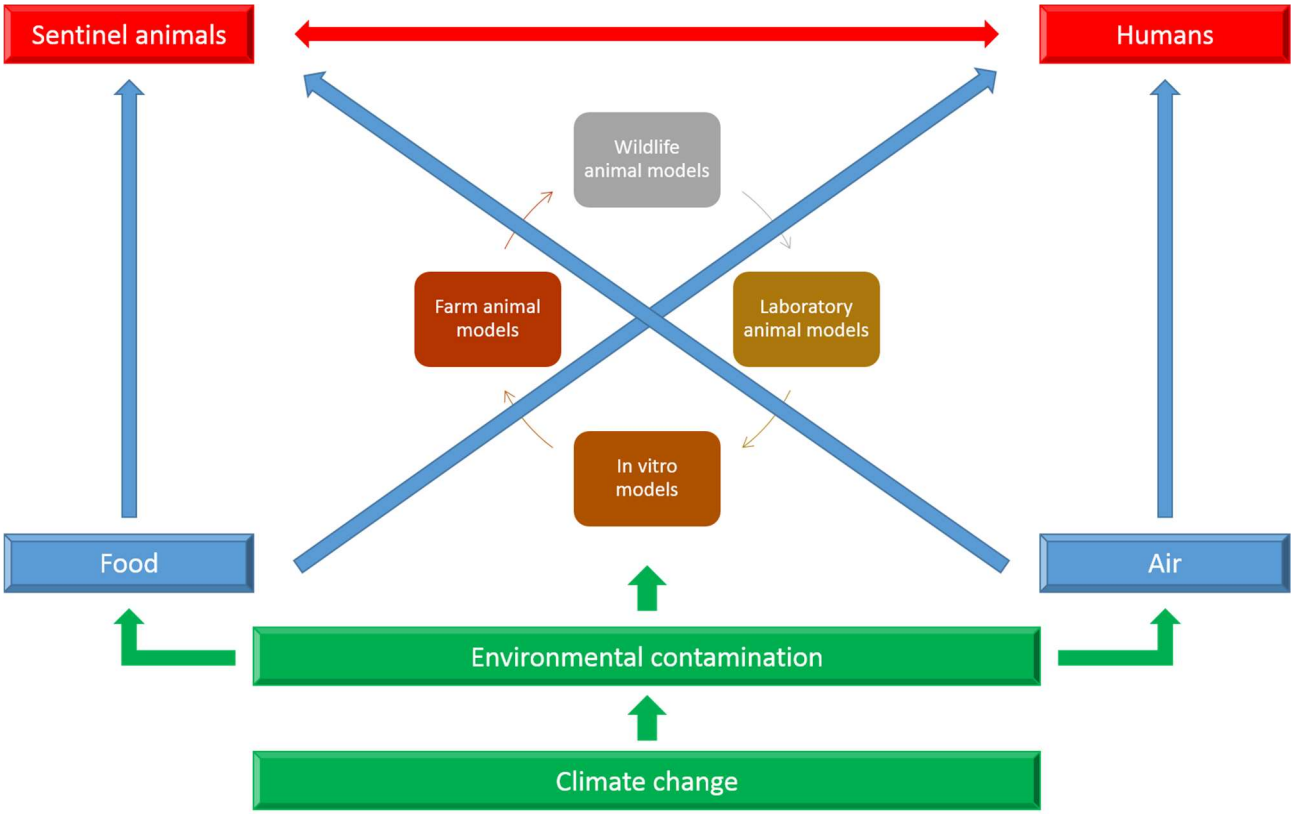
NOVA UNIVERSITY NETWORK

HOH HELSINKI ONE HEALTH

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI
ELÄINLÄÄKETIETEELLINEN TIEDEKUNTA
VETERINÄRMEDICINSKA FAKULTETEN
FACULTY OF VETERINARY MEDICINE

Reproductive health in a changing world – Effects of environmental contamination & climate change

