

STRATEGIC PLAN FOR RESEARCH AND PROFESSIONAL DEVELOPMENT 2014- 2016

DIVISION OF ENVIRONMENTAL MEDICINE
NORWEGIAN INSTITUTE OF PUBLIC HEALTH

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NEW STRATEGIC ACTION PLAN FOR DIVISION OF ENVIRONMENTAL MEDICINE

Knowledge generation through our own and others' research and monitoring constitutes the main basis for what we provide to society in the form of advice and services. In order to maintain the high quality of our services, it is important to build on our solid expertise in mechanism understanding, toxicology, exposure research and water hygiene. Furthermore, a strong national and international commitment is crucial for succeeding in the competition for external research funding.

MI's new strategic plan for research and professional development emphasizes academic integration and bridging the gap between toxicological, experimental research and epidemiological research. In this way, we will actively contribute to more efficient utilization of the department's academic breadth.

We wish to further develop our expertise in dietary and environmental epidemiology at a high scientific level using tools within GIS and relevant statistical methods. We will also strengthen our expertise in analysing disease burden attributable to environmental impact.

Water hygiene is an important focus area where major efforts are being made both nationally and internationally. It is therefore important to maintain and expand our expertise in this area.

Experimental work with animal models and cell cultures will continue to constitute the core of toxicological research at MI. This area must therefore also be strengthened and better anchored in the institute's common strategy.

FOUNDATION

Solid professional expertise is our most important foundation. We develop this expertise further in two ways; by assessing knowledge that others have brought forward and through their own research on the importance of environmental factors for disease development, disease outbreaks and health. Our research is conducted in collaboration with other academic communities nationally and internationally, and is of crucial importance for good advisory activities.

MAIN GOAL

- Prevent and reduce health damage caused by environmental factors.
- Promote good health through research, risk assessments, advice and proposals for measures that improve health and prevent disease.

BENEFITS

- Scientifically based analyses, advice and services to local and central health authorities and other authorities.
- Causal research of a high standard on environmental factors and health.
- Preparedness in acute situations where environmental factors may pose a threat to the health of the population, now or in the future.
- Information to the public and the media, and contributions to competence development in cooperation with universities, university colleges and other academic communities.

WHY IS ENVIRONMENTAL MEDICINE IMPORTANT?

We are exposed to the influence of a large number of factors in air, water, food and consumer products, as well as noise and radiation. Some of these factors promote good

health, while others can play a triggering or contributing role in health damage, illness and reduced quality of life. In order to maintain a high level of protection against health damage and promote good health, there is a need for increased knowledge about both positive and negative effects of environmental factors on our health.

