continents.

Session chairs

Nicolas Sananès
Praticien Hospitalier en Gynécologie Obstétrique aux Hôpitaux Universitaires de Strasbourg
Activité de Médecine Foetale et d'Obstétrique. Master en Santé de Publique

Valerie S. Palmer is Instructor OF Neurology, Oregon Health & Science University (OHSU) in Portland, Oregon, USA and founding president of the Third World Medical Research Foundation. Her many research contributions span experimental studies in toxicogenomics, environmental factors in motor neuron disorders, and field studies on neglected neurodegenerative diseases. In 2015, Palmer was recognized nationally for her innovative interprofessional teaching of American health professional students.

Jerome de Seze
Professor in Neurology, PhD in Immunology
Head of the neuroimmunological department of the Strasbourg hospital, specialized in Multiple sclerosis and neuro-ophthalmology
Head of the clinical research Center (CIC) of the Strasbourg hospital
Head of the DHU (Department Hospital/University called Neurogenics.
President of the Multiple Sclerosis French society

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Head of the Master degree "Drug Sciences", Speciality "Drug analysis".
Professor in Analytical Chemistry, University of Strasbourg, Strasbourg,
Expert in ANSES, French Agency for Food, Environmental and Occupational Health & Safety
Expertise: Food irradiation processing, Development and control of Food Processes. Analytical chemistry, Development of novel analytical methods.
113 publications in international peer-reviewed journals, 13 book chapters.

Organisation

Chairs
Jacques Reis and Peter Spencer

Local Organization
Marie Reis and Christel Kohler-Barbier

Advisory Committee
Guy Sandner, Paul Pevet, Edouard Baldauf

The club de Neurologie et Environnement

Scientific society created in 2003 in Strasbourg, the purpose of the Club is to study the influences of the environment on the human nervous system, and its effects on neurological diseases in order to prevent harm and promote better care of neurological patients. This goal shall be promoted by fostering awareness of the problems, teaching and training health care professionals, as well as creating a network, develop a data base and encourage research in this area.To this end, the Club intends to be interdisciplinary linking together physicians and other professionals in such fields as industrial medicine, public health, epidemiology, neurotoxicology, pharmacy, veterinary medicine, the neurosciences and chemistry, as well as national and international institutions in similar fields.

The Environmental Neurology Applied Research Group of the World Federation of Neurology

Since 2007 the ENARG (formerly the Neurotoxicology RG) is trying to bring to the neurological community knowledge on environmental risk factors (included Neurotoxicology), the importance of which is well accepted in all health and medical issues. The concept of environmental risk factors is multidisciplinary and involves many sub-specialities, for example: Neuroepidemiology, Neurotoxicology, Neurotoxinology, Nutrition, Tropical Neurology, Occupational disorders. Our ARG does not fit comfortably in any of the existing panels of the WFN (or clinical institutions) dedicated to a disease approach nor with the interest of pharmaceutical companies. Although environmental factors are widely recognized in the etiology of many neurological disorders, the former Neurotoxicology RG attracted little interest probably because it was too highly specialized. With a renewed team, we are trying to revive this ARG but with a much broader scope.

Partnership

Endorsement