

Institute and Outpatient Clinic of Occupational, Social, and Environmental Medicine

Chair of Occupational and Social Medicine

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Research focus

- Work related health research
- Population related health studies
- Biomarker in Occupational Medicine
- Dermatotoxicology
- Molecular markers of exposure to hazardous substances
- Quality assurance of biomonitoring methods
- Quality assurance of health promoting actions
- Healthcare research

Structure of the Institute

Professorships: 2
Personnel: 52
• Doctors (of Medicine): 6
• Scientists: 14 (thereof funded externally: 12)
Graduate students: 29

Clinical focus areas

- Outpatient-clinic of occupational, social, and environmental medicine
- Biological monitoring
- Occupational medical service for FAU and UK Erlangen
- Occupational medical service for teachers at schools in Northern Bavaria

Special structural features

- Chair and scientific secretary of the DFG working group „Setting of Threshold Limit Values in Biological Material“ (Permanent Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area)
- Chair and scientific secretary of the DFG working group „Analyses of Hazardous Substances in Biological Material“ (Permanent Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area)
- Management and certification center of the quality assessment program for human biological monitoring (German External Quality Assessment Scheme, G-EQUAS)

Research

In different research areas, health hazards derived by occupational and environmental exposure are investigated using clinical, natural-scientific, and sociological methods. The aim of the research of the Institute (IPASUM) is a qualitative and quantitative specification of the effects as well as their determinants and finally evidence-based recommendations of prevention measures. The research approaches vary from cell biological basic research to the scientific evaluation of prevention measures in practice.

Work related health research

Manifest diseases, resulting from chronic exposure at work, often cause substantial social-medical problems. Therefore, IPASUM carries out field studies at the work place that aim at detecting physiological and pathophysiological changes long before manifest diseases appear. Questions always arise when new technologies or working materials are introduced. New welding techniques used in the aluminum processing industry or the replacement of classical solvents by alternative solvents can be listed as examples. Furthermore, allergically mediated diseases at the workplace are still a problem although hygienic conditions have clearly been improved. Therefore, an important focus for IPASUM is on the assessment of exposure and on the effect of toxic, mutagenous, and sensitizing working materials. Many qualified field studies analyze not only the exposure, but also the data of ambient monitoring (inhalative and dermal exposure).

Funding: German employer's liability insurance association, German State Ministries, German Federal Ministry of Labor and Social Affairs

Population related health studies

Environmental medicine relates to occupational medical questions by critically proving exposure and its possible effects. IPASUM has, amongst others, the task to offer fast and adequate help if the public is postulated with high exposure to chemical agents, like PCB in public facilities, phthalates in pharmaceuticals/toys, or aluminum in deodorants.

Funding: Local authorities, Bavarian State Ministry of the Environment and Public Health, German Federal Environment Agency

Biomarker in Occupational Medicine

PI: Prof. Dr. S. Schmitz-Spanke

This working group examines the cellular response to exposure to hazardous substances in the low dose range. In cellular models, toxico-

logical endpoints (such as cell proliferation, production of oxygen radicals, alterations in the mitochondrial membrane potential, DNA damage) are correlated with alterations on the proteome and metabolome level. Here, the sequence of the cellular defense mechanism is analyzed and the transition from adaptive to adverse effects is characterized. The resultant data sets are comprehensively processed and modeled to simulate different conditions yielding insight into the mechanisms that are involved in this transition.

An additional research focus at the FAU, established in cooperation with the excellence cluster EAM (Engineering of Advanced Materials), is laid on the interaction between nanoparticles and proteins and its possible toxic effects.

Dermatotoxicology

Several projects that describe and quantify dermal penetration are conducted by using *in vitro* (static diffusion chamber, microdialysis on freshly excised human skin) and *in vivo* models (microdialysis of volunteers). Furthermore one working group deals with the assessment of hazardous substances in the area of skin penetration for the DFG Commission of Investigation of Health Hazards of Chemical Compounds in the Work Area. Clinical research in the area of dermatotoxicology considers procedures to early diagnose subclinical skin damages and irritations. IPASUM developed and validated the Hand Eczema Score for Occupational Screenings (HEROS).

