

Summary

- GenX is a potentially toxic chemical used for manufacturing goods such as firefighting foam, food wrappers, and other water-proof materials.
- We investigated gene expression of *prx-11*, a gene involved in innate immune response, when *C. elegans* were exposed to GenX through their food.
- *prx-11* was upregulated by 1.7 fold after exposure.

Abstract

The chemical GenX is used in making goods such as non-stick pans and can be found in drinking water. It is a suspected toxin, but the potential effects on humans are unclear. We aim to find out more about GenX by stressing *C. elegans* and observing the effects using qRT-PCR. Our result shows the expression level of *prx-11*, a gene that is part of the innate immune response in *C. elegans*, was upregulated after the exposure.

Introduction

Hypothesis: Feeding *C. elegans* with *Escherichia coli* (*E. coli*) cultured in 280 ng/L GenX decreases the expression of *prx-11* in the worms due to adverse effects of GenX on *E. coli*.

GenX

- GenX is a chemical with yet unknown health risks used in the manufacturing of consumer products.¹
- Culturing concentration (280 ng/L) for *E. coli* was calculated from EPA draft reference dose for human.^{2,3}

Model Organism

- *C. elegans* is a model organism whose genome is fully sequenced; it shares many genetic similarities with humans; it is easy to maintain and has a short life-cycle.⁴



Figure 1. A *C. elegans* at dauer stage. The photo was taken with a microscope at 10X magnification.

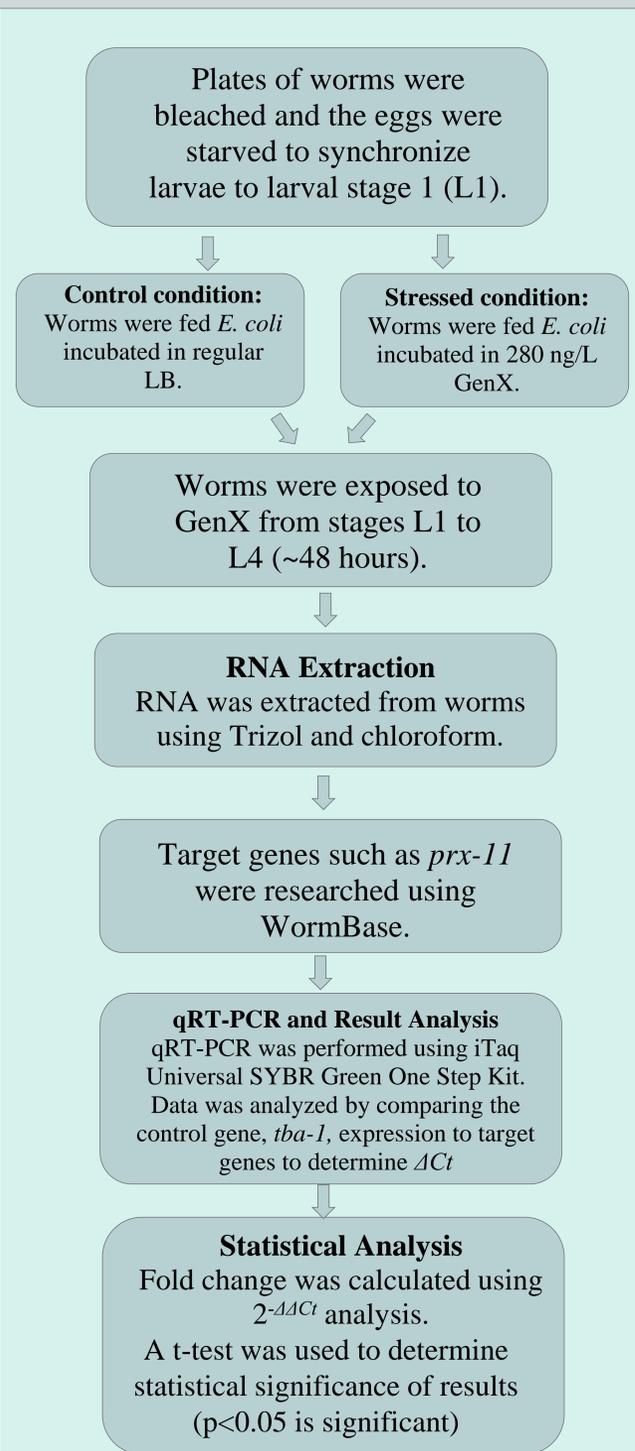
prx-11

- Part of the innate immune response which consists of physical, chemical and cellular defenses against pathogens.⁵
- Homologous to the gene *pex-11g* in humans.⁵

prx-11, a gene coding peroxisome membrane protein, was upregulated by 1.7 fold in GenX-treated *Caenorhabditis elegans*

