

# Evaluation of endocrine disruption in sea bass (*Dicentrarchus labrax*) :

Effects of persistent organic  
pollutants on their thyroid  
function

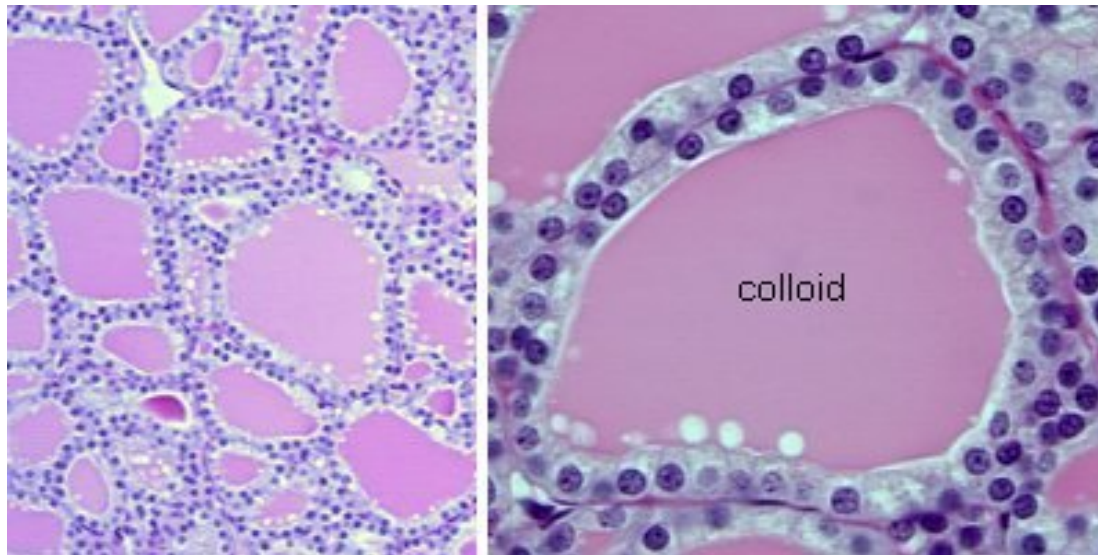
● Joseph Schnitzler

# The thyroid

- ◆ Many aspects of **thyroid endocrinology** are very **well conserved across vertebrate taxa**.
- ◆ These aspects include
  - ◆ thyroid hormone chemistry,
  - ◆ synthesis,
  - ◆ transport,
  - ◆ regulation.
- ◆ Same **proteins involved** in these processes

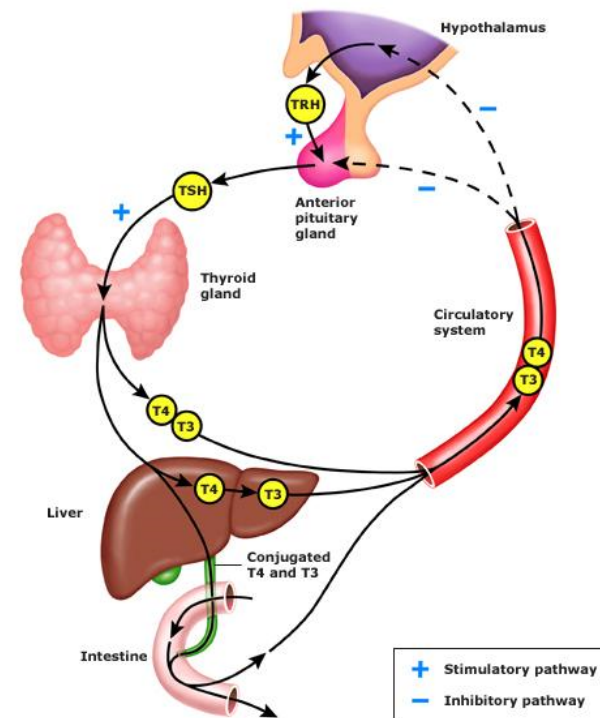
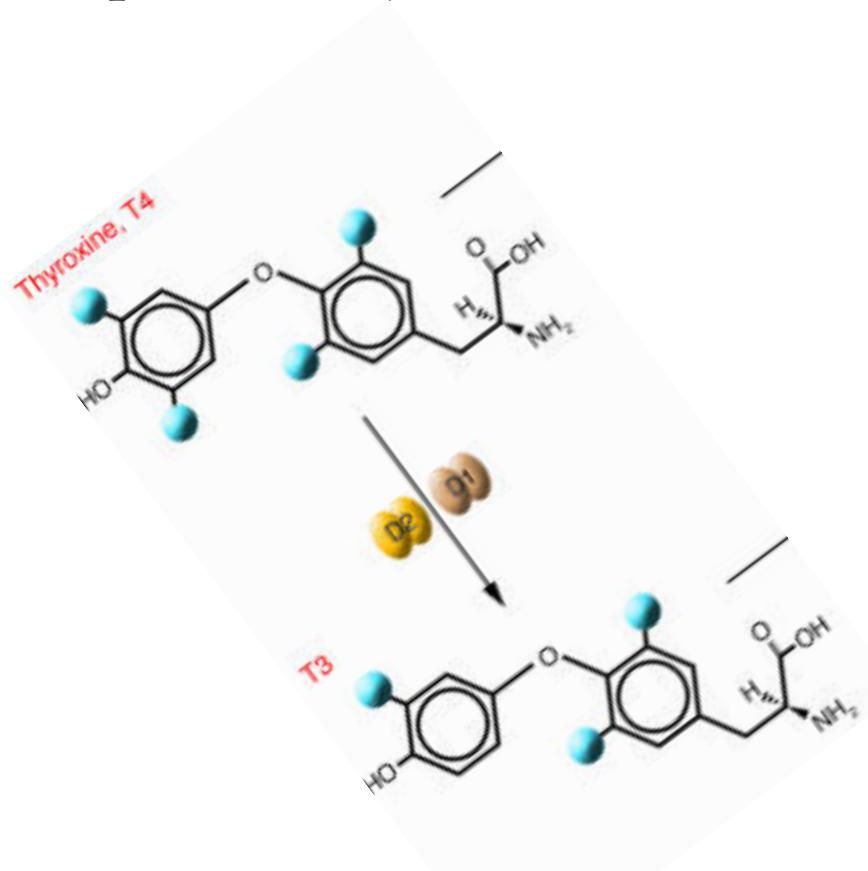
# Synthesis

- ◆ **Special functional anatomy:** Thyroid epithelial cells are arranged in spheres called **thyroid follicles**. Follicles are filled with **colloid**, a proteinaceous depot of thyroid hormone precursor.