A One Health approach



Helsinki, Finland | 7 – 11 October 2019

*NOVA PhD course**

2 ECTS

* The **course is free of charge (course participation, lunch & coffee / tea during breaks)** for students and academic personnel from the NOVA and BOVA university network as well as outside these networks working at an institution of higher education. Students include PhD/Licentiate students plus qualified master's students. Veterinary students enrolled in residency programmes are treated on a par with veterinary PhD students. For participants from the industry, the course fee is 500€. Accommodation is not included. More information: https://www.nmbu.no/en/students/nova/students/phd-fees

Course description

Global emission of environmental pollutants such as persistent organic pollutants (POPs) and heavy metals have increased dramatically. Furthermore, climate warming, one of the main features of global change, accelerated the volatilization process of environmental pollutant and increased their amount in the environment. Concurrent, there has been a decrease in the age of onset of puberty and fertility parameters as well as an increase in diseases, such as testicular cancer, and developmental abnormalities of the urogenital tract in humans. These trends have been observed also in companion animals such as dogs and cats. Causality between increased environmental pollutant and decreased reproductive health through endocrine disruption has been shown and has been supported by experiments with laboratory and farm animals and from field studies of wildlife.

This course will give an overview about environmental contamination and air pollution, sources of contaminants and interaction with climate change. Present exposure levels, bioaccumulation in the food chain, potential health effects and assessment / measurement of these contaminants will be highlighted (Course Day 1). Furthermore, the concept of endocrine disruption and the effects of endocrine disrupting chemicals (EDCs) on reproductive health in women and men as well as effects on embryonic development during pregnancy will be discussed (Course day 2). The concept of One Health, the connection between human health to the health of animals and environment, will be introduced using the example of arctic One Health (Course day 3). The arctic environment can be regarded as a sink for environmental pollutants and therefore a perfect example. Furthermore, studies on the effects of EDCs on reproductive health will be reviewed in several animal species. These animal species have been either used as sentinel models (e.g. dog, cat) or experimental models (e.g. farm and laboratory animals) for the human. These reviews will be designed to update current understanding on the impact of EDCs on reproductive development and health and to discuss the relevance of data obtained from these studies to other species, including humans. The relative advantages and disadvantages of alternative animal models will be debated and the work placed into perspective in relation to the global problem of environmental contamination with EDCs (Course day 4 – 5).

Course Organizer

Animal Reproduction Science Group, Faculty of Veterinary Medicine, University of Helsinki

