Project information

Project title
Mixtures and metabolic syndrome
Year
2013/2014
Project leader
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Participants

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Flagship

Hazardous substances, Theme: The effects of contaminants and climate change on human health, indigenous peoples and Arctic communities

Funding Source
Fram Centre, NRC
Summary of Results

Highlights:

- No difference in blood concentration of PFOS, PFOA or PFHxS between type 2 diabetes cases and controls
- Linear PFOS affects blood gene expression in healthy women from the general population

Summary:

In the current project we have explored the relationship between type 2 diabetes (T2D) and environmental exposure to perfluoroalkyl acids (PFAAs) in Norwegian women from the general population. We are also currently investigating the effect of PFAAs on blood gene expression in that same study subjects. The study design has been case control, meaning that we analyzed blood samples and questionnaire information from 108 women with confirmed T2D and from 108 healthy, age-matched controls. There was no difference in PFOS, PFOA or PFHxS concentration between T2D cases and controls (Figure 1). Nor had PFAAs any effect on T2D when controlling for known risk factors for T2D such as body mass index and hypertension. Further there were no association between disease status, PFAAs concentration and blood gene expression, suggesting no relationship between type 2 diabetes and PFAAs.

However, when exploring the effects of PFAAs on blood gene expression among the healthy controls, we found 460 single genes differentially expressed between the 25% of subjects with highest linear PFOS concentration compared to the 25% with lowest concentrations (Figure2). Further, 321 genesets were enriched in the 3rd quartile. We are currently exploring these results, however our preliminary findings suggest that blood gene expression profiles can enhance our knowledge of the human health effects of organic contaminants.

As soon as the POP data is available that will be investigated in terms of mixture effects.

