

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: 51

- Doctors (of Medicine): 7
- Scientists: 14 (thereof funded externally: 12)
- Graduate students: 21

Clinical focus areas

- Outpatient-clinic of occupational, social, and environmental medicine
- Biological monitoring
- Occupational medical service for FAU and UK Erlangen (incl. prevention of infection)
- 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, toxicological 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.

In a subproject of the project network "Ultra-Fine Particles" (UFP), funded by the Bavarian

State Ministry of the Environment and Consumer Protection, the biological response to UFP exposure is being investigated. For this purpose, a state-of-the-art air-liquid interface lung model in situ is exposed to particles of varying sizes and compositions, and the biological response is examined using a high-throughput battery of tests as well as both transcriptomic and metabolomic methods. Cooperating partner: Cooperation Group of Comprehensive Molecular Analytics at Helmholtz Zentrum München.

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.

Funding: DFG, *Chemie-Wirtschaftsförderungsgesellschaft*, German Environment Agency.

Quality assurance of biomonitoring methods

On behalf of the German Association for Occupational and Environmental Medicine, IPASUM currently organizes the most comprehensive external 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 190 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. IPA-SUM 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.

Psychological strain in the workplace

The changing world of work, as a result of working from home, increased digitalization, constant availability, or the consolidation of tasks, to name a few examples, can lead to a change in general working conditions and social cooperation. In recent years, these changes have led to more focus on mental health, psychological strain, and stress in the workplace with regard to both research and practice. The IPASUM has made a significant effort to develop risk assessment procedures for psychological strain. In this context, relevant content and methods of implementation have been specified, developed, tested, and validated for small and medium-sized businesses as well as for settings like schools and hospitals. Using these evaluative results, measures are derived and concepts are developed which are then further analyzed for success. The goal of this project is to develop methods and concepts for employers to analyze their own current situations (whether independently or with partial support) and improve them as needed.

Healthcare research

In the field of healthcare research, the project "Healthcare in Bavarian schools" was conducted. The project aims to improve occupational healthcare in public Bavarian schools as well as to support the construction of the *Arbeitsmedizinische Institut für Schulen* (Occupational Medicine Institute for Schools, AMIS Bayern). Cooperating partners: Institute for Occupational, Social, and Environmental Medicine of LMU Munich, AMIS Bayern (LGL).

Teaching

The employees of the IPASUM share in the curricular teaching of both compulsory and elective subjects in the study programs Human Medicine and Medical Process Management. In addition to the core subjects of occupational, social and environmental medicine, the IPASUM assists in coordinating complementary subjects Q3 and Q10 as well as career exploration. Moreover, Bachelor and Master theses, as well as dissertations for the medical and natural sciences, are supervised.

Selected publications

Verma N, Pink M, Kersch C, Rettenmeier AW, Schmitz Spanke S. Benzo[a]pyrene mediated time and dose dependent alteration in cellular metabolism of primary pig bladder cells with emphasis on proline cycling. *Arch Toxicol.* 2019; 93: 2593–2602

Weistenhöfer W, Uter W, Bernet F, Drexler H. The tissue viability imaging system-Suitable method for discovering minimal skin changes

in occupational screenings? Results of a cross-sectional field study. *Skin Res Technol.* 2019; 25(4): 553-563

Hiller J, Klotz K, Meyer S, Uter W, Hof K, Greiner A, Göen T, Drexler H. Systemic availability of lipophilic UV filters through dermal sunscreen exposure. *Environ Int.* 2019; 132: 105068

Eckert E, Purbojo A, Müller J, Rüffer A, Cesnjevar R, Göen T, Münch F. Plasticizer exposure of neonates by heart surgery. *Toxicol Lett.* 2020; 330:7-13

Kilo S, Wick J, Vijayan SM, Göen T, Horch RE, Ludolph I, Drexler H. Impact of physiologically relevant temperatures on dermal absorption of active substances - an ex-vivo study in human skin. *Toxicol in vitro* 2020; 68: 104954

Wischlitzki E, Amler N, Hiller J, Drexler H. Psychosocial risk management in the teaching profession: A systematic review. *Saf Health Work.* 2020; 11: 385-396

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. 'S. Fustinoni, Università degli Studi di Milano, Mailand: Italien