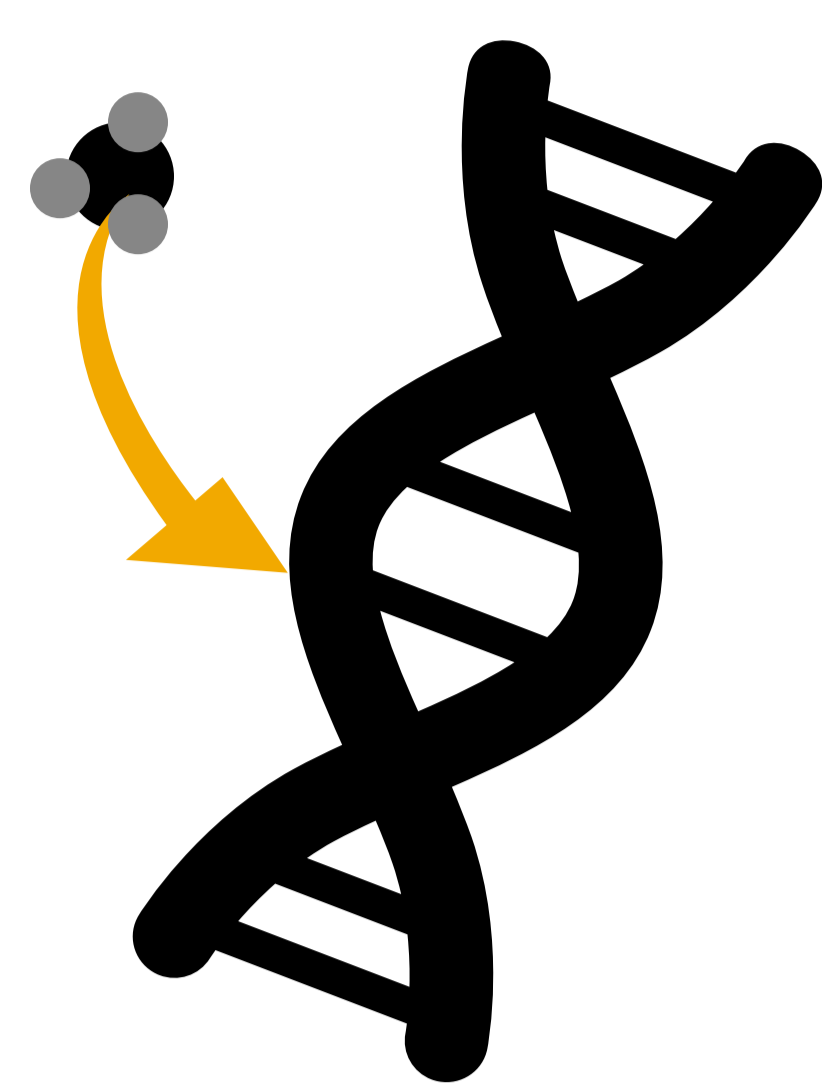


# Does PBB affect the regulation of genes?

Recently, the PBB Research Team and collaborators have tried to answer this question in a few different ways.

## But first...how are genes regulated?



Genes are made up of DNA. Epigenetics is the mechanism by which genes are turned “on” or “off” or their activity is “turned up” or “turned down.”

Environmental influences, such as a person’s diet and exposure to pollutants, can impact epigenetic regulation of gene activity by making or removing marks on DNA.

## Does PBB alter epigenetic marks on DNA?

Estrogen

In a recent study, we found the PBB exposure was associated with differences in epigenetic marks on nearly 1,900 regions of DNA

·Many of these regions are associated with estrogen (1).

·Some of the genes were related to immune function and inflammation (1).

·PBB blood concentrations were associated with a small amount of accelerated biological aging (2).