Molecular markers of exposure to hazardous substances

This research group develops and validates procedures for the quantitative assessment of molecular markers of individual exposure to hazardous substances (exposure monitoring), for the disposition for hazardous substances in the metabolism (susceptibility monitoring) and examines the effects of hazardous substances (biological effect monitoring). A special focus is laid on the biological effect monitoring, which particularly quantifies reaction products of mutagenous substances, covalently bound as adducts to macromolecules, like proteins or DNA. The valency of the biomarkers is examined in studies that give information about the specificity, sensitivity, and toxicokinetic behavior.

Quality assurance of biomonitoring methods

On behalf of the German Association for Occupational and Environmental Medicine, IPASUM currently organizes the most comprehensive ex-

ternal quality assessment scheme worldwide for the evaluation of occupational and environmental biomarkers. The 62nd round robin test of G-EQUAS was finished within the report period. Now G-EQUAS comprises 182 analyses parameters; more than 200 laboratories worldwide (two-thirds of them international) take part in G-EQUAS every six months.

Quality assurance of health promoting actions

Within the framework of company health management, measures are offered and implemented in companies that support the health resources and wellbeing of the employees. IPASUM develops concepts to examine the effectiveness and sustainability of health promotion in companies and uses them in practice. The evaluation concepts are developed and implemented for individual companies, networks or for regional programs, like Medical Valley EMN. One evaluation task for these programs is to assess the consistency and feasibility of their objectives. Other tasks are to evaluate the applied measures, their suitability and efficiency and to rate their sustainability.

Healthcare research

In the area of the healthcare research the project "Healthcare in Bavarian schools" was conducted. The project aims at developing the need for occupational care in Bavarian schools and at establishing a model for a decentralized support system in German schools. The project is run in cooperation with the Institute and Outpatient Clinic of Occupational-, Social- and Environmental Medicine of the LMU Munich.

Teaching

IPASUM shares in in the curricular teaching of the Faculty of Medicine by compulsory and optional subjects. Particularly highlighted is the management of the cross-sectional courses Q3 and Q10 as well as the tutelage of the exploration of occupational fields by the students. From 2006 until 2019, Prof. Dr. H. Drexler was Dean of Students. Moreover, Bachelor's and Master' theses as well as MD and PhD theses are supervised.

Selected publications

Clarner A, Uter W, Ruhmann L, Wrenger N, Martin A, Drexler H. Sickness absence among peer-supported drivers after occupational trauma. *Occup Med (Lond)* 2017; 67(2): 143-150

Weistenhöfer W, Uter W, Drexler H. Protection during production: Problems due to prevention? Nail and skin condition after prolonged wearing of occlusive gloves. *J Toxicol Environ Health A* 2017; 80(7-8): 396-404

Klotz K, Weistenhöfer W, Neff F, Hartwig A, van Thriel C, Drexler H. The Health Effects of Aluminum Exposure. *Dtsch Arztebl Int* 2017; 114(39): 653-659

Seitz M, Kilo S, Eckert E, Müller J, Drexler H, Göen T. Validity of different biomonitoring parameters for the assessment of occupational exposure to N,N-dimethylformamide (DMF). *Arch Toxicol* 2018; 92(7): 2183-2193

Pink M, Verma N, Kersch C, Schmitz-Spanke S. Identification and characterization of small organic compounds within the corona formed around engineered nanoparticles. *Environ.-Sci. Nano* 2018; 5(6): 1420-1427

Greiner A, Göen T, Hildebrand J, Feltes R, Drexler H. Low internal exposure and absence of adverse effects in workers exposed to high air levels of inorganic selenium. *Toxicol Lett* 2018; 298: 141-149

International cooperations

A. LeBlanc, Institute National de Santé Publique du Québec, Québec: Canada

Dr. T. Berman, Department of Environmental Health, Jerusalem: Israel

Dr. K. Jones, Health and Safety Laboratory (HSL), Buxton: UK

Prof. P. Grandjean, MD, Harvard School of Public Health, Boston: USA

Prof. P. Jacobsen, Bispebjerg University Hospital, Copenhagen: Denmark