# Developmental expression of glucocorticoid receptor during early ontogeny in gilt-head sea bream, *Sparus aurata*, and European sea bass, *Dicentrarhus labrax*

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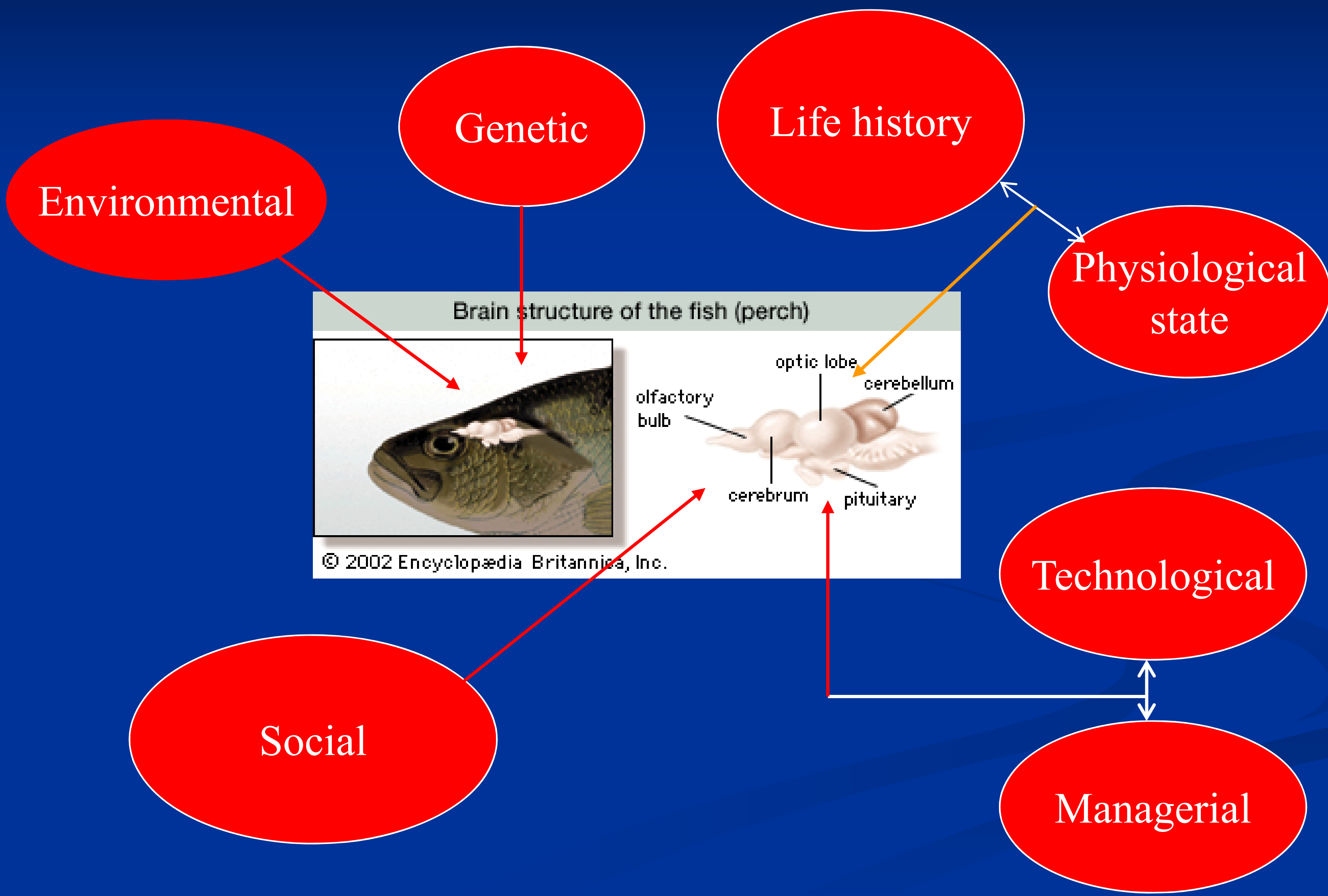
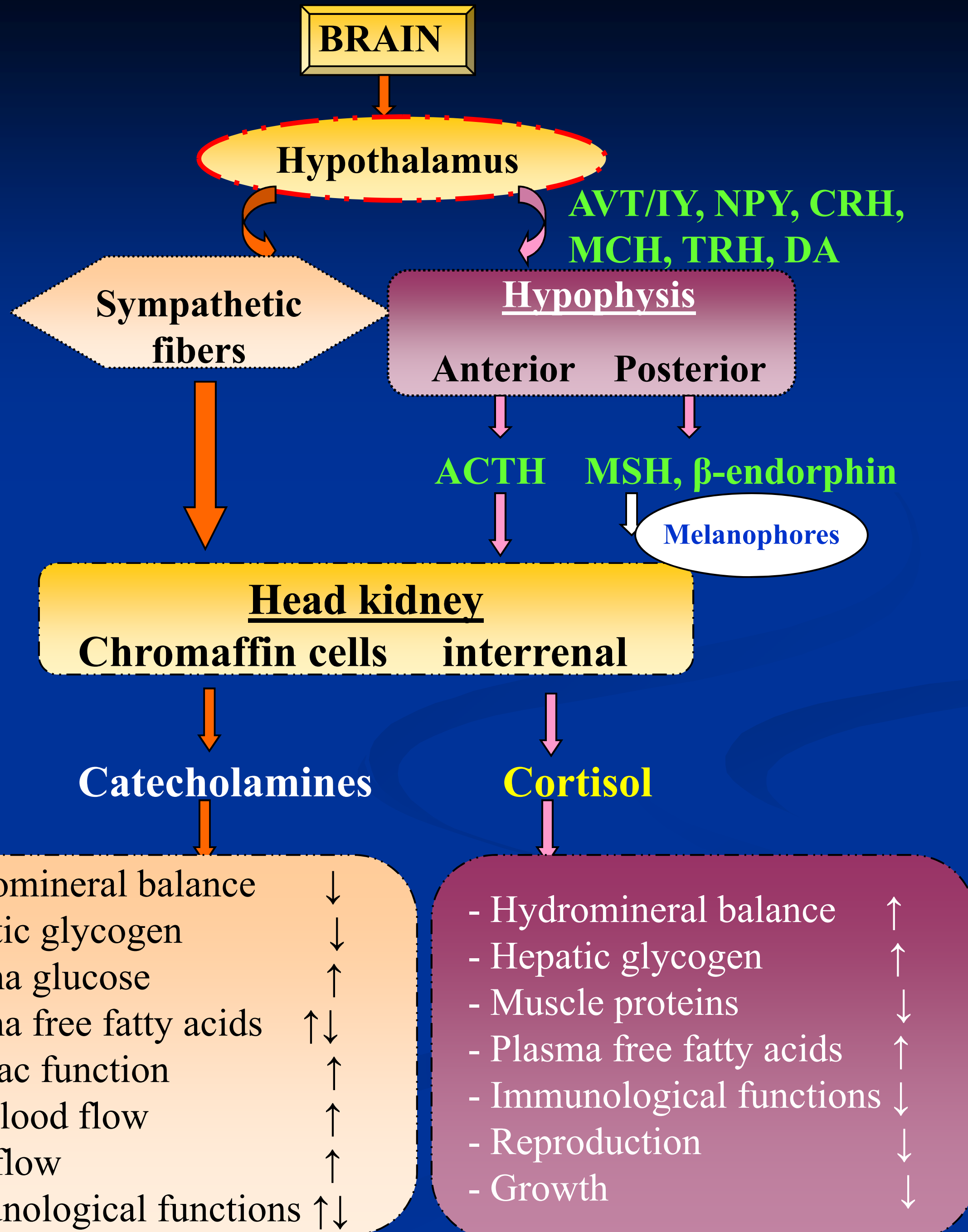
Heraklion, Crete, Greece