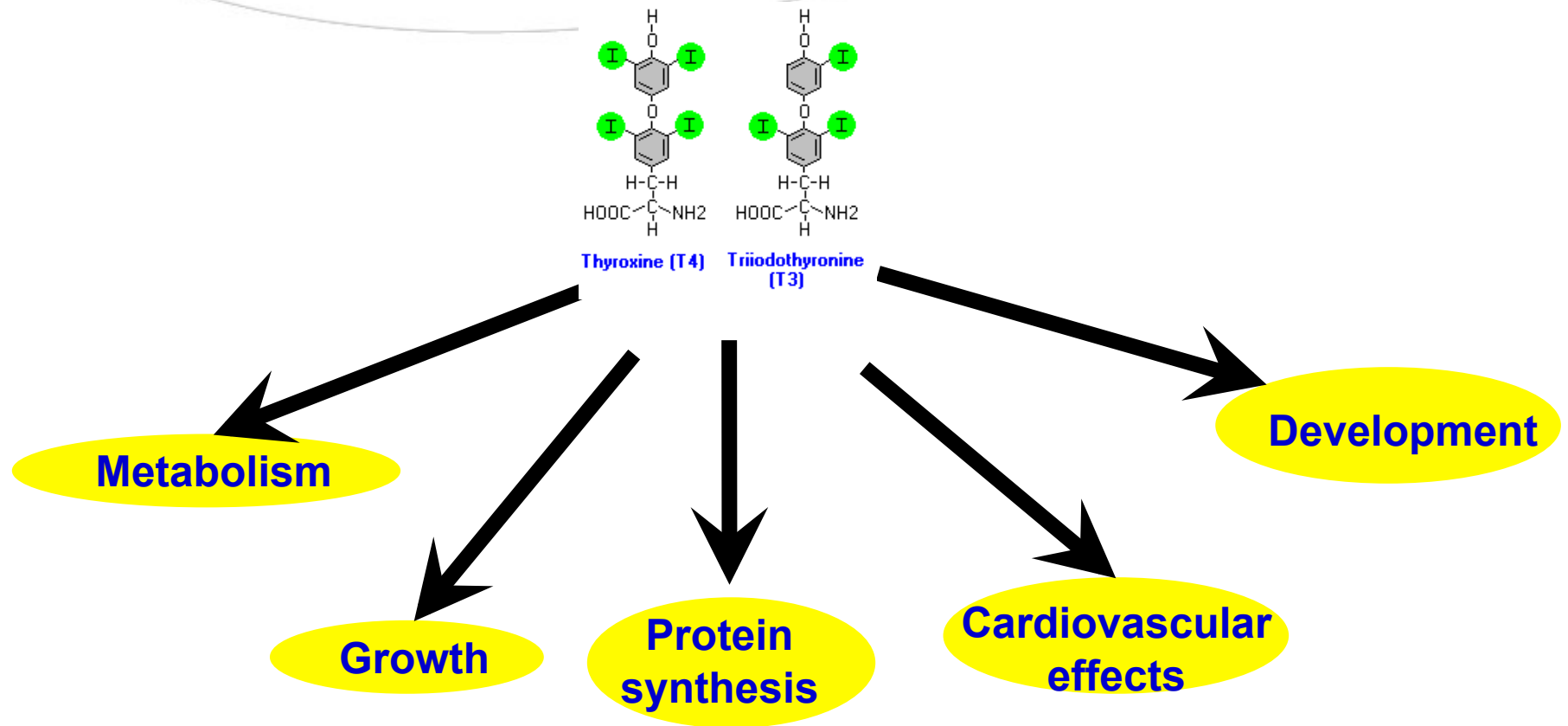
# Metabolism

- 💧 **Secrete a prohormone:** which has to be metabolized by specific enzymes deiodinases.

