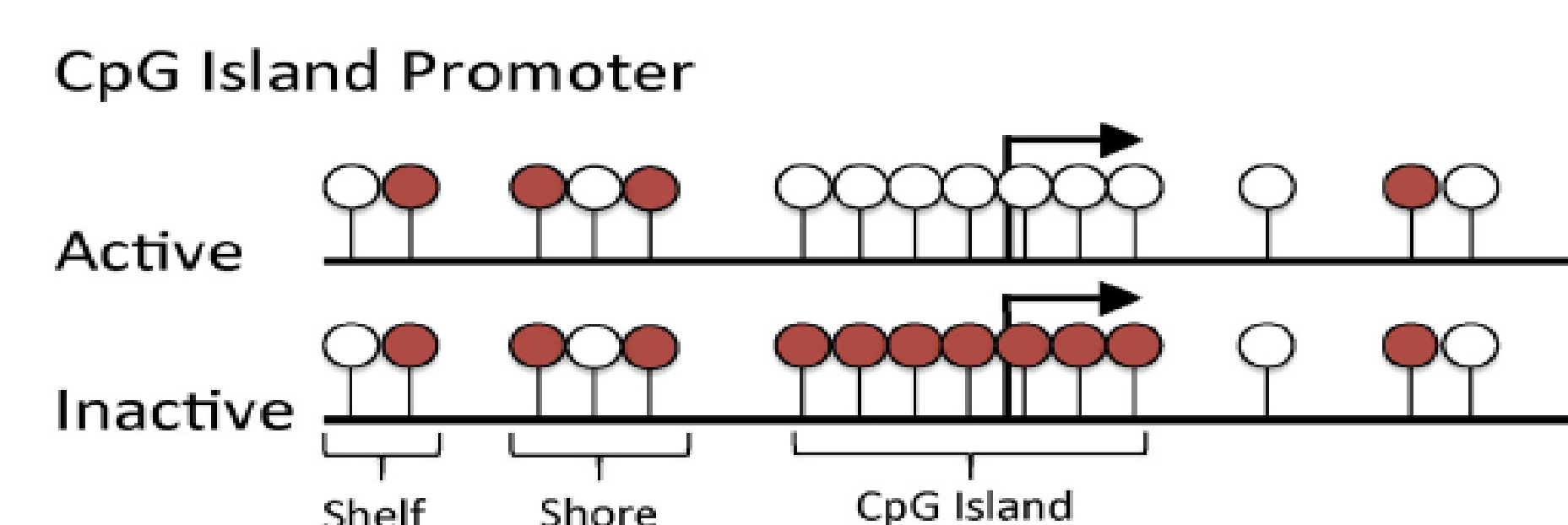
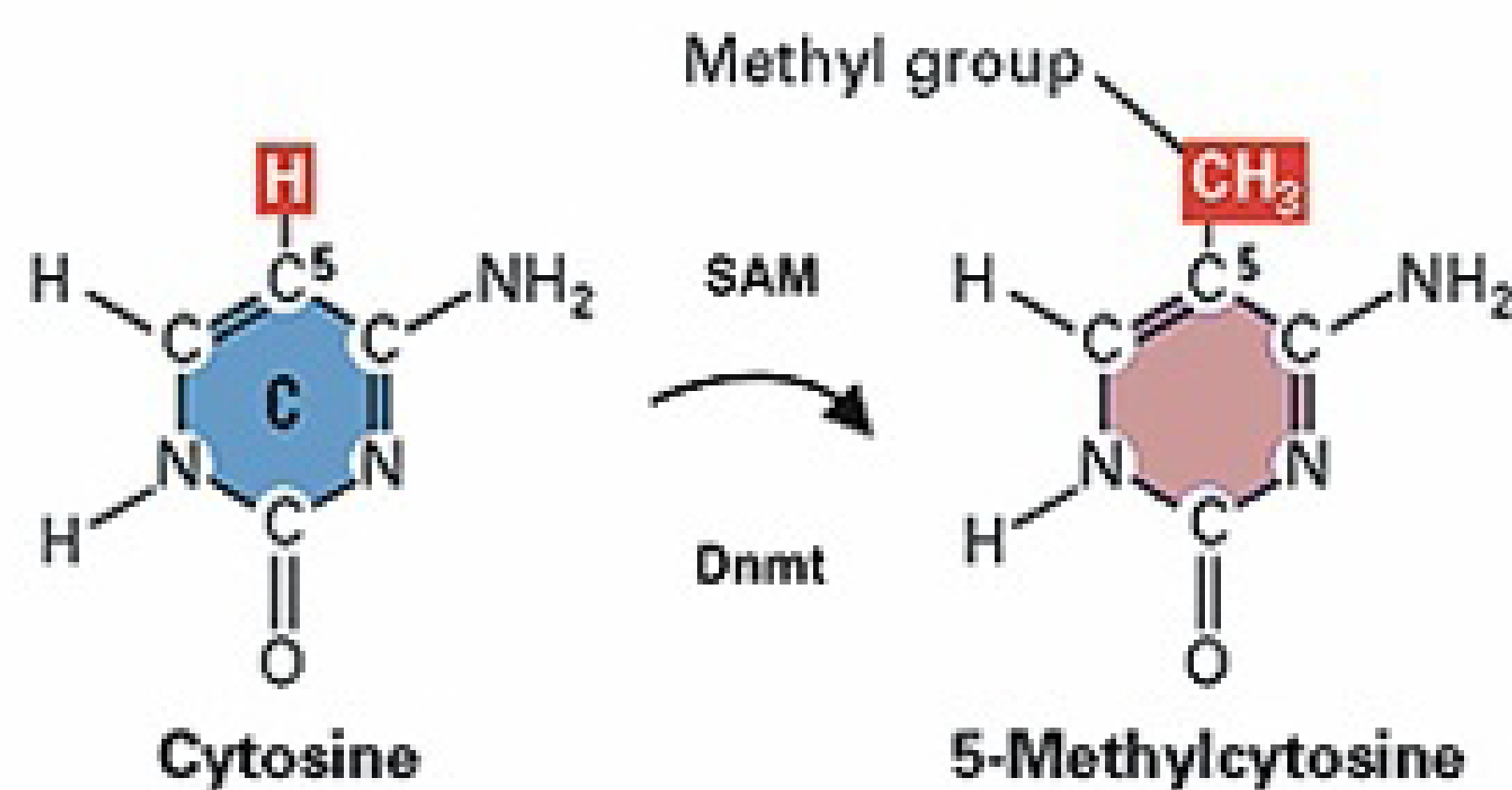