# How fish cope with stressors ?



# Physiological Stress Response



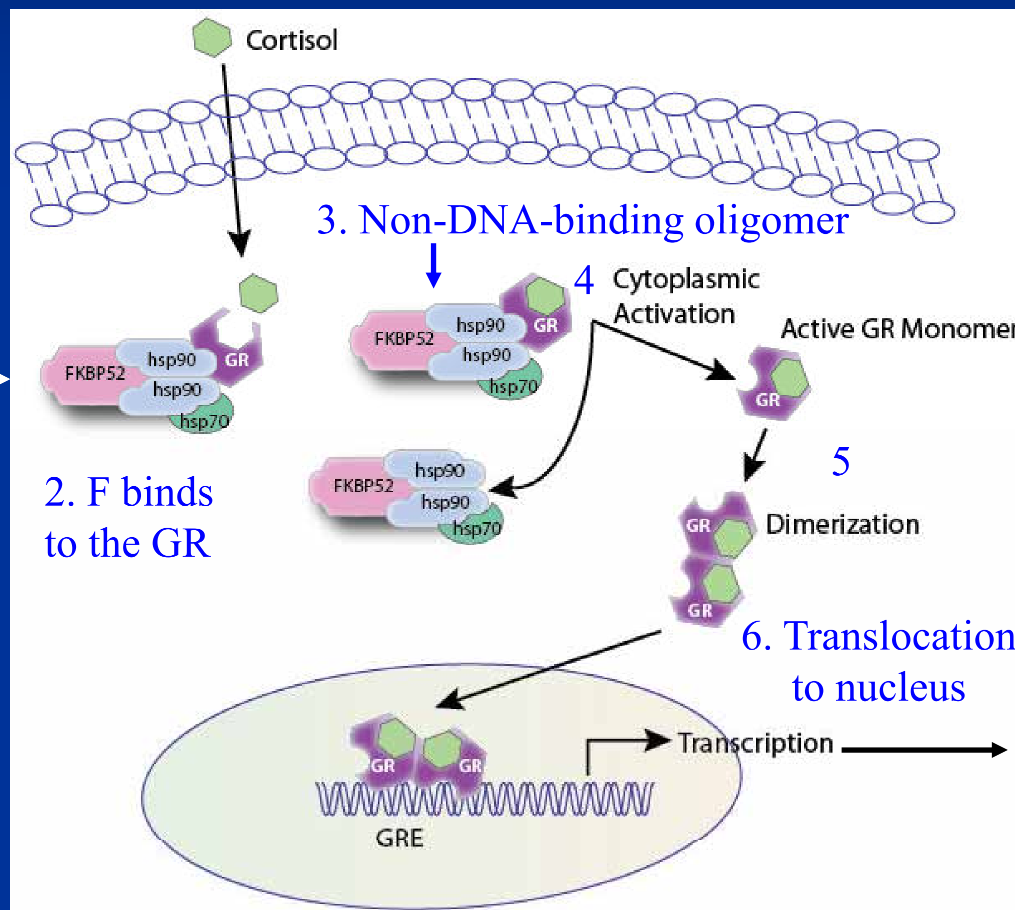

*Modified from S.E. Bonga, 1997*

# How does Cortisol Act?

1. Cortisol passes through the plasma membrane into the cytoplasm

GR (or NC3C1)

Inactive oligomeric complex

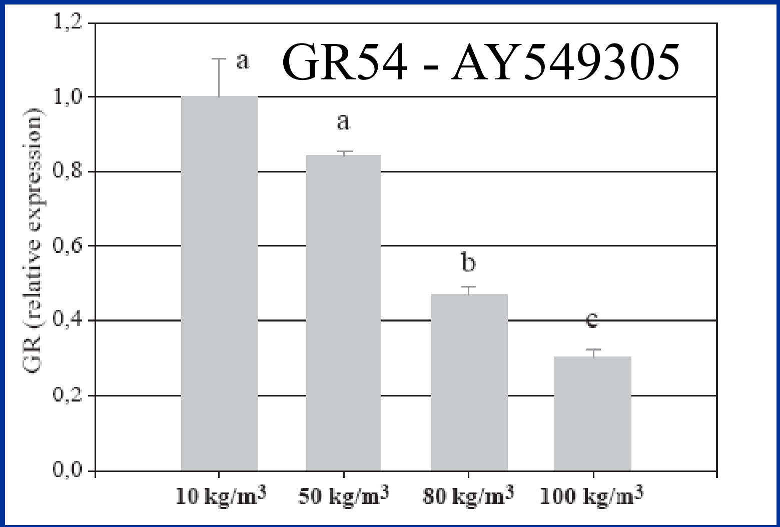



7. Binding to DNA

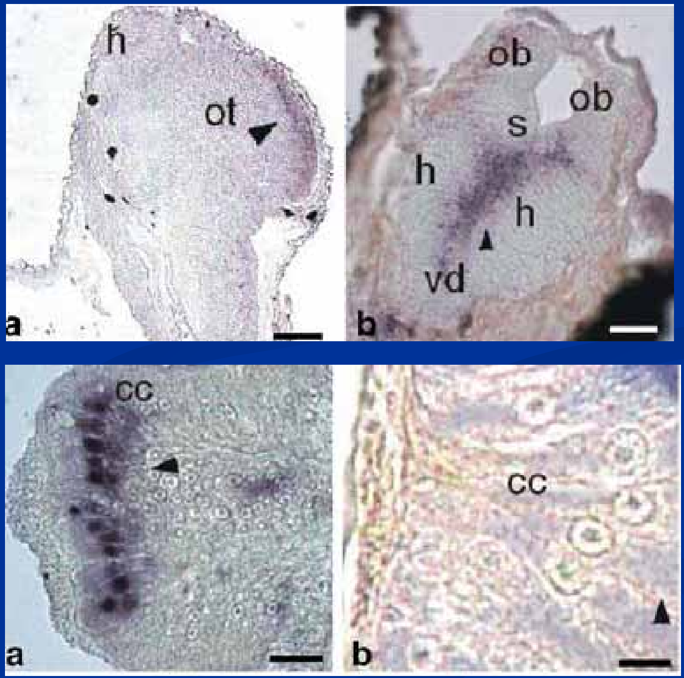
1. Transactivation
2. Transrepression
3. Non-genomic