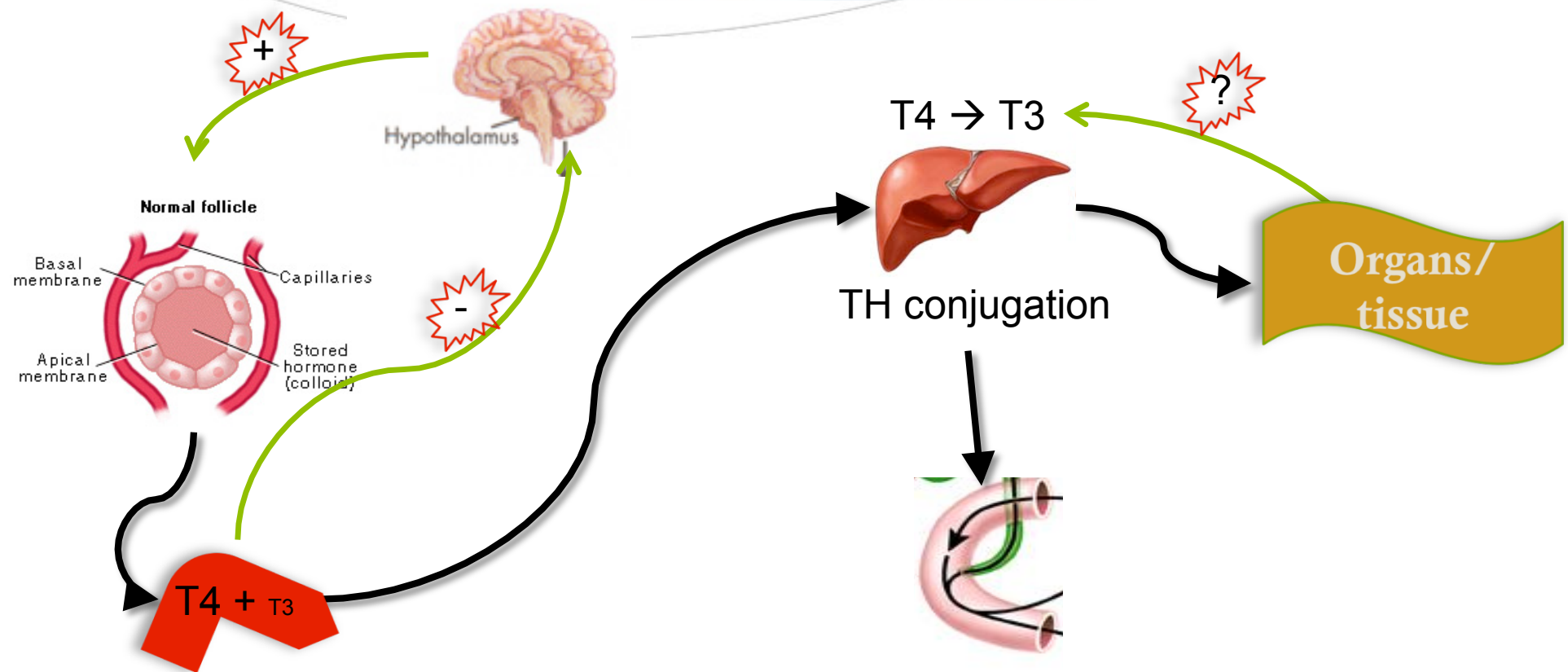




# Thyroid hormones play a crucial role in:



# Regulation



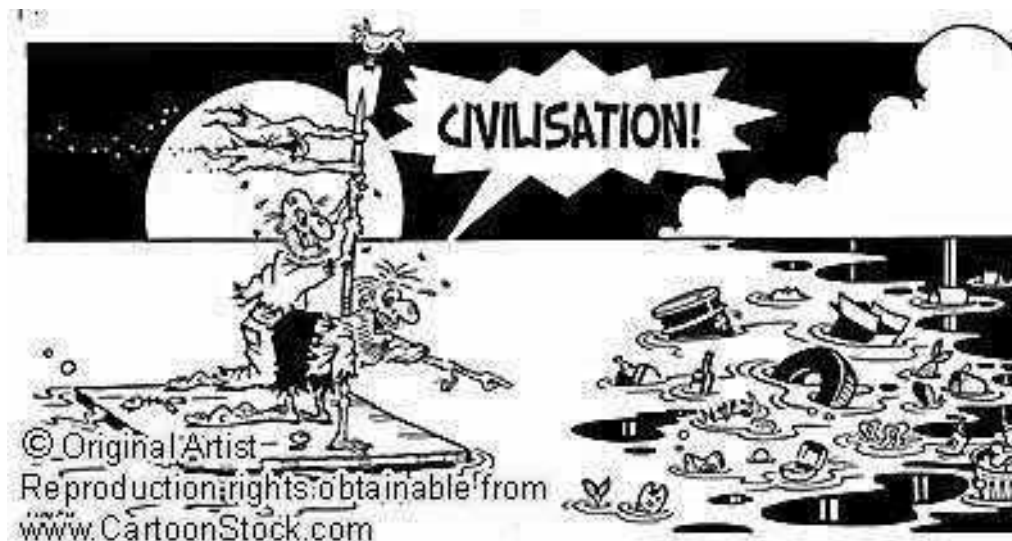
T4 → Centrally controlled  
hypothalamus-pituitary-thyroid axis

T3 → Peripheral control in extra-  
thyroidal tissues

# Endocrine disruptors

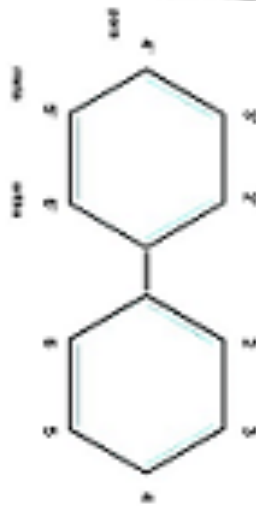
Endocrine disruptors:

- ◆ synthetic chemicals
- ◆ mimic or block hormones
- ◆ disrupt hormone function

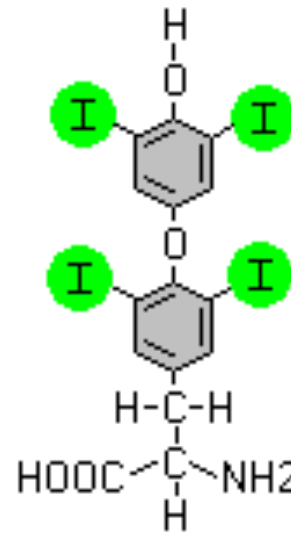


→ Sea as “final sink” for pollution contains high concentrations of endocrine disruption chemicals

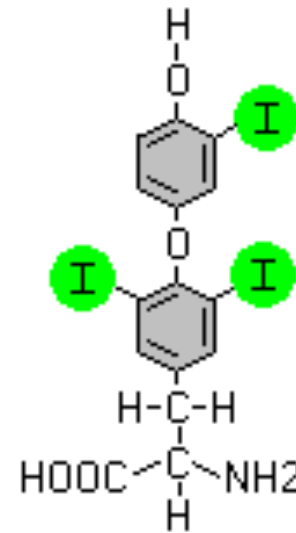
# Organochlorinated pollutants



Polychlorobiphenyls (PCBs)



Thyroxine (T4)



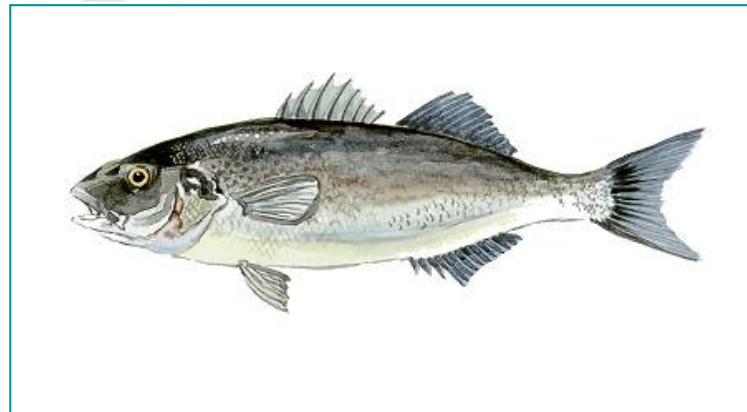
Triiodothyronine (T3)

→ similar structures as thyroid hormones

→ may generate an endocrine disruption



# Sea bass (*Dicentrarchus labrax*)



- 💧 easily accessible, large distribution and relatively abundant
- 💧 optimal size
- 💧 long lived animals at the top of the food web
- 💧 sedentary habits



