



Endocrine disruption in freshwater crustaceans. The case of the amphipod *Gammarus fossarum* exposed to an insect juvenile hormone

H. Arambourou^a, A. Chaumot^a, N. Delorme^a, K. Abbaci^a, E. Vulliet^b, G. Daniele^b, V. Debat^c

a: Irstea Lyon

b: Institut des Sciences analytiques, CNRS, Lyon

c: Museum National d'Histoire Naturelle (MNHN)

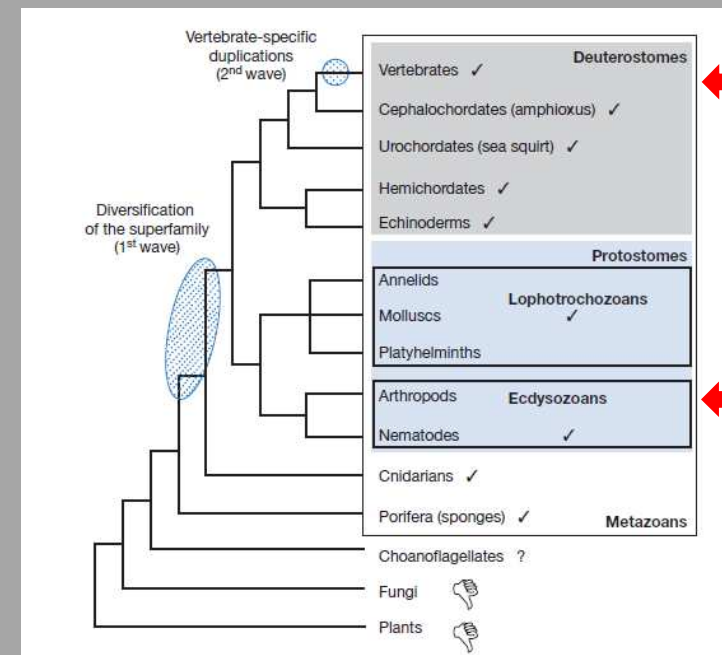


French Ec2co program – CNRS-INSU

Endocrine disruption in ecotoxicology: a human-centred approach

- Numerous studies have tested effects of mammal ED in arthropods;
- However throughout the evolution some genes of nuclear hormone receptors were lost and became independent of hormone regulation;

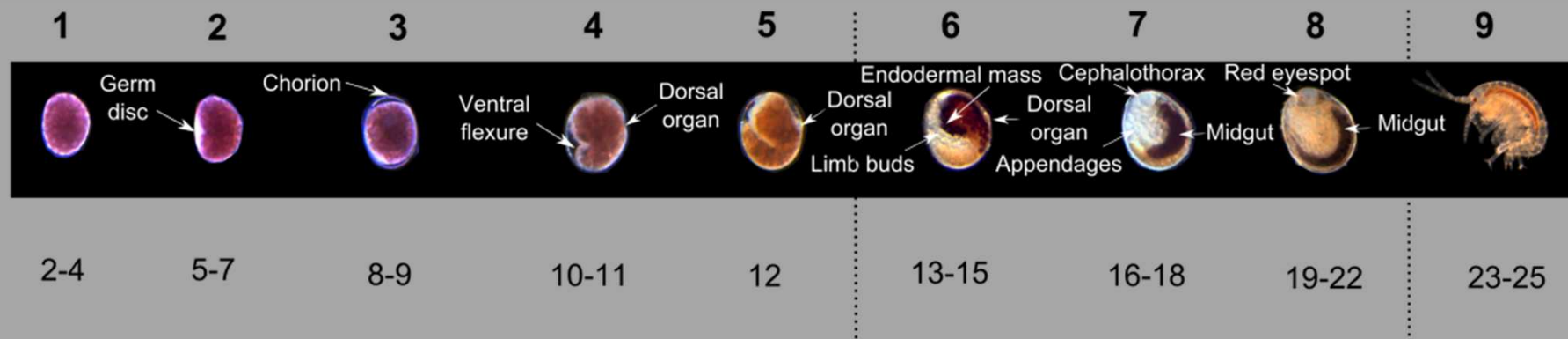
- **Mammal ED could have little effects on arthropods**
- **It is necessary to consider the specificity of arthropod hormone regulation to better assess the effects of ED**