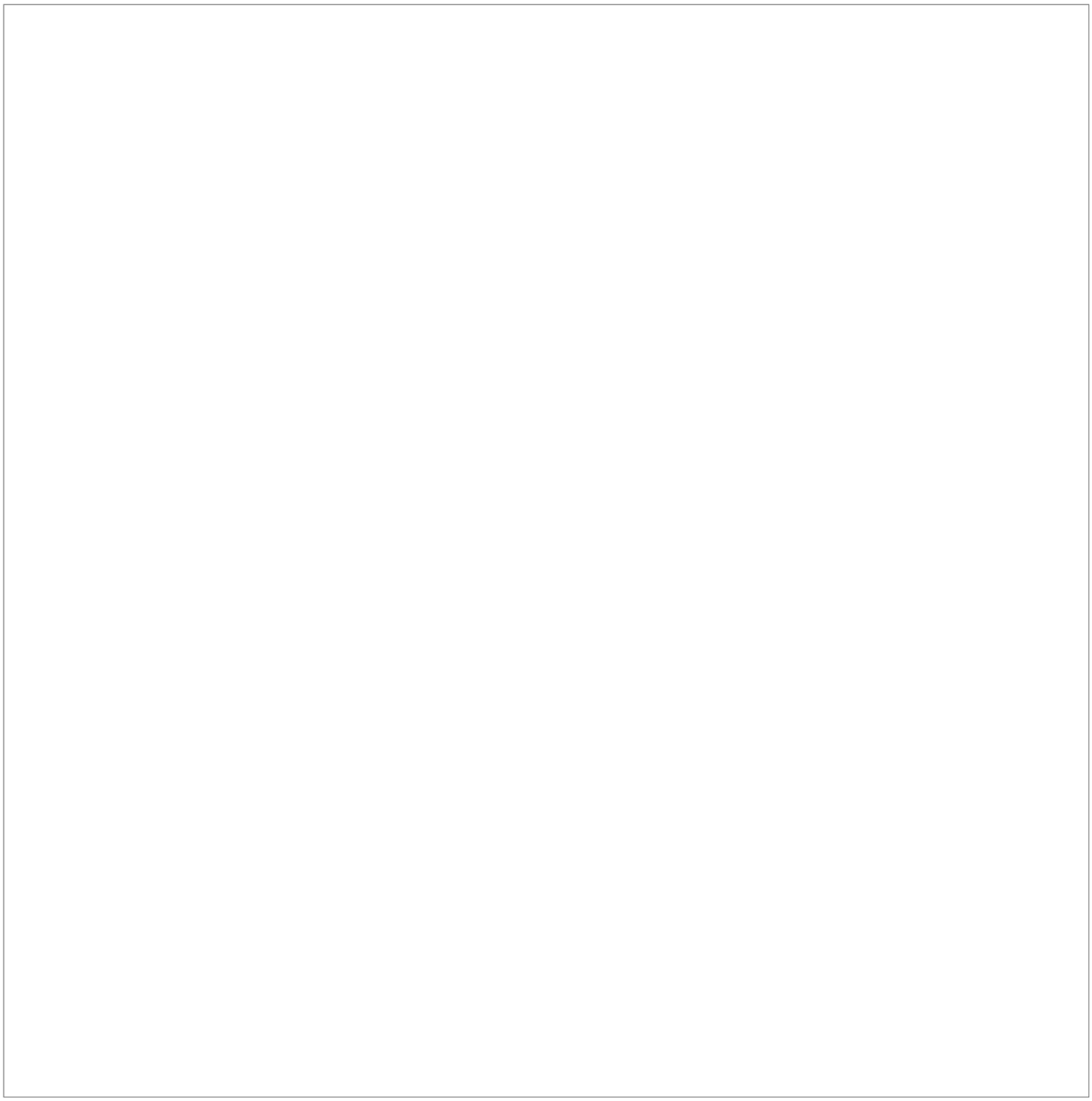

Figure 1.

For the Management

The findings that pollutants influence the way our genes are expressed can have a large potential both in terms of identifying new exposure markers, but also has the potential to be developed into disease markers. For risk assessment this is a considerable potential but there is a large amount of research needed before we can start discussing diagnostic tests etc.

Published Results/Planned Publications

A number of publications are planned as part of a postdoc study and the fram Centre funding has enable dinclusion of a large number of compounds and thus enabling publications on the mixture topic. The fact that this is part of a postdoc project ensures that the planned papers will be published.

Planned publications in peer reviewed journals:

- Mixture composition in diabetes cases and controls - the NOWAC study
- Interpreting the effects of mixtures through gene expression analysis

Communicated Results

The preliminary data is currently being assessed and the POP data are not finalized yet. Thus findings have not been communicated yet.

Interdisciplinary Cooperation

A number of disciplines have been involved in this project: Epidemiologists, environmental chemists, biostatisticians and molecular biologists.

This project would not have been feasible without a multidisciplinary approach sine the samples are from a large prospective cohort currently developing the field of molecular epidemiology. The understanding of gene sets etc is challenging without an understanding of the molecular biology and the statistical interpretation of such a large number of data impossible without the biostatisticians.

The power of this approach is evident through an increasing number of publications in this field. The research group has participants spread out globally and it can be challenging at time to communicate with all.

The research group still needs to collaborate more with groups on biochemistry and molecular biology.

Budget in accordance to results

The Fram Centre funding has been essential for this project to change from a project on PFOS and metabolic syndrome to a project on mixtures and metabolic syndrome. This has allowed for much more insight into the exposure component. This of course makes data assessment more complex and time consuming.

If Yes

The results of such a project have the potential of being developed into diagnostic tests but we are far from that now. This potential will be part of a large EU proposal planned for march 2014.

Conclusions

a) Indicate future research and/or perspectives which the project results have led to

b) List and describe new methods or techniques that have been developed during the project or that the project has revealed a need for

Using functional genomics to study health outcome and exposures has shown us that we are closed to understanding the outcome in terms of molecular mechanisms than we are to connecting the exposure and even more so the right exposure to the right mechanism and far down the line the right effects. Including the metabolic component seems rewarding at this point.