**Perfect for sentinel species**

# Aims of this study

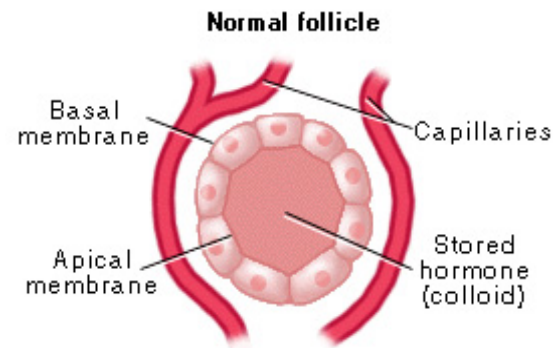
- ◆ Evaluate the potential effect of environmental pollutants on the thyroid function using simultaneously different thyroid parameters
- ◆ Study the underlying mechanisms and effects of such an endocrine disruption

# Experimental part



# Thyroid parameters

- ◆ In order to examine all facets of fish thyroid function, we propose to study simultaneously different endpoints



**Hyperthyroid**



Colloid being reabsorbed

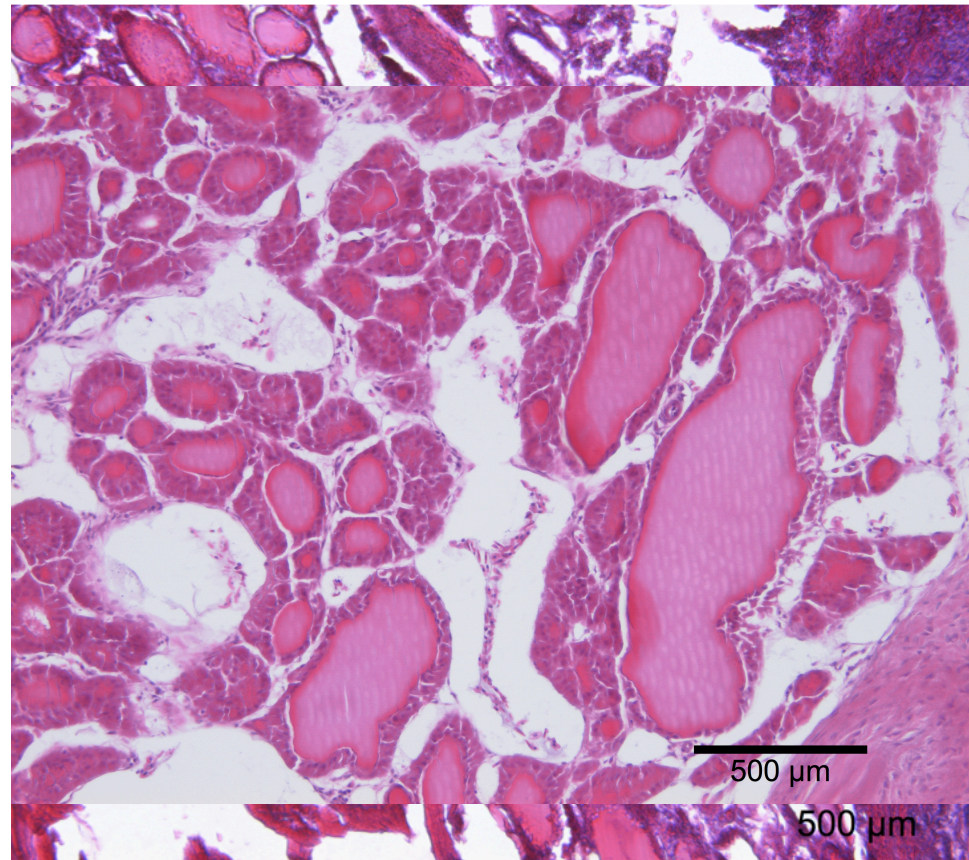
**Hypothyroid**



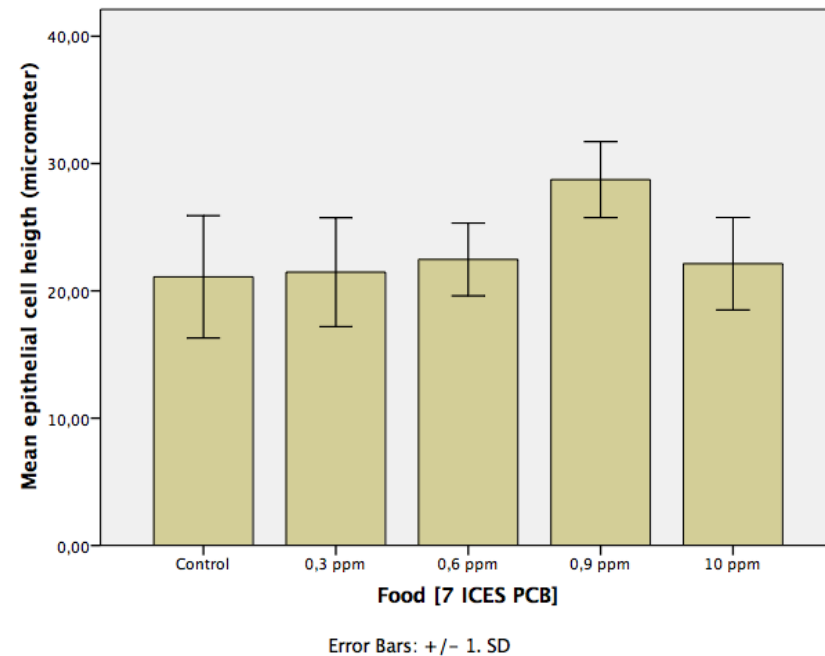
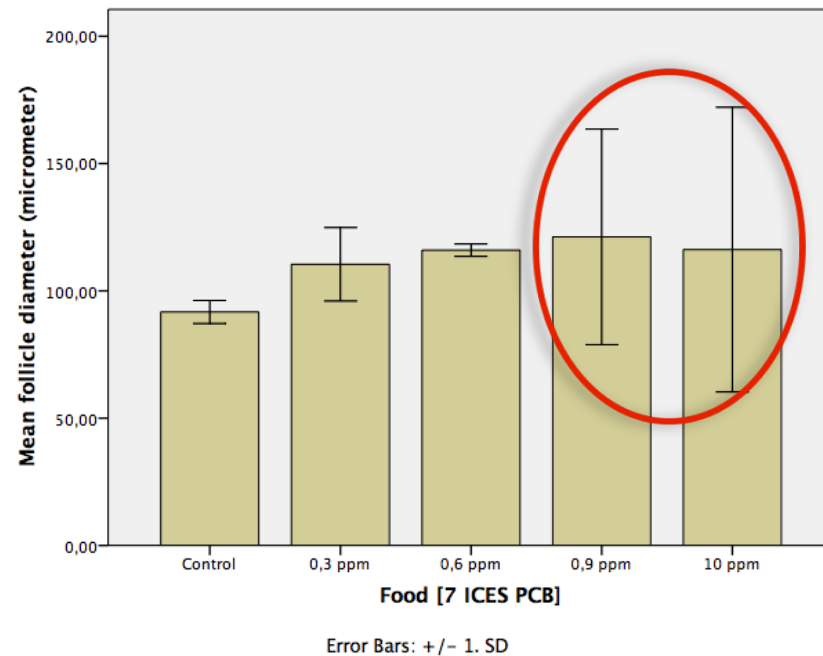