Schematic phylogeny of metazoans, plants, fungi, and choanoflegellates (Escria et al. 2004)

Endocrine regulated functions in crustaceans

- Major role in endocrine regulation of two hormones: ecdysteroids and methyl farnesoate
- Implicated in:
 - - Morphogenesis

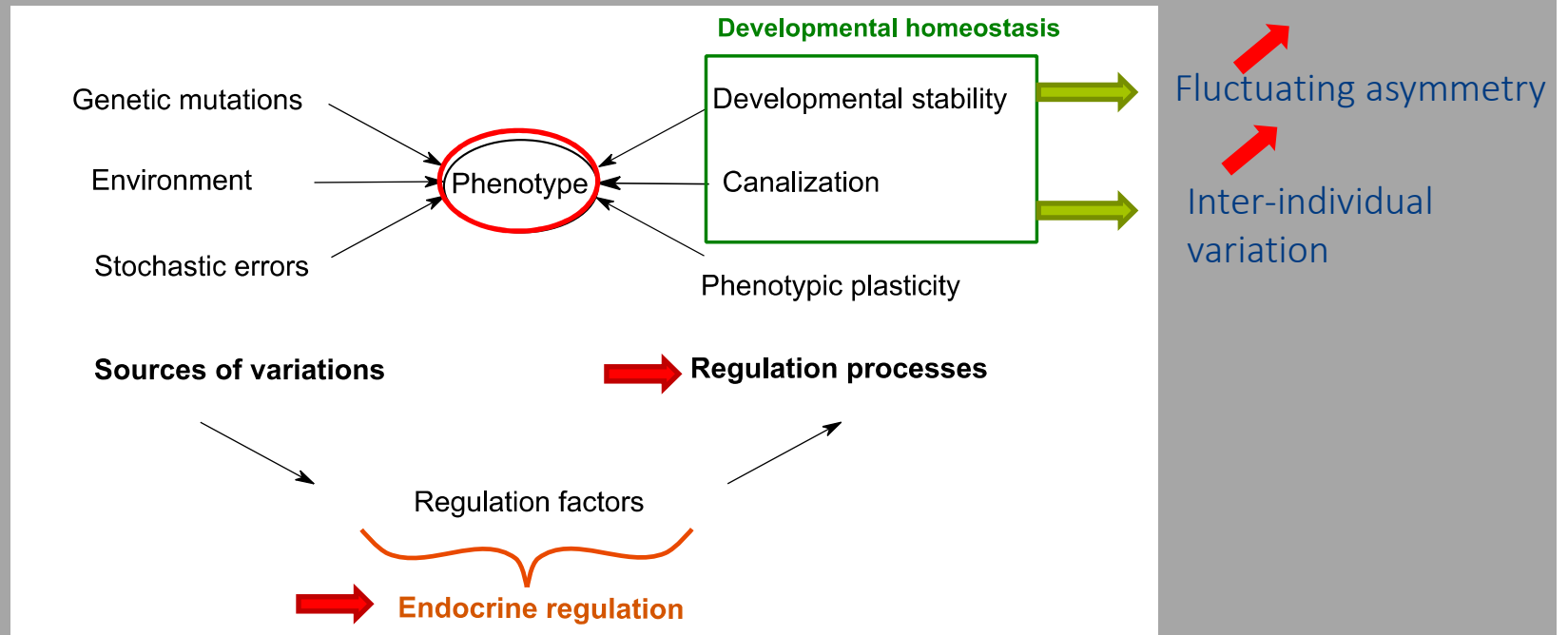


- - Reproduction



Development and morphogenesis

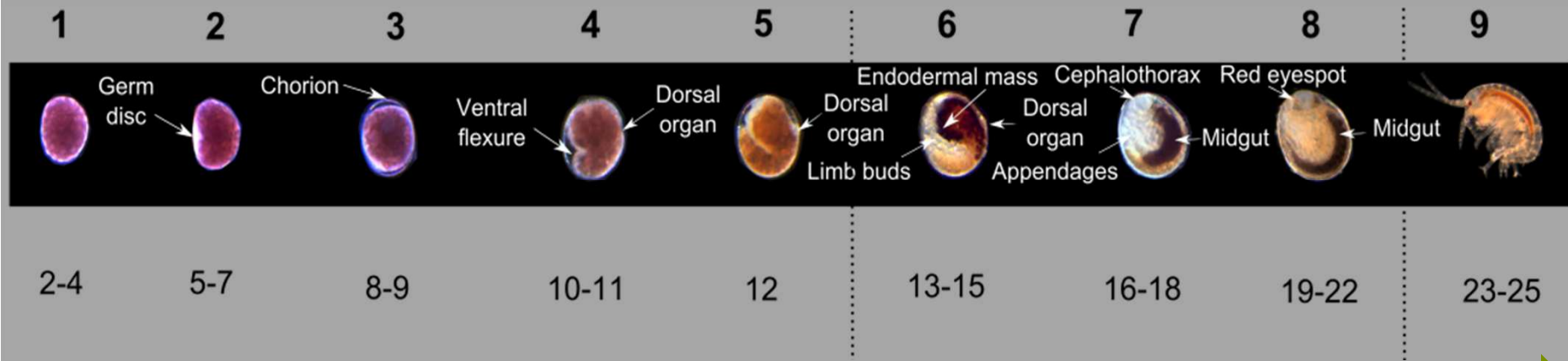
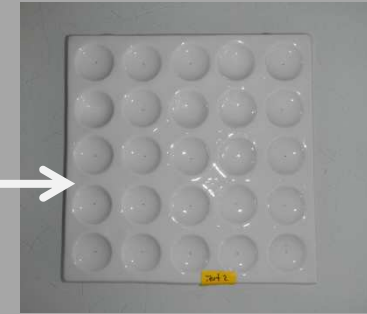
The phenotype results from the interplay between sources of variations and regulating processes which are under endocrine regulation