# Glucocorticoid Receptor in European Sea Bass

Two isoforms that differ significantly in their transcriptional activation domain (GR54 & GR61)



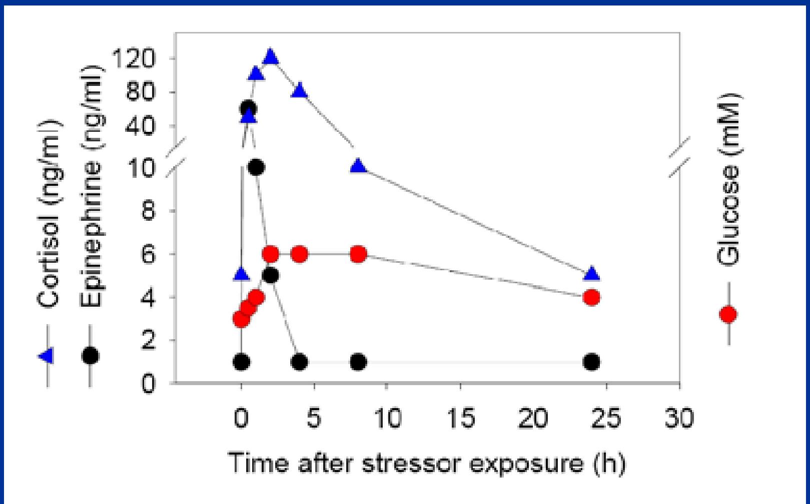

GR expression levels in liver tissue of adult sea bass in response to high rearing densities (Terova *et al*., 2005)



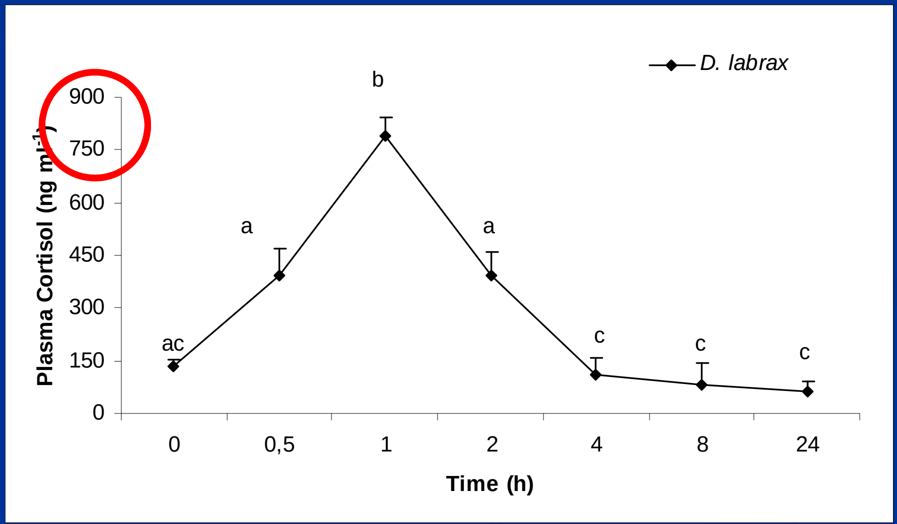

GR61 (AY619996) expression levels in tissues of larval stages of sea bass (Bella *et al*., 2008)

# The cortisol stress response in European Sea Bass

Up to present the stress response has been studied mainly in juvenile and adult fish

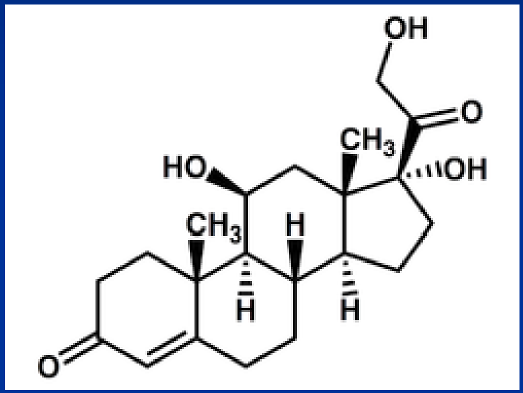



*Source: Iwama et al., 2004. AquaNet Workshop on Fish Welfare*




*Source: Fanouraki, 2008. Fish Physiology Lab. UoC, unpublished data*

## Recently research has been focused on the




Ontogenesis and molecular regulation of the corticosteroid stress axis during early development