# Thyroid Histology

- ◆ Follicles dispersed on connective tissue near the pharyngeal region located next to the ventral aorta.
- ◆ Irregular or oval follicular lumen
- ◆ Surrounded by flattened, cuboidal epithelial cells
- ◆ Measure follicle size, cell heights, roundness, form factor and aspect ratio.



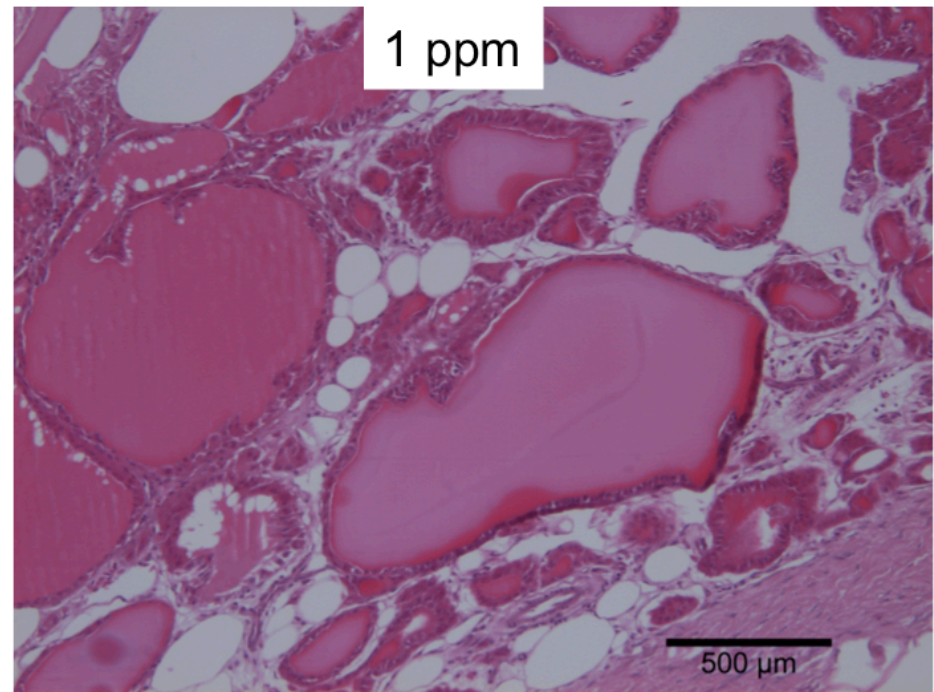
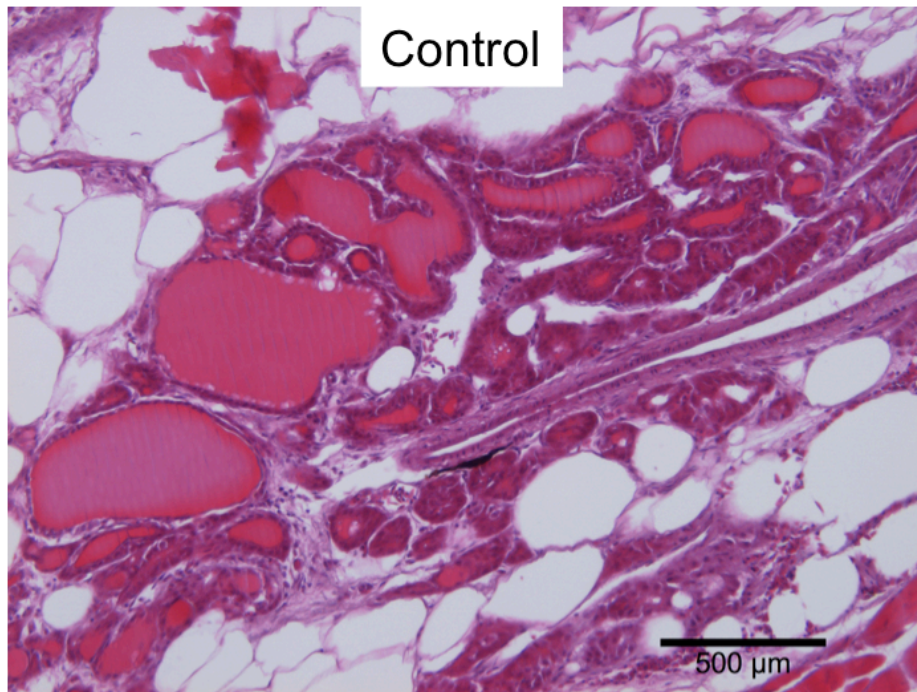
# Histomorphometry