Helsinki One Health research group, University of Helsinki

Course leader: Stefan Björkman, DVM, PhD, DiplECAR

Contact: Stefan.bjorkman@helsinki.fi

Like us on facebook **@AnimalReproductionScience**

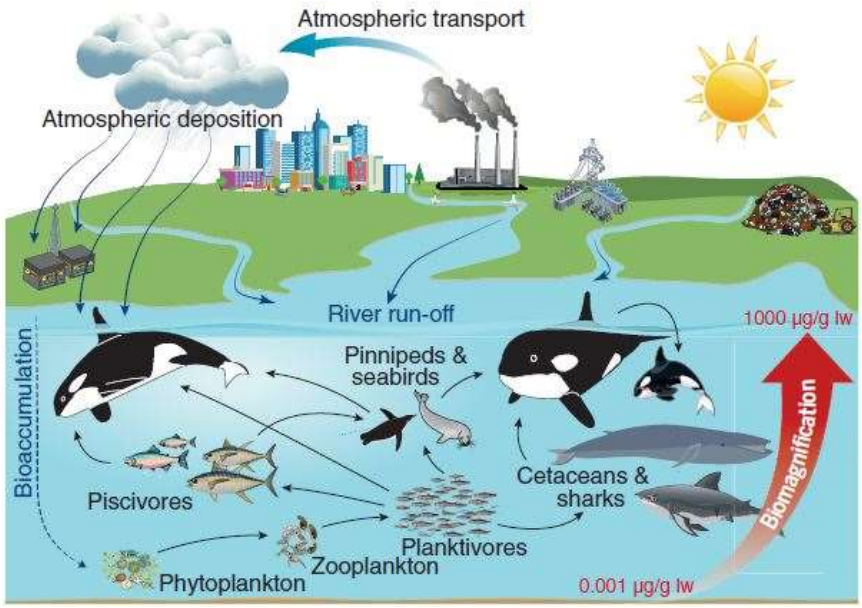
Course Application

Deadline: September 1, 2019, 8:00 PM EEST

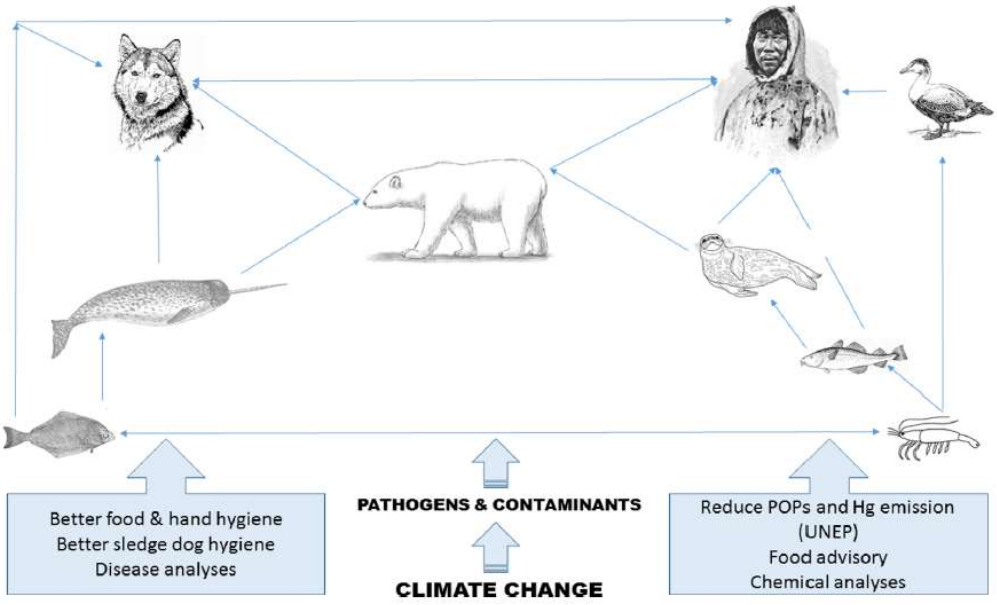
Apply here:
https://forms.office.com/Pages/ResponsePage.aspx?id=WXWumNwQiEKOLkWT5i_j7skF5jpU0sNDo_extrD9HhtUQUhRRjRDNloyRzExN0w1WlBXOEJNMTRaNi4u

Course Background

Environmental pollution, endocrine disrupting chemicals and reproduction | Chemical pollution has markedly increased over the last centuries. The 1850s marked the period of early industrialization and was associated with elevated emissions of heavy metals, whereas the onset of the 1940s marked the onset of large volume worldwide use of industrial chemicals and pesticides. In recent years, increased public awareness of toxic environmental chemicals in agriculture has led to increased attention on domestic animal production systems and the potential consequences of dietary exposure to the consumer. These environmental chemicals can be regarded as endocrine-disrupting chemicals (EDCs). An EDC has been defined as an exogenous substance that alters the endocrine system and consequently causes adverse health effects. It is now clear that many of these EDCs perturb a wide range of biological processes and physiological systems including gametogenesis, steroidogenesis, the neuroendocrine and immune systems as well as nutrient partitioning and metabolism. Since all of these processes are crucial for reproductive development, EDCs have the potential to impact on fertility at multiple levels. Chemicals described as EDCs are extremely heterogeneous and originate from a diverse range of sources. The main route of exposure to EDCs is through the diet. However less characterized modes of exposure also occur through the inhalation of industrial volatile organic chemicals, the production of which has markedly increased in recent years. (Text adapted from: Lea, Richard G., et al. "Endocrine disruptors and ovine reproductive development.")