- Gilth-head sea bream, *Sparus aurata* (Szisch *et al*., 2005)
- European sea bass, *Dicentrarhus labrax* (Bella *et al*., 2008)
- Zebrafish, *Danio rerio* (Alsop & Vijayan, 2008; 2009)
- Red drum, *Sciaenops ocellatus* (Applebaum *et al*., 2008)

# Aims of the Study

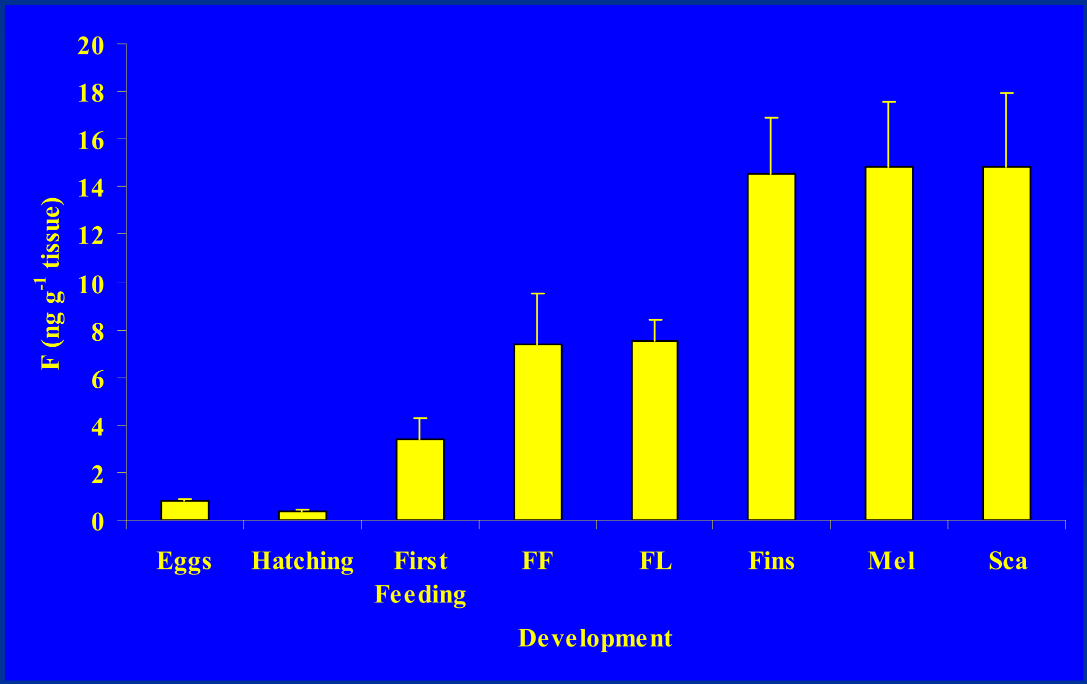
- Onset of cortisol production
- Development of cortisol response
- Molecular regulation of the stressor-induced cortisol response