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Methodology



Results

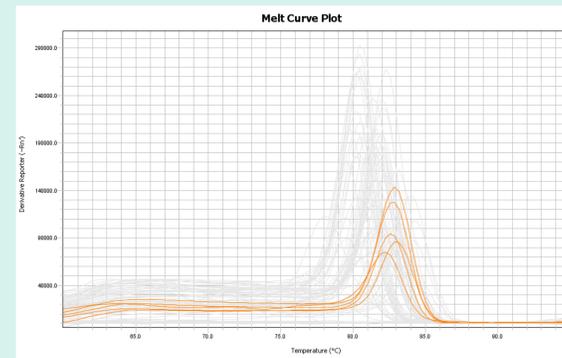


Figure 2: qRT-PCR melt curve for *prx-11*. Peaks show melting temperature of amplification products of qRT-PCR. Closeness of peaks indicates similarity of RNA transcript product. Plot was generated in QuantStudio™ Design & Analysis Software.

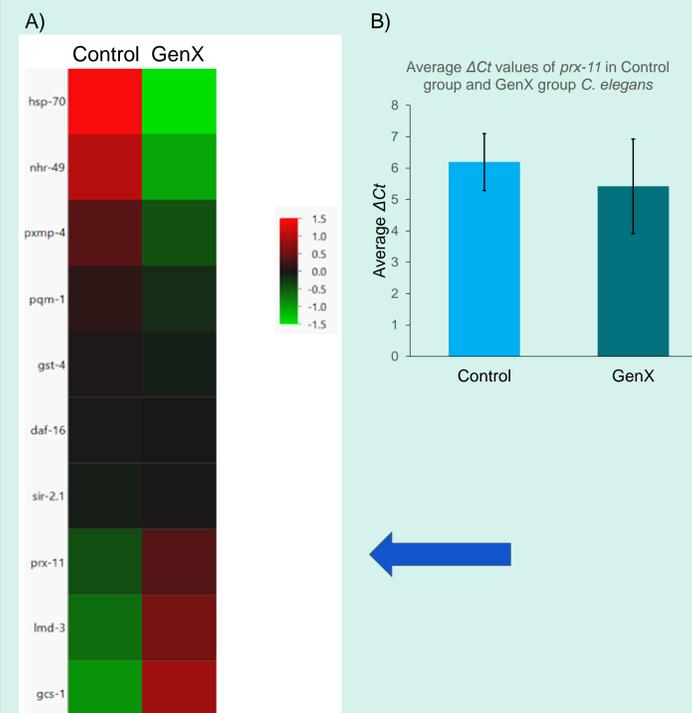


Figure 3: Comparison of *prx-11* expression levels in control group and exposure group. (A) Heatmap showing relative expression levels of tested genes. *prx-11* is highlighted by the arrow. The heatmap was created using JMP Pro 14. (B) Bar graph showing average ΔCt values. Error bars represent standard deviation. The difference between the averages are not statistically significant (p=0.527).

Conclusions

- Transcription of *prx-11* was upregulated by 1.7 fold after worms ingested GenX-exposed *E. coli*
- The upregulation of *prx-11* was not statistically significant.
- Results suggest GenX might increase innate immune response to pathogens in *C. elegans*.
- Due to *prx-11* having a homolog in humans (*pex-11g*), GenX may affect immune systems in humans.
- More data is needed for a more certain conclusion.

Study Limitations

- We only tested gene expression at one time point and didn't observe the expression across the developmental stages in the worm life cycle.
- Only one GenX concentration (280 ng/L) was used.
- *C. elegans* were pooled for analysis, therefore we could not account for individual variation.
- Exposures were done by feeding *C. elegans* with *E. coli* exposed to GenX rather than directly exposing the worms.

Future Directions

- More experiments focused on different life stages in *C. elegans* could also be useful for learning more about how GenX affects them at different stages of development.
- In a future experiment we could expose the worms to different amounts of GenX to determine a safe concentration threshold.
- *C. elegans* could be cultured in liquid media with GenX to be directly exposed.

References