- Toxic exposure by causing adverse effects on endocrine regulation could translate into an increase of phenotypic defects

Phenotypic defects in *Gammarus fossarum* exposed to fenoxycarb as embryo

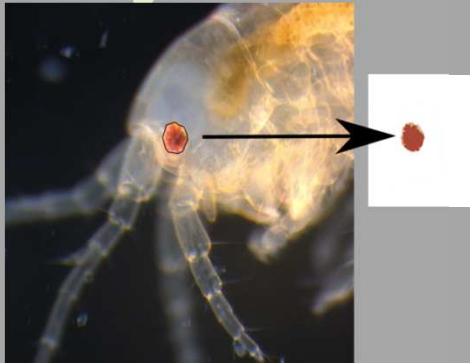
- Exposure to fenoxycarb, a growth regulator insecticide, analog of the juvenile hormone
- 0, 0.5 $\mu\text{g.L}^{-1}$, 5 $\mu\text{g.L}^{-1}$ and 50 $\mu\text{g.L}^{-1}$
- Throughout the embryogenesis



irstea

Morphogenesis

Phenotype measurement in newborn individuals of exposed embryos⁶



1. Eye pigmentation

2. Fluctuating asymmetry and inter-individual variance of the antenna and the gnathopode (secondary sexual characteristic)