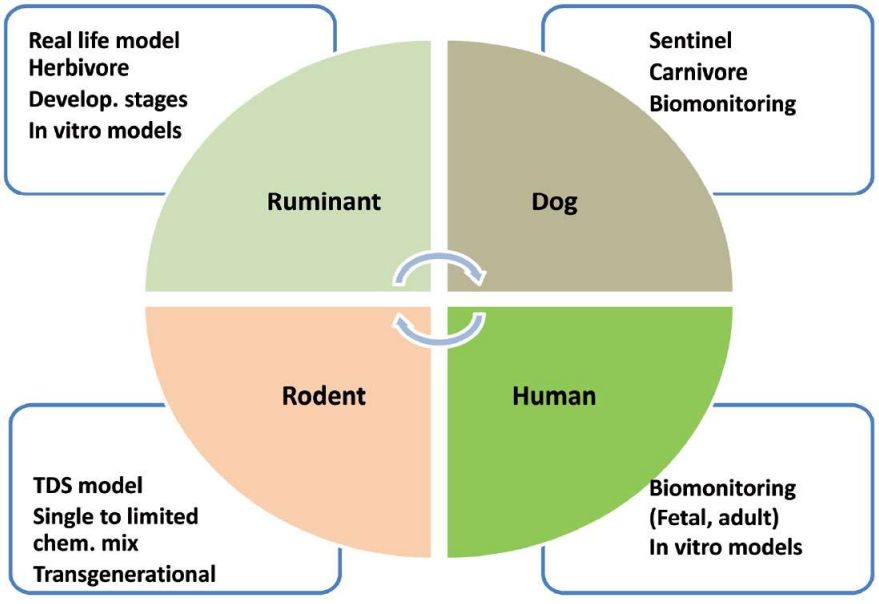


One Health in the artic | Hunting and fishing have always been an important part of Arctic human existence and their intensity has increased with a growing Arctic human population. In addition to elevated heavy metals, an array of anthropogenic chlorinated, brominated, and fluorinated persistent organic pollutants (POPs) have been introduced to the Arctic. POPs and heavy metals typically originate from industrial and household emissions at temperate regions and are transported via global atmospheric and oceanic pathways that result in deposition in the Arctic environment. Arctic fish and wildlife take up these POPs and heavy metals. Additional low excretion of these compounds results in a net intake of POPs and heavy metals over time, referred to as bioaccumulation, and is moreover transferred from prey to predator along the food chain resulting in biomagnification. Long-range transported pollutants have been extensively monitored in the Arctic due to the high exposure of Inuit populations, resulting from their consumption of a marine diet consisting especially of marine predators high in contaminants. (Text and Figure adapted from: Sonne, Christian, et al. "A veterinary perspective on One Health in the Arctic.")



A simplification of the marine food web and One Health in the Arctic.

Use of animal models | Animals can contribute in a more general way to increasing our understanding of endocrine disruption. The generality of data obtained from studies on EDCs in laboratory rodents can always be challenged with reference to the physiological diversity of the animal kingdom. This is true with regard to toxicology relating both to wildlife and humans. In the latter case, it is difficult for practical reasons to generate a regulatory system using other species than laboratory rodents. Experimental studies in farm animals would reveal how universal findings in laboratory rodents actually are for EDCs. Therefore, endocrine disruption is best studied in a number of laboratory and sentinel species in order to properly account for inter-species differences in exposure, internal dosage, metabolism and phenotypic response. Companion animals have been used as sentinel models for human exposure to EDCs. The use of sentinel models, especially for chronic exposure to ambient levels of environmental EDCs, provides insight not gained from experimental models Nevertheless, because disturbances in the endocrine system can affect multiple systems, understanding the effects of EDCs is best accomplished by combining *in vitro* with *in vivo* approaches. (Text adapted from: Magnusson, Ulf. "Can farm animals help to study endocrine disruption?"; and Lea, Richard G., et al. "Endocrine disruptors and ovine reproductive development")



Roles of experimental animal models and sentinel species in determining the reproductive impact of endocrine disrupting chemicals