- ◆ No clear relationship to pollutant levels

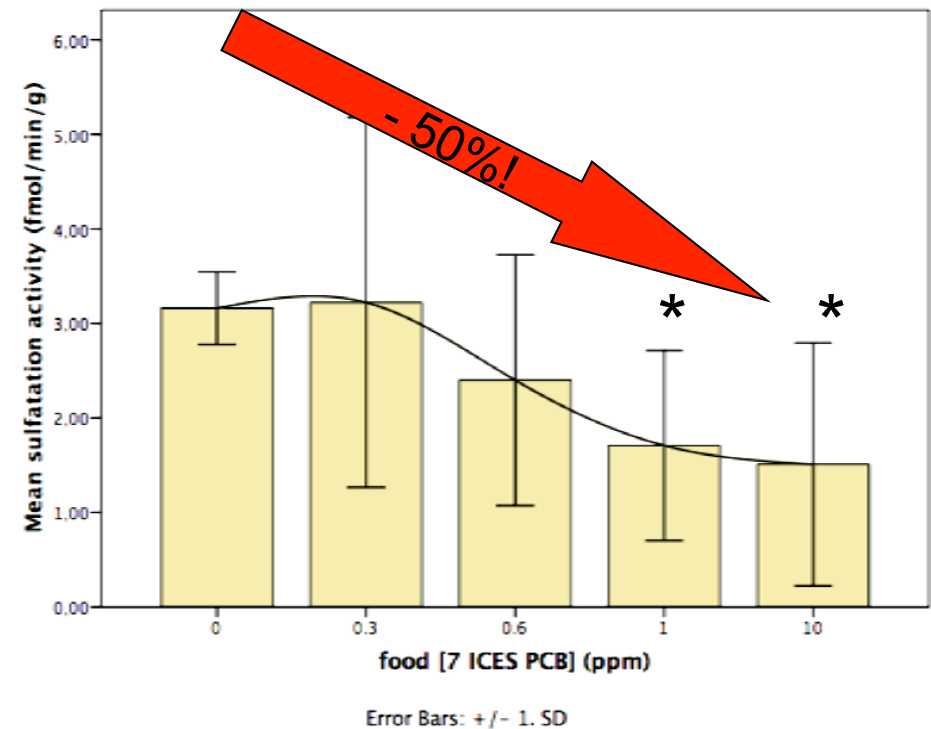
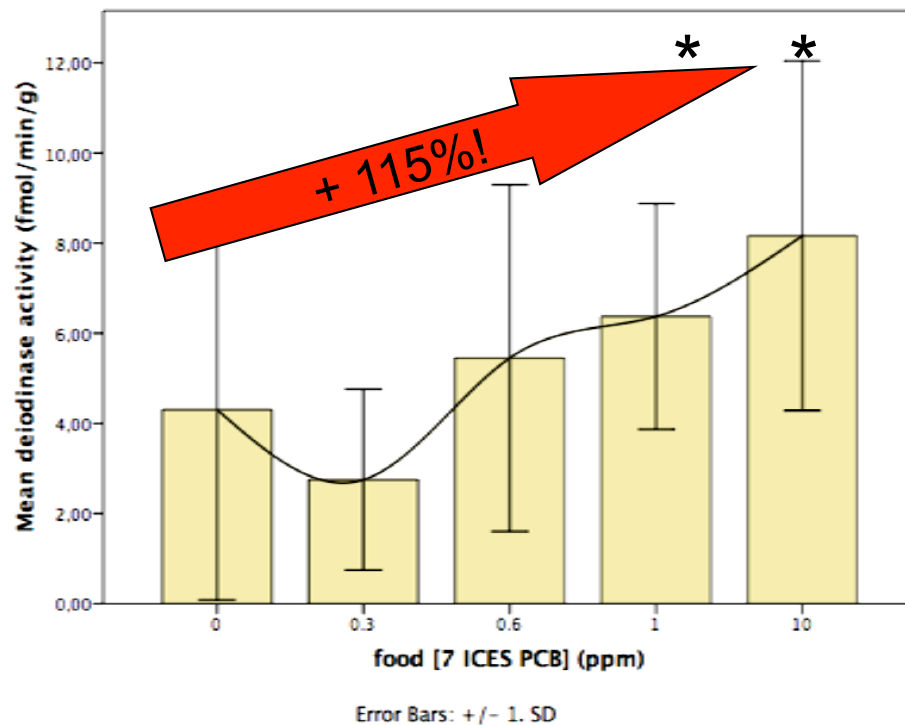


# Thyroid Histology



- ◆ Heterogeneity of follicle size

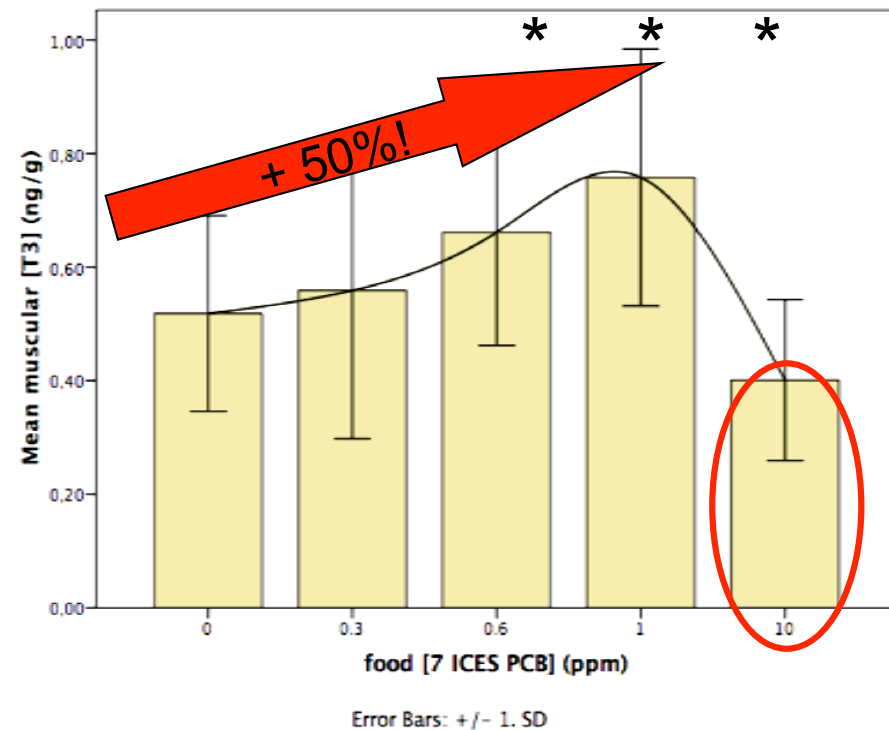
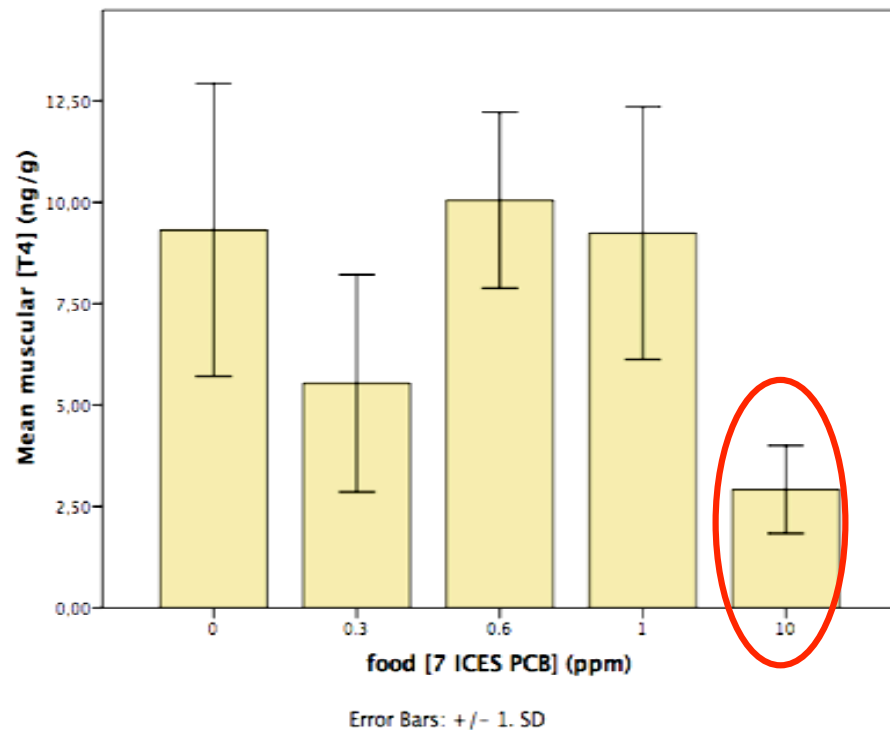
# Metabolic activity