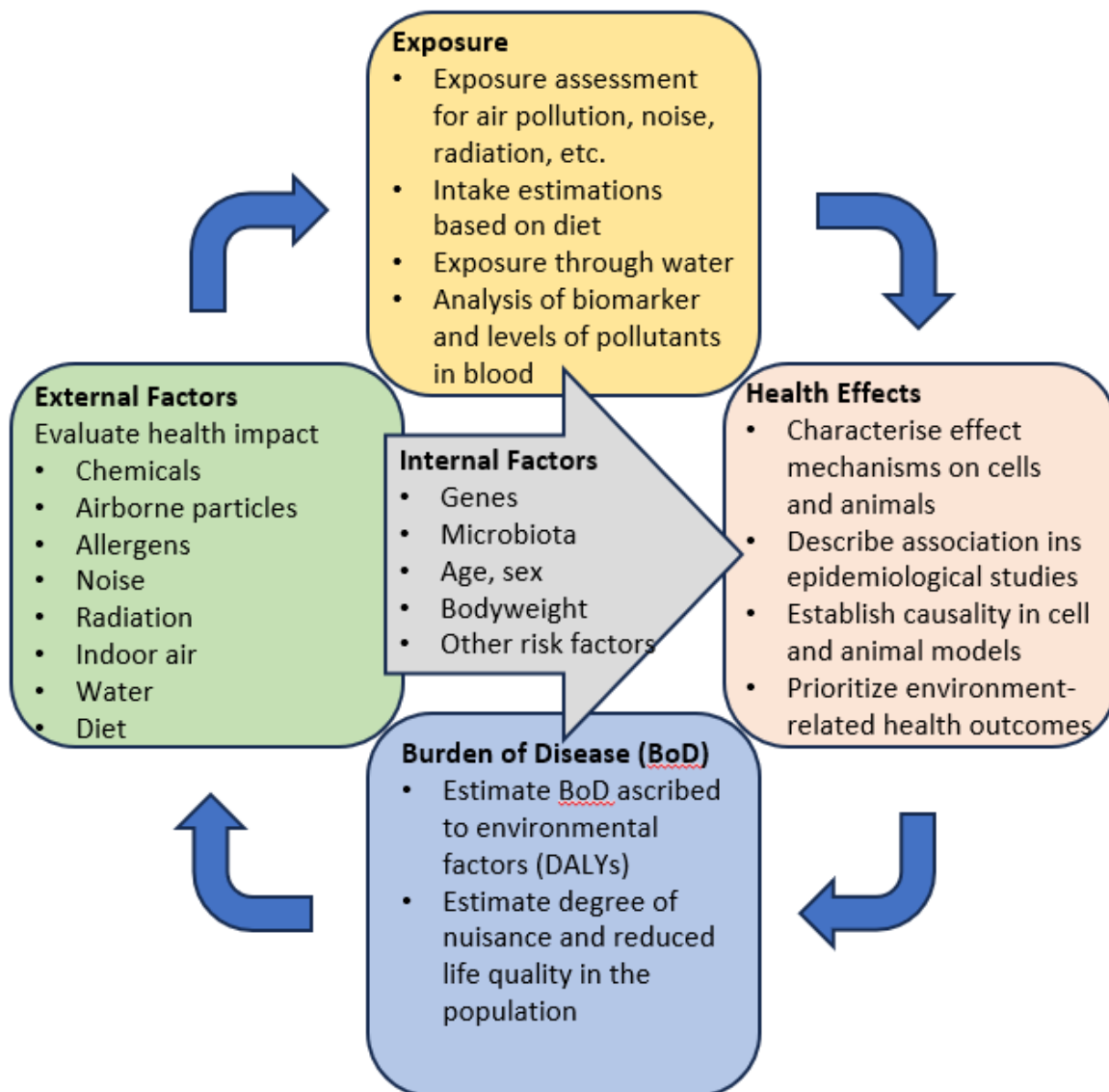
SUMMARY OF OBJECTIVES FOR MI'S PROFESSIONAL DEVELOPMENT

- Develop broad professional expertise and use this by participating in REACH, VKM, EFSA and other expert work.
- Building on our solid expertise in mechanism understanding, toxicology, exposure research and water hygiene.
- Continue to further develop our expertise in animal models and cell cultures.
- Greater professional integration and closer cooperation between both own disciplines and other areas at NIPH.
- Further develop our expertise in dietary and environmental epidemiology through research projects and closer cooperation with other divisions
- Build competence in disease burden analysis attributable to environmental impact using tools such as GIS and relevant statistical methods.
- Further develop our expertise in water hygiene, especially in international research across NIPH's disciplines
- Have a strong national and international commitment, which is crucial for succeeding in the competition for external research funding.
- Some new initiatives that will require extra effort and resources:
 - Establishment and operation of human environmental biobank
 - EU project HELIX
 - Projects under the WHO Protocol on Water and Health
 - Experimental activities related to new NFR-funded projects, EFSA assignments and the CoE project CERAD
 - Emergency preparedness work in the environmental/chemical area

THE RELATIONSHIP BETWEEN ENVIRONMENTAL FACTORS AND HEALTH

MI's overall goal consists of answering questions about the relationship between environmental factors and health. Health problems or illness that occur during life depend on genetic predispositions and factors such as age, body composition, microflora and other risk factors. Environmental influences may contribute to the development or exacerbation of existing disease.

In order to arrive at a better understanding of the importance of environmental factors for health, we need a wide range of tools, methods and, not least, expertise to work with the various areas. The figure below is intended as a way to illustrate elements that are part of knowledge generation in this area.



WHAT HEALTH EFFECTS ARE RELEVANT IN ENVIRONMENTAL MEDICINE?

Health effects that are relevant in environmental medicine range from diseases with high mortality to risk factors and various ailments and disorders that impair the quality of life of the individual.

Relevant health effects in environmental medicine:

- Cancer
- Lung diseases
- Cardiovascular disease
- Obesity
- Diabetes
- Allergy
- Waterborne diseases
- Decreased fertility
- Cognitive development in children

Which health effects should be most focused on should be subject to continuous assessment based both on the effects of new and existing substances and estimates of the disease burden attributed to environmental exposures. Moreover, clinical examinations of both children and adults constitute an increasingly important part of research in environmental medicine.

There will also be a need for research on exposures with as yet unknown health outcomes. Here, mechanistic research on cells and animals will be crucial for assessing which health outcomes are relevant.