Course Programme

Environmental contamination & pollution | Monday, October 7, 2019

8:30 – 9:00	SB – Welcome / Introduction of the course
9:00 – 12:00	**Session 1 – Air quality & pollution**
9:00 – 9:45	TR – Birth, life and death of air pollutants & working with Air Quality Index - Sources of air pollutants, long range transport & Definition & measurement of air quality index
9:45 – 10:00	Coffee break
10:00 – 10:45	TR – From urban and regional air quality to global viewpon - Indoor, urban & regional air quality, potential health effects of air pollutants, interactions & climate change
10:45 – 11:00	Coffee break
11:00 – 12:00	TR – Discussion / Workshop on air quality & pollution
12:00 – 13:00	Lunch break
13:00 – 16:00	**Session 2 – Environmental contaminants in food products**
13:00 – 13:45	RP - Sources, present exposure levels, potential health effects & risk assessment of organic contaminants in food products
13:45 – 14:00	Coffee break
14:00 – 14:45	RP - Sources, present exposure levels, potential health effects & risk assessment of heavy metals in food products
14:45 – 15:00	Coffee break
15:00 – 16:00	RP – Discussion / Workshop on environmental contaminants in food products
18:00 – 21:00	**Social event**

Endocrine disruption & reproductive health in humans | Tuesday, October 8, 2019

9:00 – 12:00	**Session 3 – Endocrine disruption & reproductive health problems in men**
9:00 – 9:45	JT – Environmental endocrine disruption
9:45 – 10:00	Coffee break
10:00 – 10:45	JT – Effects of EDCs on reproductive health in men
10:45 – 11:00	Coffee break
11:00 – 12:00	JT – Discussion / Workshop on endocrine disruption & reproductive health problems in men
12:00 – 13:00	Lunch break
13:00 – 16:00	**Session 4 – Reproductive health problems in women**
13:00 – 13:45	PD – Effects of EDCs on reproductive health in women
13:45 – 14:00	Coffee break
14:00 – 14:45	PD – Human fetal exposure to EDCs during pregnancy
14:45 – 15:00	Coffee break
15:00 – 16:00	PD – Discussion / Workshop on the effects of EDCs on reproductive health in women & fetuses

One Health in the arctic & arctic animal models | Wednesday, October 9, 2019

9:00 – 10:30	SB – Peer Group work
10:30 – 11:00	Coffee break
11:00 – 12:00	CS - One Health in the arctic: Artic environment & climate change, Bioaccumulation of environmental contaminants in the arctic food chain, human health in the arctic
12:00 – 13:00	Lunch break
13:00 – 16:00	**Session 5 – Arctic animals**
13:00 – 13:45	CS – Arctic wildlife animals: Effects of EDCs on reproductive health of polar bears, seals, whales & seabirds
13:45 – 14:00	Coffee break
14:00 – 14:45	CS – Arctic domesticated animals: Effect of EDCs on reproductive health of sled dogs & arctic foxes
14:45 – 15:00	Coffee break
15:00 – 16:00	CS – Discussion / Workshop on One Health in the arctic & arctic animals

Experimental animal models | Thursday, October 10, 2019

9:00 – 12:00	**Session 6 - Laboratory animal & *in vitro* models**
9:00 – 9:45	UM – Use of laboratory animals to better understand the effects of EDCs on reproductive health
9:45 – 10:00	Coffee break
10:00 – 10:45	RL – Use of *in vitro* models to better understand the effects of EDCs on reproductive health
10:45 – 11:00	Coffee break
11:00 – 12:00	UM / RL – Discussion / Workshop on laboratory animal & in vitro models
12:00 – 13:00	Lunch break
13:00 – 16:00	**Session 7 – Farm animal models**
13:00 – 13:45	UM – Effects of EDCs on reproductive health in pigs
13:45 – 14:00	Coffee break
14:00 – 14:45	RL – Effects of EDCs on reproductive health in ruminants
14:45 – 15:00	Coffee break
15:00 – 16:00	UM / RL – Discussion / Workshop on farm animal models

