

Project information

Project title

Contaminant effects on polar bear energetics

Year

2011/2012

Project leader

Heli Routti, NPI

Participants

- Heli Routti (NPI)
- Mikael Harju (NILU)
- Marte Rusten (UiB)
- Anders Goksøyr (UiB)
- Ingebrigt Sylte (UiT)

Flagship

Hazardous substances, Theme: Animal health and ecosystem

Funding Source

Fram Centre, NFR

Summary of Results

Our current *in vitro* work has been done in co-operation with NP, NILU and UiB.

In our *in vitro* work we have extracted the mixture of contaminants found in polar bear (*Ursus maritimus*) fat and liver. The total mixture from polar bear liver has been further fractionated to mixtures of various contaminant groups. We have used these mixtures to expose mouse fat and liver cell lines to investigate contaminant effects of energy metabolism and genes involved in that. Our preliminary results suggest that exposure to contaminant mixture leads to fat accumulation in preadipocytes (pre-fat cells). Our preliminary results also suggest that PPAR α , which regulates fat catabolism, and its target genes are affected by contaminant exposure in mouse liver cells. We are currently preparing contaminant mixtures of synthesized contaminants as a control for the extracted mixtures, and we will test the effects of those mixtures in fat and liver cell lines.

We have used ringed seals from low and high contaminated populations namely Svalbard and the Baltic Sea to model and study genes regulating fat metabolism *in vivo*. Our results indicate that the function of these genes may be affected by contaminant mixtures in ringed seals. The highly contaminated ringed seal population had higher mRNA expressions of PPAR γ , which regulates fatty acid storage, in fat tissue than control seals. In addition, in ringed seal liver, contaminant exposure was related to higher fat content and lower mRNA expression of PPAR α , which regulates break-down of fatty acids. We are working further on expressions of PPAR-target genes in the two ringed seal populations in order to get a more complete picture of contaminant effects on energy metabolism in ringed seals.

Based on the *in vitro* studies, we are planning the *in silico* modeling. A post-doc from UiT (Lisa Helgason) and a MSc-student from UiT/NP (Anne Marte Kvello) are starting the *in silico* modeling in December/January.

Published Results/Planned Publications

Submitted abstracts:

H. Routti, M. Rusten, M. Harju, A. Goksøyr: Effect of contaminants on polar bear fat metabolism *in vitro*. IPY, Montreal, April 2012.

H. Routti, A. Arukwe, G.W. Gabrielsen, B.M. Jenssen, M. Kanerva, R.J. Letcher, M. Nyman, M. Rusten: Contaminant effects on multiple endpoints in ringed seals - conclusions from a 5 year study. IPY, Montreal, April 2012.

Planned publications (order of authors will be defined later) to be submitted during spring 2012:

H. Routti/ M. Rusten, M. Harju, A. Goksøyr: Synergistic effects of contaminant mixtures extracted from polar bears on adipocyte differentiation *in vitro*

H. Routti/ M. Rusten, M. Harju, A. Goksøyr: Effects of contaminant mixtures extracted from polar bears on PPAR-alfa and its target genes *in vitro*

M. Castelli/ H. Routti/ M. Rusten, A. Goksøyr: Contaminant effects on genes regulating energy metabolism in ringed seal.

In addition 2-3 publications are planned based on the *in silico* work.

Communicated Results

Framdagen 11.11.2011. Short presentation "Effekter av miljøgifter i fetthomeostase" by Heli Routti

Endocrine disruption workshop in Finse 23-25.11.2011. Presentations by Marte Rusten and Heli Routti

Articles will be published at web-pages such as forskning.no and Framsenteret and NP, and press releases will be sent out after publishing the results in peer-reviewed journals.

Interdisciplinary Cooperation

The project has definitely had only benefit from the interdisciplinary cooperation. In this project fields of chemistry, molecular biology and physiology have been integrated to find answers to questions relevant for ecology and management.

Budget in accordance to results

Fram Centre budget covered approximately one third of the total costs. Bigger budget would have been preferable.

Could results from the project be subject for any commercial utilization

No

Conclusions

Our future plans are

- 1) investigate the effect of contaminants on human and polar bear PPAR α , PPAR γ and PPAR δ and human fat cell lines using *in vitro* reporter gene assay by using both extracted mixtures and those made of synthesized standards
- 2) investigate the expression of different genes in fat cells following contaminant exposure for planning future correlative studies in wild polar bears
- 3) investigate the expression of PPARs and their target genes in different tissues of polar bears
- 4) conduct proteomics in ringed seals in order to get a complete picture of effects of contaminants in ringed seals
- 5) analyze a more complete set of contaminants in ringed seals in order to make proper studies on linking gene expressions to contaminant levels

The extraction method used in this study by NILU is a new combination of known methods. The methods used in *in vitro* cell line studies have previously been used by other laboratories; the methods have been implemented to UiB due to this project.