*During early life stages in*

European sea bass

Gilt-head sea bream

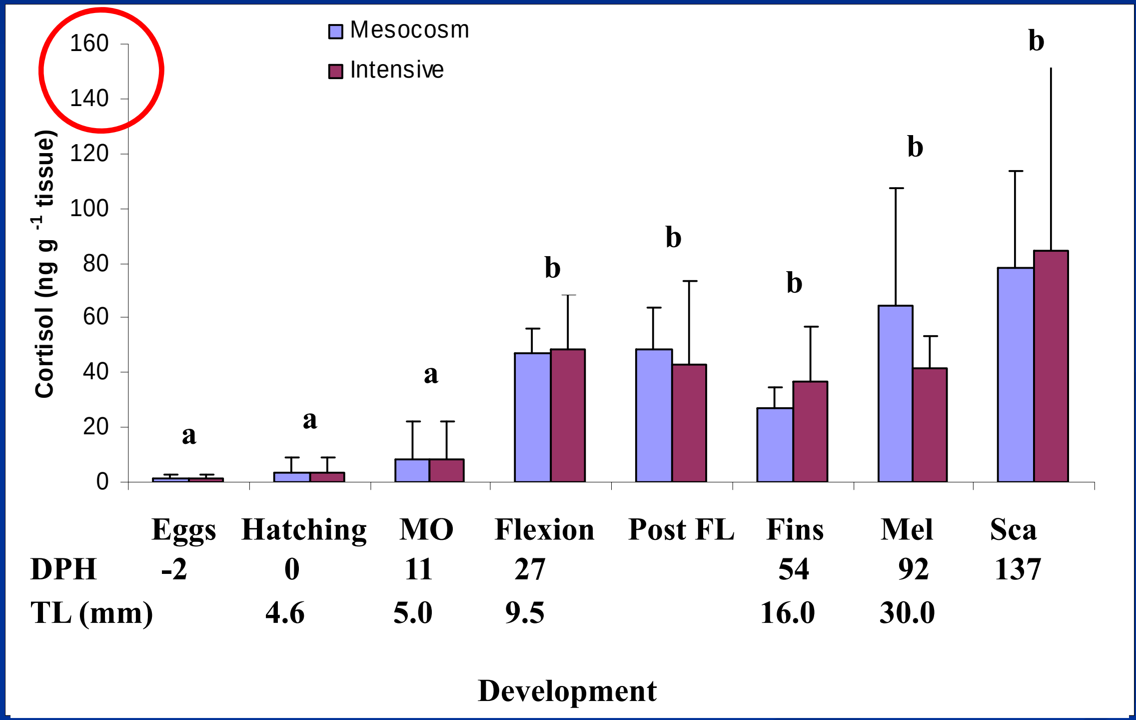
# Cortisol whole body concentration during early ontogeny in gilthead sea bream, *Sparus aurata*



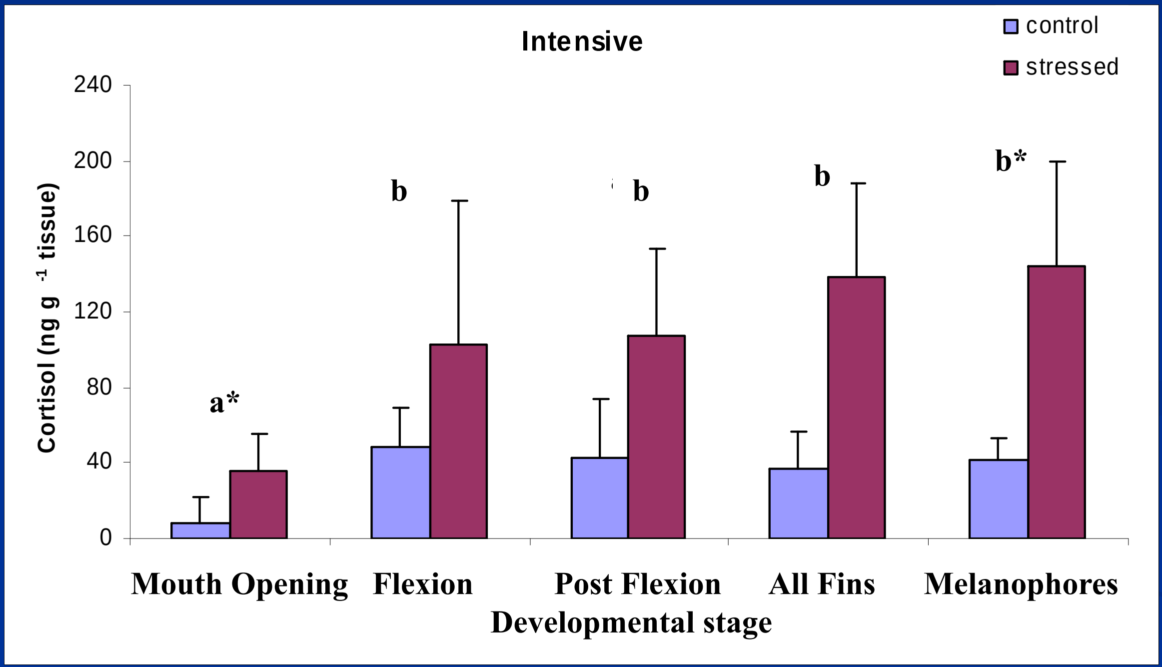

*Modified from Szisch et al., 2005*

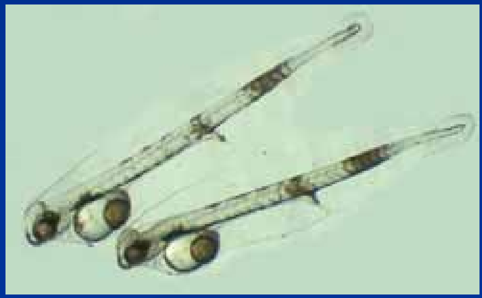
1. Fertilized eggs
2. Hatching
3. First feeding
4. Formation of first fin rays in the tail (FF)
5. Flexion (FL)
6. Formation of dorsal and ventral fins as in adults (Fins)
8. Abundant melanophores all over the body (Mel)
9. Development of scales (Sca)