Sentinel animal models | Friday, October 11, 2019

9:00 – 12:00	**Session 8 – Sentinel animal models**
9:00 – 9:45	UM – Effects of EDCs on reproductive health in minks
9:45 – 10:00	Coffee break
10:00 – 10:45	RL – Effects of EDCs on reproductive health in dogs & cats
10:45 – 11:00	Coffee break
11:00 – 12:00	UM / RL – Discussion / Workshop on sentinel animal models
12:00 – 13:00	Lunch break
13:00 – 14:30	SB – Peer group work
14:30 – 15:00	Coffee break
15:00 – 15:30	SB – Closing of the course

Course Teachers

TR – Taina Ruuskanen | Taina is a university lecturer at the Atmospheric and Earth System Research (INAR), University of Helsinki. This institute is the state-of-the-art research institute globally in atmospheric sciences, especially in the field of atmospheric aerosols. Research topics cover a wide range from urban and regional air quality to aerosol measurement techniques and aerosol-health interaction. INAR is providing intensive training courses on aerosol measurement techniques all over the world.
More information: https://tuhat.helsinki.fi/portal/en/person/ruuskane

RP – Raimo Pohjanvirta | Raimo is a Professor at the Department of Food Hygiene and Environmental Health, University of Helsinki. His research focuses mostly on one significant group of environmental contaminants: PCBs, especially on risks for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food. Raimo has also conducted research on food contamination with heavy metals, especially in game meat.
More information: https://tuhat.helsinki.fi/portal/en/person/rpohjan

JT – Jorma Toppari | Jorma is a Professor in Physiology at the Institute of Biomedicine, University of Turku. He is teaching male reproductive endocrinology, endocrine disruption, and reproductive toxicology. He is an international expert in environmental endocrine disruption and male reproduction. He is leading a joint Finnish-Danish birth cohort study exploring the environmental aspects of human reproduction. His research focus is on identification of risk factors of reproductive health and the effects of endocrine disruptors on reproductive health.
More information: https://www.utu.fi/en/people/jorma-toppari.

PD – Pauliina Damdimopoulou | Pauliina is a senior researcher at the Division of Obstetrics and Gynaecology, Department of Clinical Science, Karolinska Institutet. Furthermore, she is a docent in endocrine physiology at the University of Turku, giving lectures on endocrine disruptive chemicals and female fertility. Her research focus is on the identification of chemicals that associate to decreased fertility in woman, on the effects of chemical exposures on ovarian follicles using in vitro cell and follicle culture models as well as patient samples, and mapping human foetal exposure to endocrine disrupting chemicals.
More information: https://ki.se/en/people/paudam.

RL – Richard Lea* | Richard is an Associate Professor of Reproductive Biology, Faculty of Medicine & Health Sciences, University of Nottingham. Richard has recently established a research program on environmental effects on reproductive function in the dog. He and his colleagues have detected a number of environmental chemicals in dog food and in adult dog testes obtained from routine veterinary castrations. Furthermore, he has developed ovine experimental models in which pregnant ewes have been exposed to mixtures of chemicals representative of 'real-life' exposure.
More information: https://www.nottingham.ac.uk/vet/people/richard.lea

UM – Ulf Magnusson* | Ulf is a Professor of Animal Reproduction at the Department of Clinical Sciences at SLU, Uppsala. He worked several years in the field of reproductive toxicology related to environmental pollution and endocrine disruptors. That work inculded experimental studies in the domestic pigs and field studies in the wild mink. He developed the wild mink as a sentinel species for monitoring effects of and exposure by endocrine disrupting chemicals in the environment.
More information: https://www.slu.se/en/cv/ulf-magnusson/

CS – Christian Sonne* | Christian is a Research Professor at the Department of Bioscience, Aarhus University. Christian has conducted 20 years of research on Arctic wildlife, Inuits and OneHealth and is considered globally the leading expert on this topic.
More information: http://pure.au.dk/portal/en/csh@dmu.dk

