

Environmental Influences on the Thyroid

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Thyroid Hormone

Brain Development

- Thyroid hormone is essential for normal brain development.
- Fairly models levels of thyroid hormone insufficiency are associated with cognitive deficits at the population level.
- The timing of thyroid hormone insufficiency is important.

How we know this

- Early observations identified an association between maternal goiter and cretinism in the infant.
- Observations in both experimental animal systems and in humans show that “mild” thyroid hormone insufficiency affects brain development.

<https://www.hhmi.org/biointeractive/development-human-embryonic-brain>

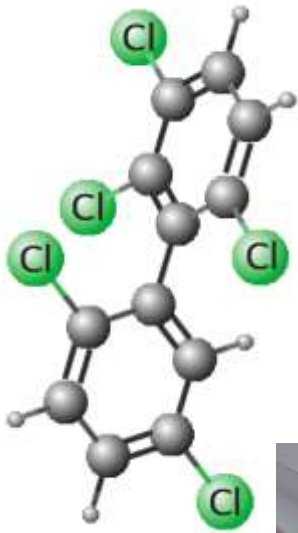
Environmental Goitrogenesis

- The concept here is that there are environmental factors that cause goiter. These factors are things like:
 - low dietary iodine
 - the presence of natural chemicals in food that inhibit thyroid function
- But, this concept also came to mean that if a chemical wasn't "goitrogenic" (i.e., cause a decrease in thyroid hormone levels), then it didn't interfere with thyroid hormone action.

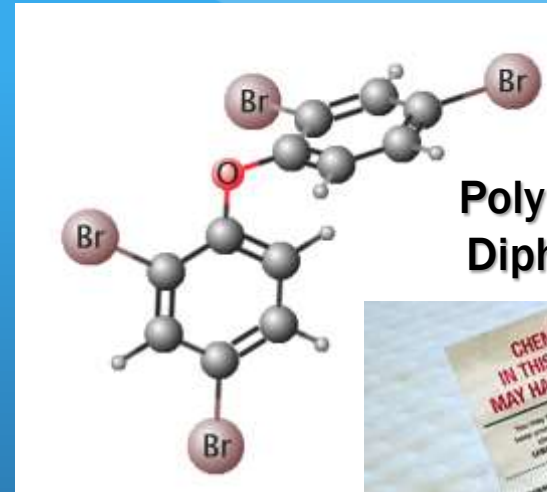
Modern Manufactured Chemicals

- The problem is that we are now exposed to chemicals that nature didn't make, and that appear to interfere with thyroid hormone action in a manner that is fundamentally different from what could be considered "goitrogenic".

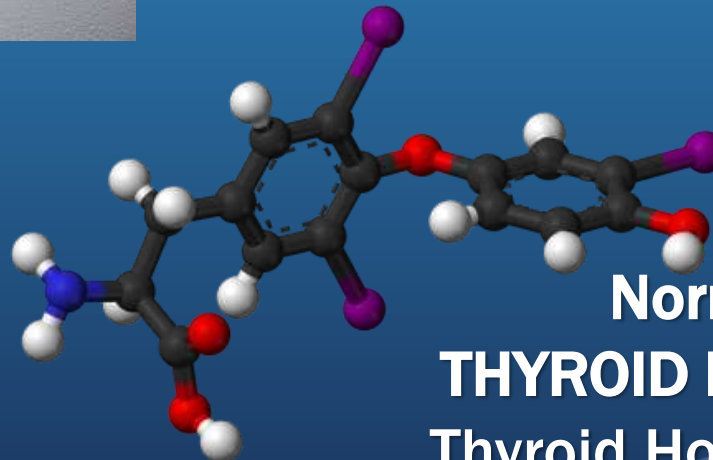
Modern Manufactured Chemicals



**Polychlorinated
Biphenyls**



**Polybrominated
Diphenyl Ethers**



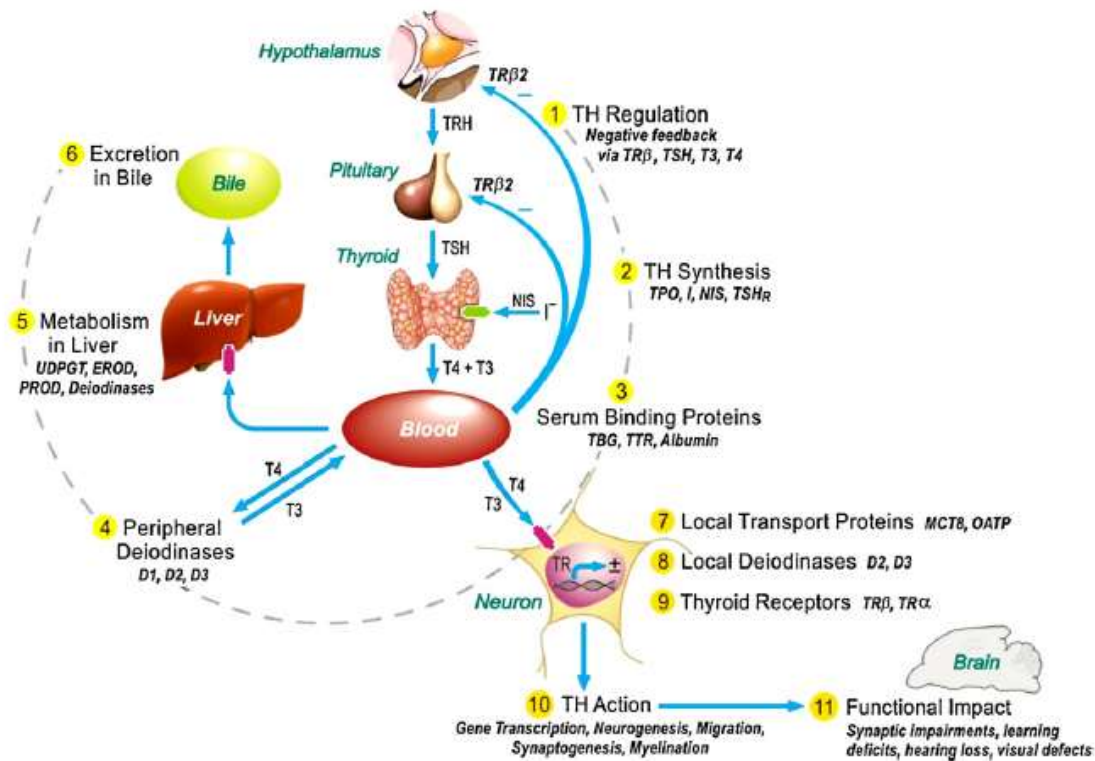
**Normal:
THYROID HORMONE
Thyroid Hormone (T₃)**

Modern Manufactured Chemicals

- These chemicals are not “natural”, so the concept of humans having evolved defense mechanisms is probably not appropriate.
- These chemicals may affect the thyroid system in a manner is that not identified by (regulatory) toxicology programs.
- What are some of these ways?

Modern Manufactured Chemicals

Possible Sites of Action of Environmental Contaminants on HPT Axis



Environmental Influences on the Thyroid - Conclusions

- Thyroid hormone is essential for development and for adult health
- Severe effects are observed when thyroid hormone levels are very low or very high (both in development and adult).
- Recent research indicates that some manufactured chemicals can interfere with thyroid hormone action - and produce adverse effects - in a manner that is not revealed by changes in blood levels of hormone.
- The regulatory system is reluctant to address this (either in the US or in Europe)