3. Midgut tissue damages

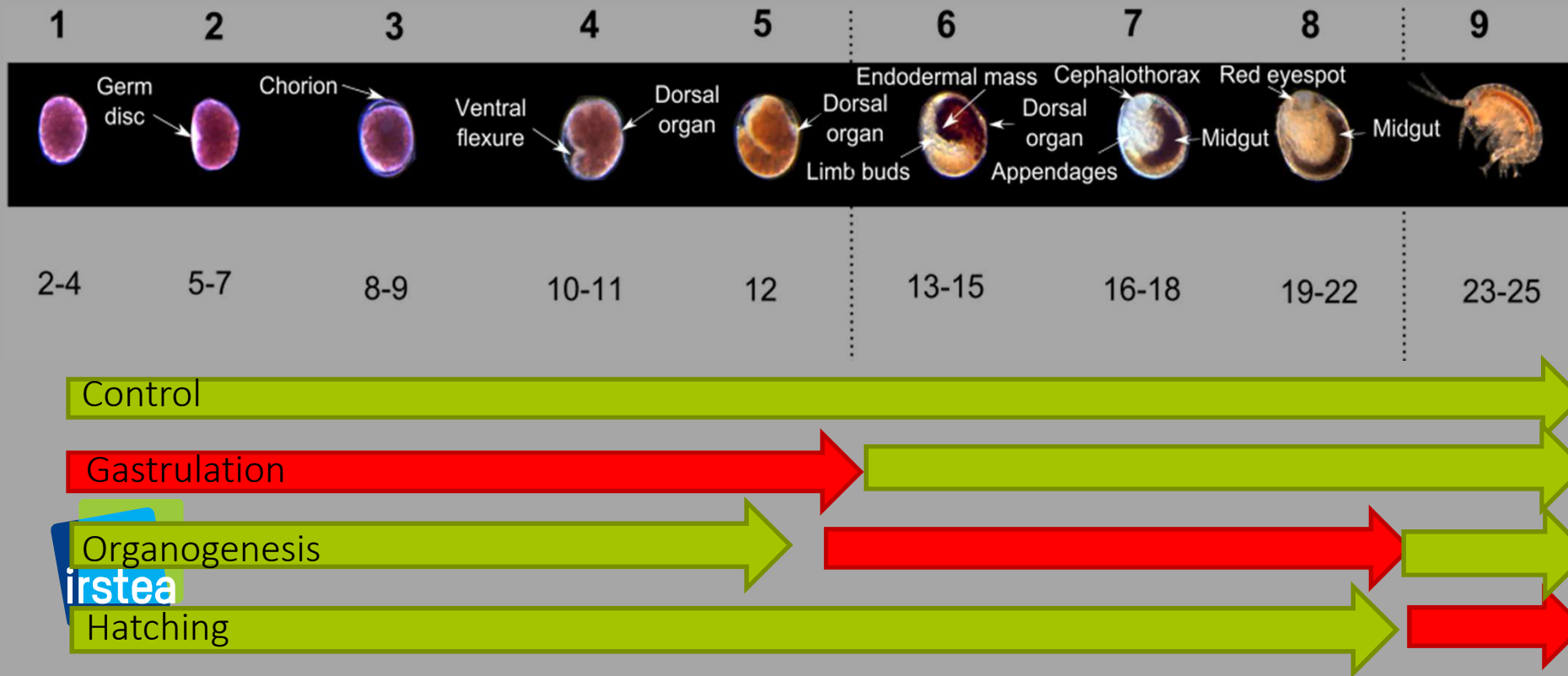


Results: paper in preparation...



Phenotypic defects in *Gammarus fossarum* exposed to fenoxycarb as embryo

- Exposure to fenoxycarb, growth regulator insecticide, analog of the juvenile hormone;
- $5 \mu\text{g.L}^{-1}$
- During gastrulation or organogenesis or hatching



irstea

Results: paper in preparation...



Effects of fenoxycarb exposure on female reproduction



Oocytes



Females exposed throughout the oogenesis to fenoxycarb ($50 \mu\text{g.L}^{-1}$)

1. Pairing success
2. Fertilization success
3. Number of embryos
4. Viability of the embryos
5. Lipid content

Results: paper in preparation...



Conclusions

1. Fenoxycarb interferes with embryogenesis

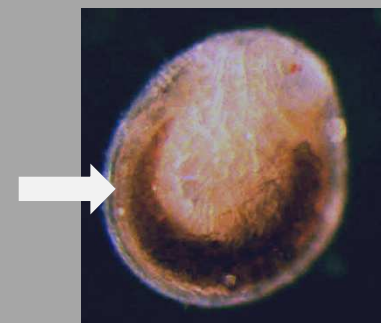
- Pigmentation disruption as a biomarker of endocrine disruptor exposure ?

2. Early developmental stages of the embryogenesis are more sensitive

3. Few effects on developmental homeostasis

4. Effects were more pronounced on the reproduction

- Protective role of the chorion during embryogenesis ?
- Impairment of exoskeleton states ?
- Impairment of chemical signaling ?
- Disruption of lipid metabolism



Lipid metabolism under endocrine regulation
→ Lipidomic analysis of both females and newborn individuals of exposed embryos... in progress (CSIC-IDAEA, Spain, Carlos Barata)