* - Main teachers

Venue

Venue | Biomedicum Helsinki I, Meilahti Campus, University of Helsinki (http://www.biomedicum.fi/index.php?page=105&lang=2)

Address | Haartmaninkatu 8, 00290 Helsinki

Room | Kok.2 K88612-BP36 (https://tilavaraus.helsinki.fi/en/meilahti/biomedicum-haartmaninkatu-8/biomedicum-kok2)

Intended learning outcomes

- List the major environmental contaminants (ECs) in air and food products
- Describe how these ECs can be measured / assessed
- Associate these ECs with reproductive health problems
- List and describe current reproductive health problems in men and women
- Recall effects of ECs on embryonic development
- Explain how ECs affect reproductive health and embryonic development through environmental endocrine disruption
- Explain the concept of One Health
- Implement the concept of One Health on exploring effects of ECs on reproductive health
- Recall studies that have been conducted in laboratory animal models, *in vitro* models, farm animal models and sentinel animal models
- Interpret the results of the aforementioned studies in the context of One Health
- Propose an own study plan in exploring effects of ECs on reproductive health
    - Choose relevant environmental pollutants in regard to reproductive health
    - Explain where the pollutants come from and how to measure them
    - Identify relevant research papers on this pollutant and the effects on reproductive health
    - Outline a short description of the research method
    - Discuss possible outcomes in the context of One health

Teaching methods

- Peer-groups:
    - Participants will be divided into peer-groups of 4 students / group based on their interests (which will be explored through a questionnaire at course registration)
    - There are 2 x 1.5h peer-group sessions during the course
    - Peer-group work will continue after the course (see post-assignment)
    - During the first peer group session, participants need to present their pre-assignment (see below) to their peer-mates for discussion
    - During the second peer group session, participants start to work on their post-course assignment. They also need to discuss and decide how to proceed with peer-group work after the course
- Pre-assignment:
    - 1-2 month before the course each peer-group will get assigned 1 paper (original research article or review article) for each session (= 8 papers)
    - Each participant of each peer-group will need to read 2 articles
    - Each participant can read all 8 papers (voluntarily)
    - Each individual participants needs to write a short learning diary (analyzing ideas and information from the articles) about the papers they read (max. 1 page / paper; max. 2 pages / participant)
    - Learning diaries will serve as a base for the discussions / workshops in each session
    - Learning diaries will be used to creates wikis and will be made available to all participants
    - Learning diaries need to be submitted 1 week before the course
- Course
    - Each course day has 1-2 sessions.
    - Each session consist of 2 x 45min lectures and 1h discussion / workshop (interactive).
    - Lecture material will be shared before the lectures via moodle
    - There are 2 session for peer-group work. During peer-group work, the group will work on the post-assignment.

- Post-assignment:
    - Peer groups need to hand in a short assay (research plan) within 4 weeks after the course
    - Assignment is started during the course (see above) and will continue after the course
    - After the course, participants need to decide on how to communicate and finish the assignment (e.g. Skype for business)
    - Max. 4 pages / group
    - Assays will be shared on moodle

Assessment of the learning process

- Formative assessment:
    - Pre-assignments will be assessed before each session by the speaker of the session
    - During the workshop / discussion, speaker will give oral feedback to the participants and formative assessment of the key concepts of the lectures will be conducted
    - There will be peer-group feedback during the first peer-group session of the pre-assignment
- Summative assessment:
    - Summative assessment will be based on post-assignment
    - Post-assignment will be checked by the course leader and a written feedback will be given
    - No individual assessment; only peer-group assessment
- Grading
    - Grading is pass/fail
    - Students will pass, if the following criteria are met
        - Individual pre-assignment handed in before the course
        - Course attendance
        - Peer-group assignment (post-assignment) handed in within 1 month after the course

Estimated workload

- 2 ECTS
- Pre-assignment: 15h = 0.5 ECTS
- Lectures / Discussions / workshop during the course: 30h = 1 ECTS
- Peer-group work during the course / Post-assignment: 15h = 0.5 ECTS