TOOLBOX

In order to conduct good research and service provision in environmental medicine, which is an interdisciplinary field, we need a wide range of methods and tools. A better understanding of the burden of disease attributable to environmental factors will help concentrate efforts on the most important challenges. It is important to strengthen efforts in the field of environmental medicine by making greater use of epidemiological methods and tools.

MI's toolkit should include the following:

- Exposure calculations
- Chemical analyses of human material
- Cell and animal studies
- Clinical trials in humans
- Epidemiological methods

- Disease burden analyses
- Use of registry data

In some of these areas, MI has great strength and expertise, but in other areas we need to develop further. It is important to have good and close cooperation with others who have related and complementary expertise.

EXPOSURE

Food is the main source of a number of harmful environmental pollutants, such as heavy metals and biodegradable organic pollutants. However, many toxic substances have more than one route of exposure, and it is the total exposure via food, water, air and via the skin that is decisive for the level we end up with in the body and thus determines the health risks associated with the given exposure.

Where a causal association between a given exposure and a health outcome has already been established, human exposure data can be used directly to draw conclusions about health risks. In many cases, however, we do not know which levels entail health risks, nor which health outcomes are most likely. It is therefore crucial that exposure calculations and mechanistic research in cells and animals go hand in hand, and that associations from epidemiological studies are followed up with mechanistic studies to confirm causal relationships.

- MI has built up a strong and competitive environment in exposure research, including solid professional expertise and a state-of-the-art analysis park of instruments that together make us an attractive partner both nationally and internationally. Investment in a human environmental specimen bank and participation in the EU project HELIX will contribute to further development in this area.
- Water can be a source of exposure to toxic substances. But drinking water can also be a source of waterborne disease outbreaks and health problems caused by gastrointestinal infections and diarrhoea-like illnesses (endemic waterborne diseases). New projects under the WHO Protocol on Water and Health will contribute to development in this area.

ENVIRONMENTAL EPIDEMIOLOGY

The main strength of epidemiology as a working method is that it is people who are studied, and that the data obtained are directly relevant to human health. However, the relationship between disease and environmental exposure cannot be studied using epidemiological methods alone - these methods also have their weaknesses. Epidemiology is an observational method in which one has no control over the conditions of exposures and other relevant factors. Furthermore, epidemiological studies often have too low sensitivity to detect low incidences of injury or disease.

Despite many studies, no clear causal relationships have been found between the given exposure and health outcomes. That is, in many cases there is still a gap between epidemiological studies that describe correlations or associations between a given exposure and health outcomes and mechanistic toxicological research. To confirm that there is a causal relationship between a given exposure and the health effect studied, epidemiological studies must be supplemented by toxicological and mechanistic research.

The connection between contaminated drinking water and health problems is in many ways a known causal relationship. Experience has shown that waterborne outbreaks caused by drinking water can have major societal consequences. The consequences of endemic waterborne diseases, however, are less well known. There is a need to incorporate a safer method for calculating the extent of endemic disease caused by drinking water.

- MI will continue to build up its environmental epidemiological research in the areas of diet, air, noise and climate-related issues in collaboration with relevant academic communities inside and outside NIPH.
- Through participation as a key partner in the EU project HELIX, MI will build up its expertise in advanced statistical methods that can handle complex data materials in a better way than is currently possible.
- MI will develop in the area of disease burden analyses, both through projects linked to WHO's protocol for water and health and participation in NIPH's burden of disease project.

MECHANISTIC RESEARCH IN CELLS AND ANIMALS

Cell and animal models provide us with unique knowledge that we do not obtain from other types of laboratory experiments or population studies. In fact, many important results and advances in biomedical research that are often taken for granted have emerged through the use of cell and animal models. Most biomedical research is therefore conducted on biological models that meet specific criteria for accuracy, repeatability and reliability.

The essence of an experiment is to isolate and observe the effects of varying and often few specific parameters. For biomedical research, that usually means trials with well-defined populations that can be kept in highly controlled systems. Humans are too heterogeneous a group to provide accurate experimental data within a reasonable time frame.

Experimental research with cells and animals is of key importance in the prevention of health damage from environmental factors, and is closely linked to our advisory activities. In order to establish causal relationships in risk assessments carried out for the Norwegian Environment Agency, the Norwegian Food Safety Authority/VKM, EFSA, WHO, etc., results from animal and cell experiments are crucial. Associations observed in human epidemiological studies are not sufficient.