- Towards more conversion of T4 to T3 and less elimination of thyroid hormones

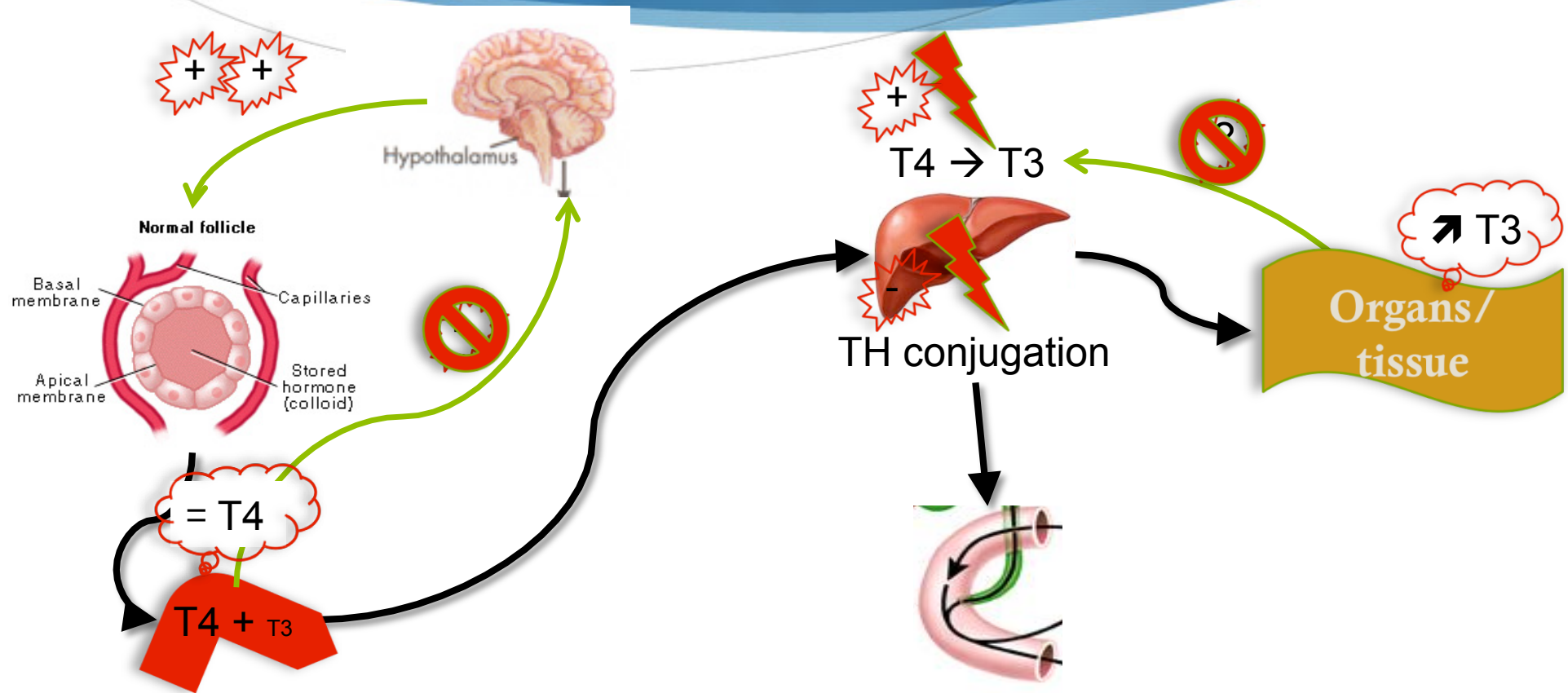


# Thyroid status



- Thyroid hormone levels preserved in environmental relevant exposure
- important depression @10ppm!