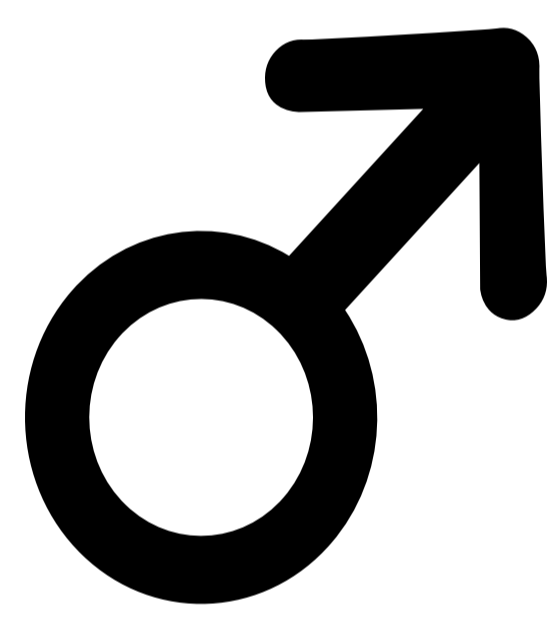
Immune Function & Inflammation

Biological Aging

These epigenetic alterations could explain some of the hormone-related health effects associated with PBB exposure. We have not yet tested a direct relationship between the epigenetic marks and health effects.

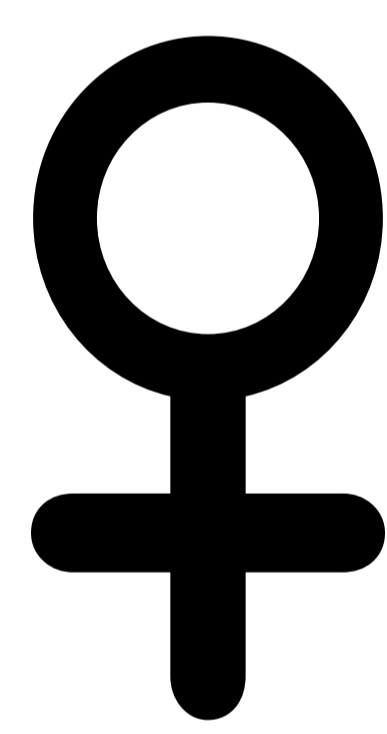
## Does biological sex influence how PBB alters gene regulation?

**Yes, for some genes.**



In a separate analysis, we found that PBB exposure alters epigenetic marks on certain genes in males differently than in females, and vice versa.

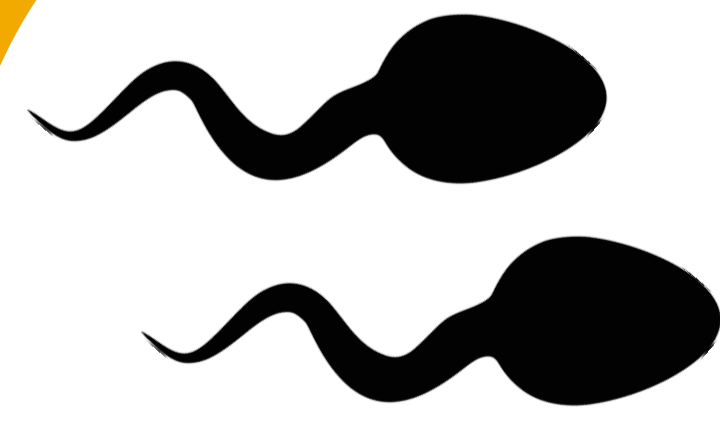
·Males’ PBB exposure was associated with altered marks in DNA regions related to immune function and reproductive function.



·In females, PBB exposure was associated with altered marks in DNA regions related to cancer development (3).

These differences in epigenetic marks in certain DNA regions could explain why PBB exposure causes different health effects in men and women.

## Can epigenetic changes associated with PBB be passed down from one generation to the next?



In a first effort to answer this question, semen samples from men in the PBB registry were analyzed for epigenetic changes. Four gene regions, which are very important for growth and development in the womb, were examined.

·The regulation of one of these four genes was abnormal among the men exposed to PBB. Normally, this gene is “turned off” in sperm. However, many of the PBB-exposed men did not have this gene completely turned off. (4)

## Citations for Research Articles

1. Curtis SW et al, 2019: Exposure to polybrominated biphenyl (PBB) associated with genome-wide DNA methylation differences in peripheral blood
2. Curtis SW et al, 2019: Environmental exposure to polybrominated biphenyl (PBB) associates with an increased rate of biological aging.
3. Curtis SW et al, 2019: Sex-specific DNA methylation differences in people exposed to polybrominated biphenyl (PBB).
4. Greeson KW et al, 2020. Detrimental effects of flame retardant, PBB153, exposure on sperm and future generations.