Own experience with research on cells and animals is crucial both for acquiring important knowledge and for having the necessary expertise to give advice and carry out risk assessments of high quality. It is important to have the competence to understand the strengths and weaknesses of studies, to assess relevance and to be able to assess which factors may influence experimental outcomes.

There are a number of trends that point to a continued central importance of animal experiments:

- When it comes to testing of substances, the adjuvant effect (enhancer effect) of various substances in the development of asthma and allergy is increasingly being included in international guidelines.
- Weak effects and complex combination exposures cannot be studied using epidemiological methods alone. Endocrine disruptors are particularly relevant.
- Replacing well-known substances with new substances with unknown health effects requires being at the forefront of developments and mapping possible health effects even *before* they occur in the population.

- Human health risk assessments, including chemical assessments in accordance with EU REACH legislation, are increasingly based on an understanding of mechanisms. Maintaining the competence to assist the authorities in this important work requires solid expertise in both *in vitro* and *in vivo* experiments, including mechanism research in advanced animal models.

In general, research on the relative importance of different sources of pollution also often requires experimental models

Research is demanding in terms of resources. It is therefore important that what is done is well thought out and carried out in the most rational way possible.

All research issues should be relevant to human health outcomes and provide an opportunity to test the effect of environmental factors.

Methods and models used in research should be suitable for answering the research question posed.

COMPETENCE DEVELOPMENT

To ensure a solid foundation that enables us to pursue holistic knowledge development in the field of environmental medicine, we need to strengthen ourselves in the following:

- Calculation of disease burden attributable to environmental factors
- Competence in the use of health registry data
- Statistical competence (small group statistics and epidemiological statistics)
- GIS based exposure calculations
- Epidemiological methods
- Competence in water hygiene
- Better experimental animal models and cell and organ cultures
- Close collaboration with clinical environments

General measures:

- New recruitment
- Training of employees we already have

- Closer cooperation with departments/divisions/institutions that have the desired expertise

Specific measures:

- Create a GIS group that works with exposure calculations, as well as procurement of GIS programs (ARC GIS)
- Establishment of the Environment and Health group, and follow-up in the form of concrete research collaborations
- Establish a separate expert group on climate and mould
- Better utilization of the MoBa material (started through the MoBa human environmental biobank)
- Strengthen MI's registries and make better use of these for research
 - Strengthen the registers for cosmetics and food allergy and see these to a greater extent in conjunction with other registries
 - Make greater use of VREG for both research and procurement of data requested by the authorities

We must also ensure that we remain strong in areas that make us attractive as partners in research projects (exposure research, experimental toxicological research)

RESEARCH DILEMMAS

In research, we are faced with a number of questions and dilemmas that we keep coming back to. In the following, we attempt to shed light on some such dilemmas.

May research and advice go hand in hand?

We conduct research both to build up expertise that is relevant to our advice and to obtain useful data that can be used in consulting. However, we do not have the opportunity to conduct research on everything we are supposed to advise, and researchers must be able to give advice in other/broader areas than the specialist area they are researching. MI conducts different types of counseling that require different types of expertise.

When it comes to work on risk assessments and other scientific assessments for VKM, EFSA, the Norwegian Environment Agency etc., our own research experience is crucial for the competence to assess the quality of studies and methods that are to be used as a basis for the professional advice.

Some types of advice, such as vulnerability/risk assessments in the aquatic field, are more experience-based and do not require separate research. Some of the counselling is more general and literature-based.

How to prioritize and finance new projects?

As a general rule, the division's research projects should be externally funded. This ensures that the projects have clearly defined hypotheses and that the research is of high quality. Unfortunately, external sources often do not fully finance the projects, so equity in the form of funds above the ordinary framework is required. However, it is important that internal funds are also set aside to test new pilot projects/spin-off projects. Such projects should also have clearly defined goals towards a "go/no go", and should, as a general rule, form the basis for applications for new research funding.

The division may consider earmarking a portion of the operating funds for such projects. A simple application template should be prepared and completed by the researchers and presented to and discussed with the management team. It should also be possible to set aside funds for utilisation of data collected in previous projects.

Priority use of internal funds:

- Support projects that do not have full external funding
- Utilization of data already collected in previous projects
- Pilot projects with clearly defined objectives, which can form the basis for new research funding

How to safeguard both breadth, weight and expertise?

MI provides advice and services within a wide range of academic topics, which will be reflected in the research. It is a goal to have some larger, cross-cutting projects that benefit from the breadth of expertise throughout the department, but there must also be room for different subject themes to live and flourish side by side.