# Environmental relevant concentrations



T4 → Centrally controlled brain-pituitary-thyroid axis

T3 → Peripheral control in extra-thyroidal tissues

# Conclusions

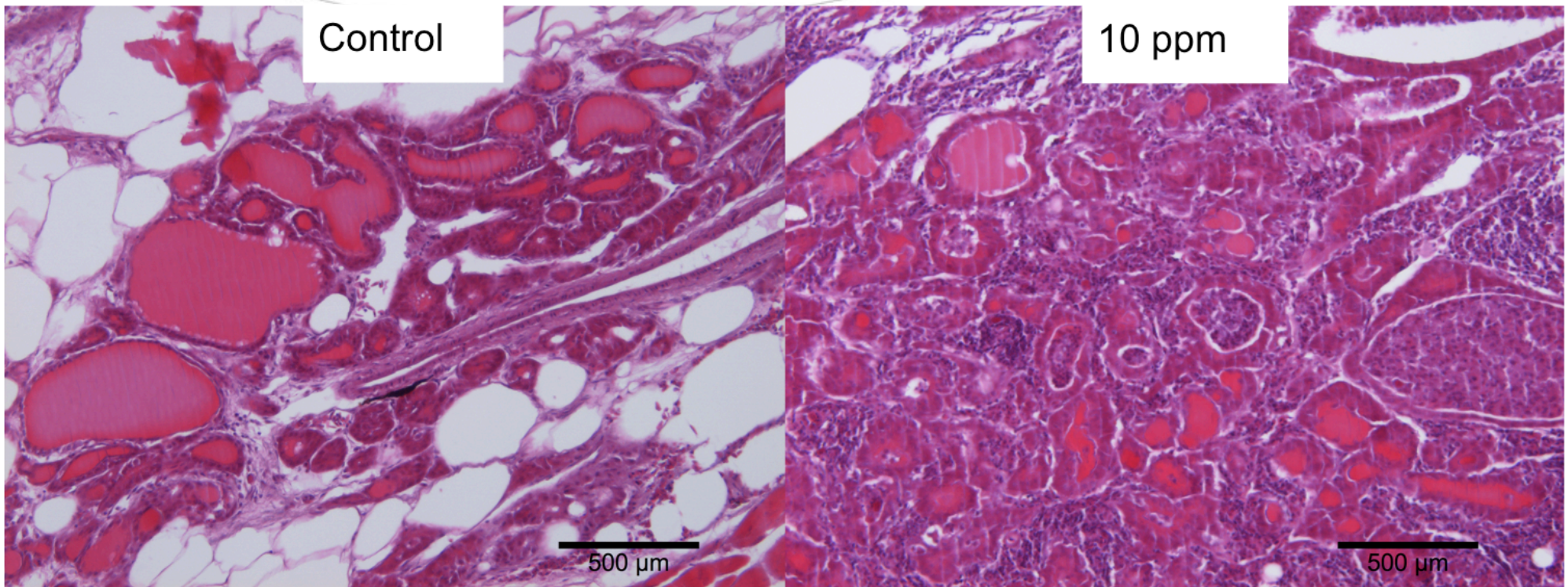
- In sea bass exposed to environmental relevant concentrations of PCBs, we observe :
  - Preserved thyroid hormone status
  - Changes in activity of metabolic pathways
  - Changes in synthesis/secretion activity

**→ Compensation by extensive autoregulatory feedback**

- We see @ higher contamination levels:
  - Depression of thyroid hormone status



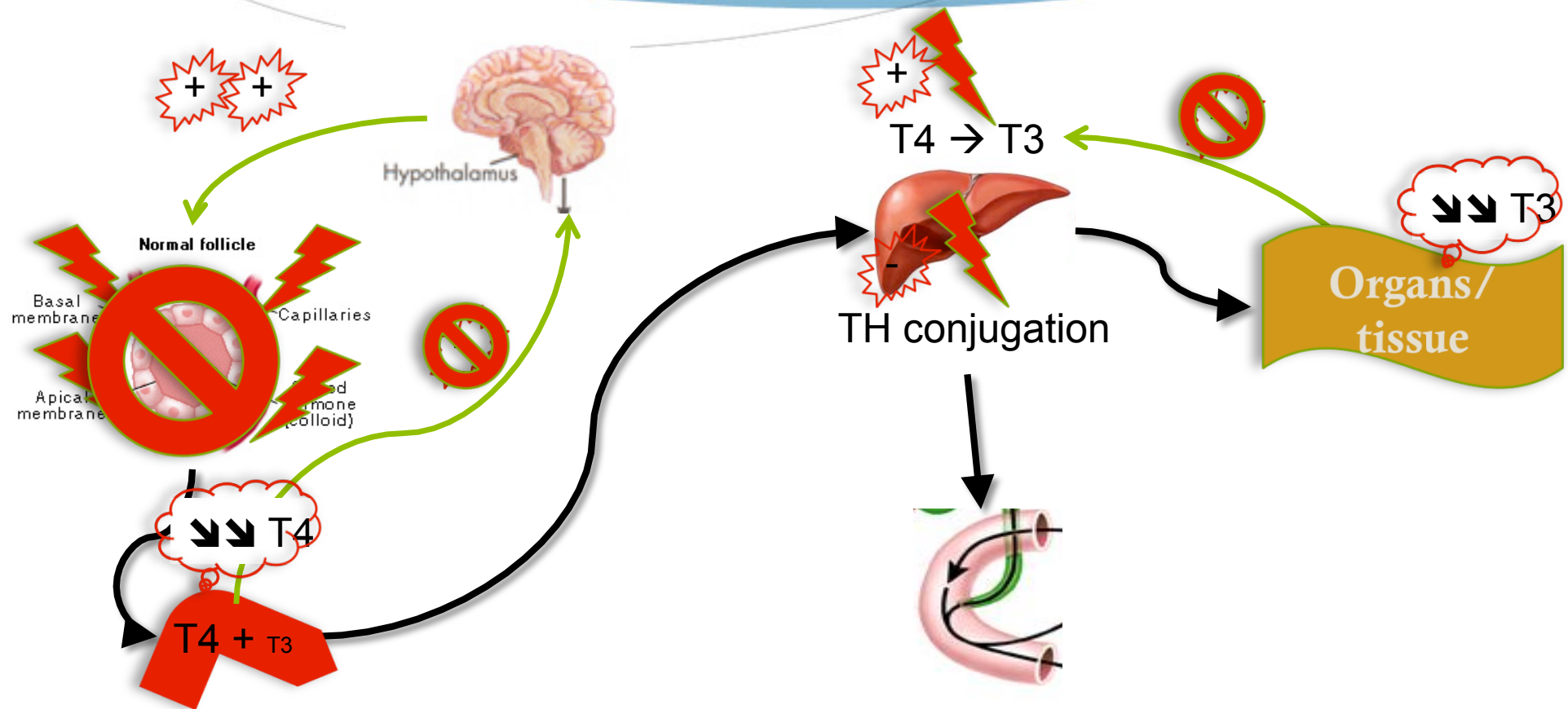
# @ 10 ppm



- ◆ lower number of follicles and disorganized tissue
- ◆ lymphoid cell infiltration, enlargement of interstitial tissue, degenerated colloid
- ◆ might have caused hypothyroidism in 10ppm fish!!!



@ 10 ppm



T4 → Centrally controlled brain-pituitary-thyroid axis

T3 → Peripheral control in extra-thyroidal tissues

# Conclusions

- In sea bass exposed to environmental relevant concentrations of PCBs, we observe :
  - Preserved thyroid hormone status
  - Changes in activity of metabolic pathways
  - Trend of a raise of synthesis/secretion activity

**→ Compensation by extensive autoregulatory feedback**

- We see @ higher contamination levels:
  - Depression of thyroid hormone status

**→ Altered thyroid hormone synthesis!**

# Thank you for your attention!!!

💧 Please come and have a look on my poster:

## WE373

💧 A field study on sea bass in European coastal waters