# Cortisol whole body concentration during early ontogeny in European sea bass, *D. labrax*

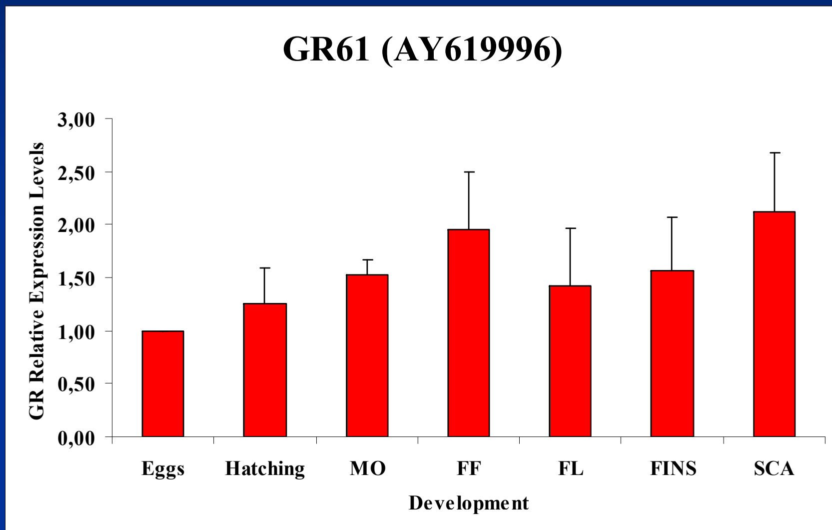


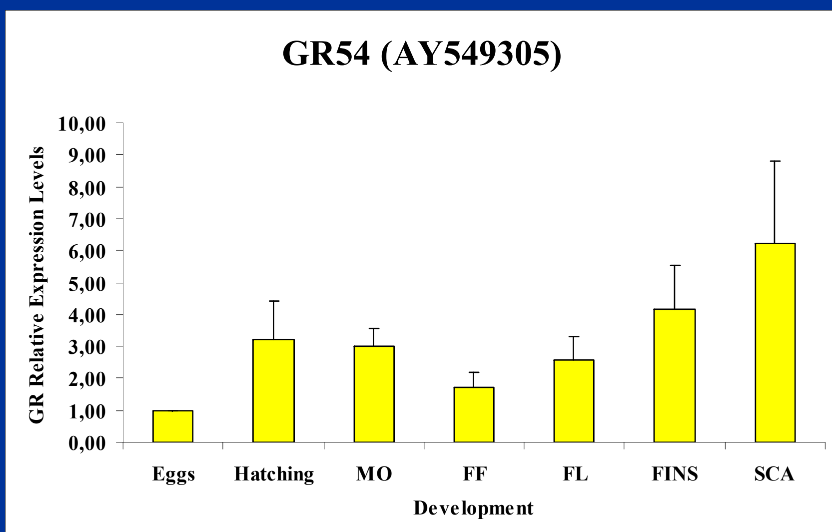
# Ontogenesis of the stress response in European sea bass, *D. labrax*



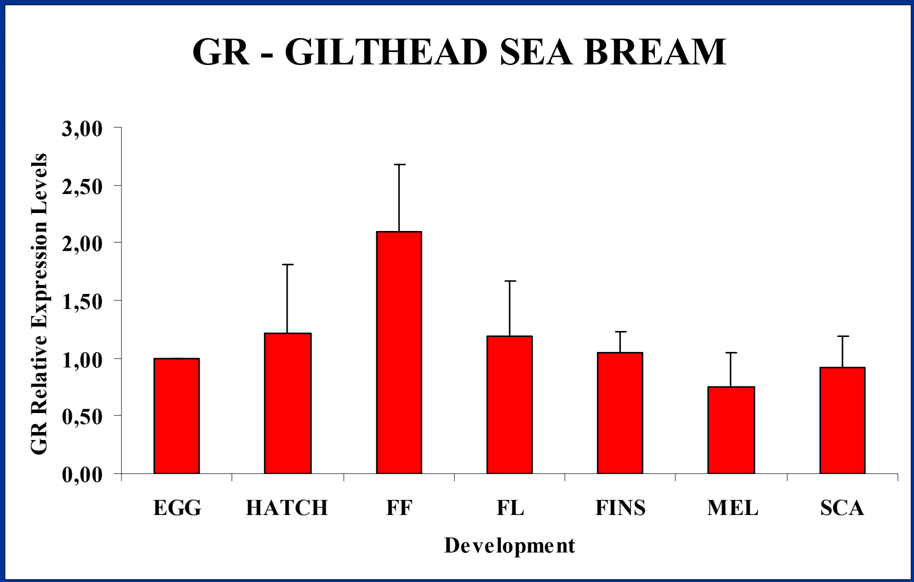
# Ontogenesis of the glucocorticoid receptor mRNA in European sea bass, *D. labrax*




1. Fertilized eggs
2. Hatching
3. Mouth opening (MO)
4. Formation of first fin rays in the tail (FF)
5. Flexion (FL)
6. Formation of dorsal and ventral fins as in adults (Fins)
8. Development of scales (Sca)

# Ontogenesis of the glucocorticoid receptor mRNA in gilt-head sea bream, *S. aurata*




1. Fertilized eggs
2. Hatching
3. Formation of first fin rays in the tail (FF)
4. Flexion (FL)
5. Formation of dorsal and ventral fins as in adults (Fins)
6. Melanophores
7. Development of scales (Sca)

# Conclusions

1a. The *ontogenetic pattern* of basal whole body cortisol concentrations in both species examined was *typical* of that observed in other teleosts

1b. However, the magnitude of the response was *much higher* in *European sea bass* than that reported in other warm-water teleosts

2a. The *presence of cortisol in embryos* is of maternal origin as has been previously observed in other teleosts

2b. The *onset of cortisol production* (*de novo* synthesis) occurs near the transition from *endogenous to exogenous feeding*, indicating that cortisol biosynthesis is important for adapting to different nutritional sources for energetic, growth and osmoregulatory purposes

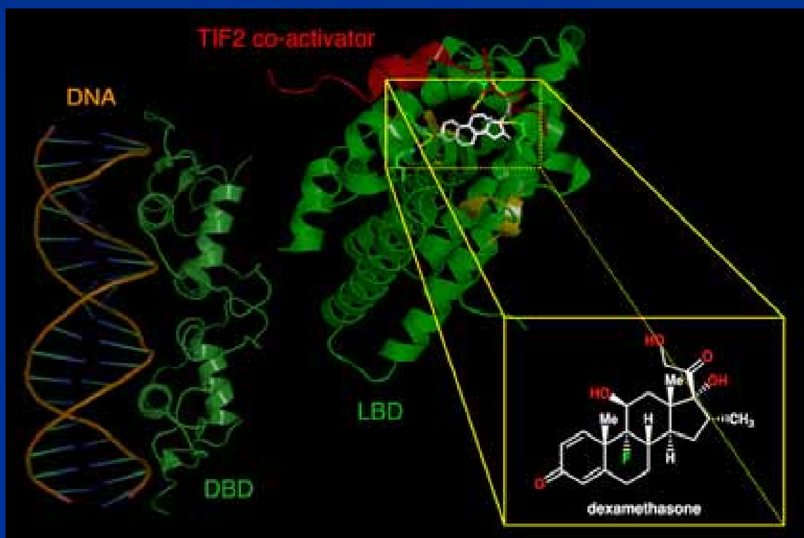
3a. Application of the same stressor during early ontogeny elicits a significant increase in whole body cortisol content even at *mouth opening*

3b. The dynamics of the response showed changes during the subsequent larval stages to give a *maximum response* at the *melanophores' stage*

4a. Expression of the GRs was detected in embryos and in all larvae stages examined

4b. Expression of GRs was *different* between the two *species* examined and between the *two isoforms in European sea bass*

8. The *GR61 transcripts* show an *increase* throughout *embryonic* development to reach a *maximum at first feeding and at full formation of scales*




9. The *GR54 transcripts* show an *increase* throughout *embryonic* development till mouth opening to reach a peak at *full formation of scales*

10. The *GR transcripts* in gilt-head sea bream showed a peak at *first feeding* and then a decrease to reach a minimum at *full formation of scales*

# Future Perspectives

- Characterization of the GRs in gilt-head sea bream
- Individual functions of the two GRs isoforms in European sea bass ?
- What is the adaptive significance of the differences in the magnitude of the stress response in developing larvae ?

# Thank you

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