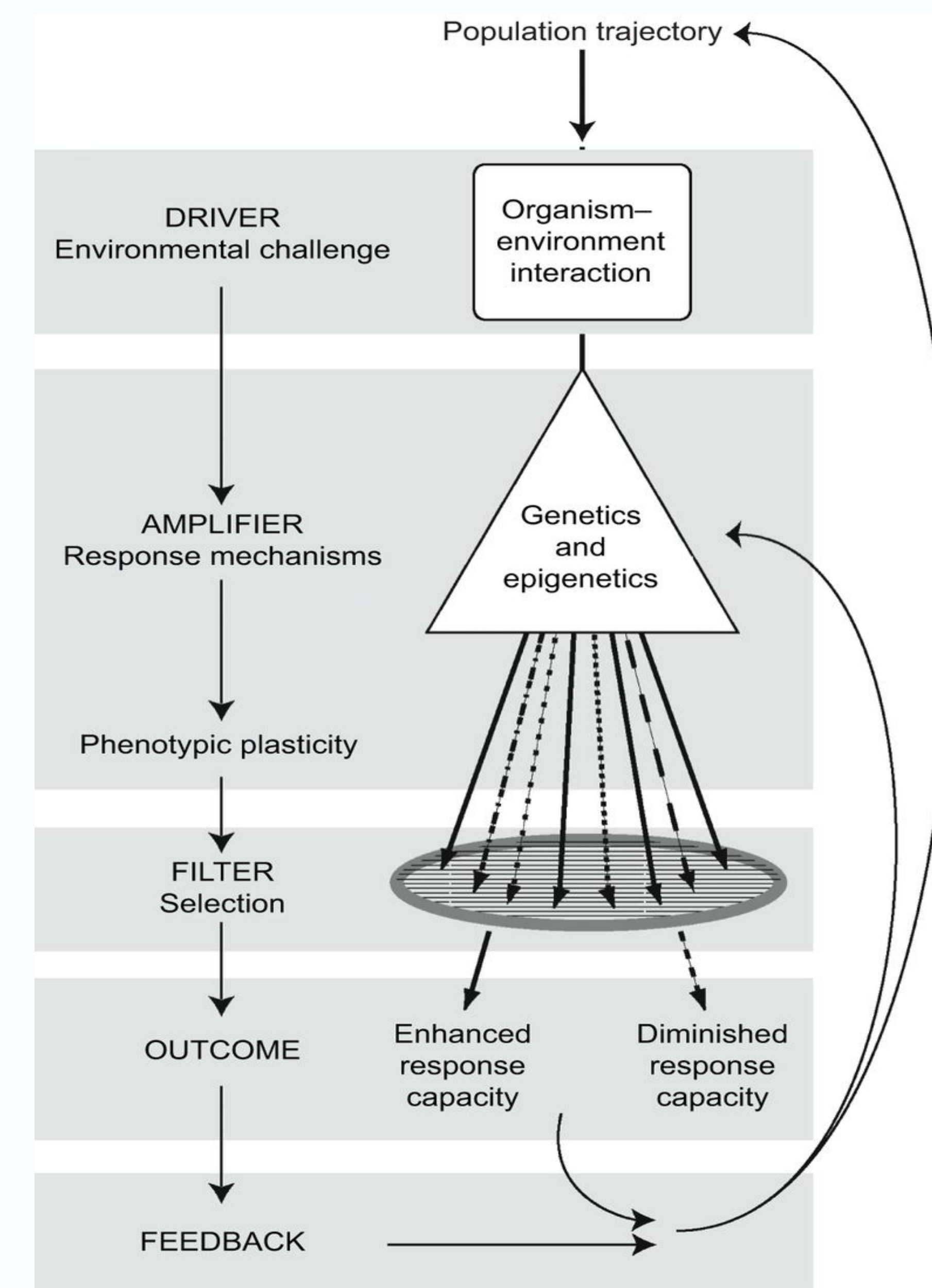
Temperature and Epigenomics in Marine Fish: DNA Methylation



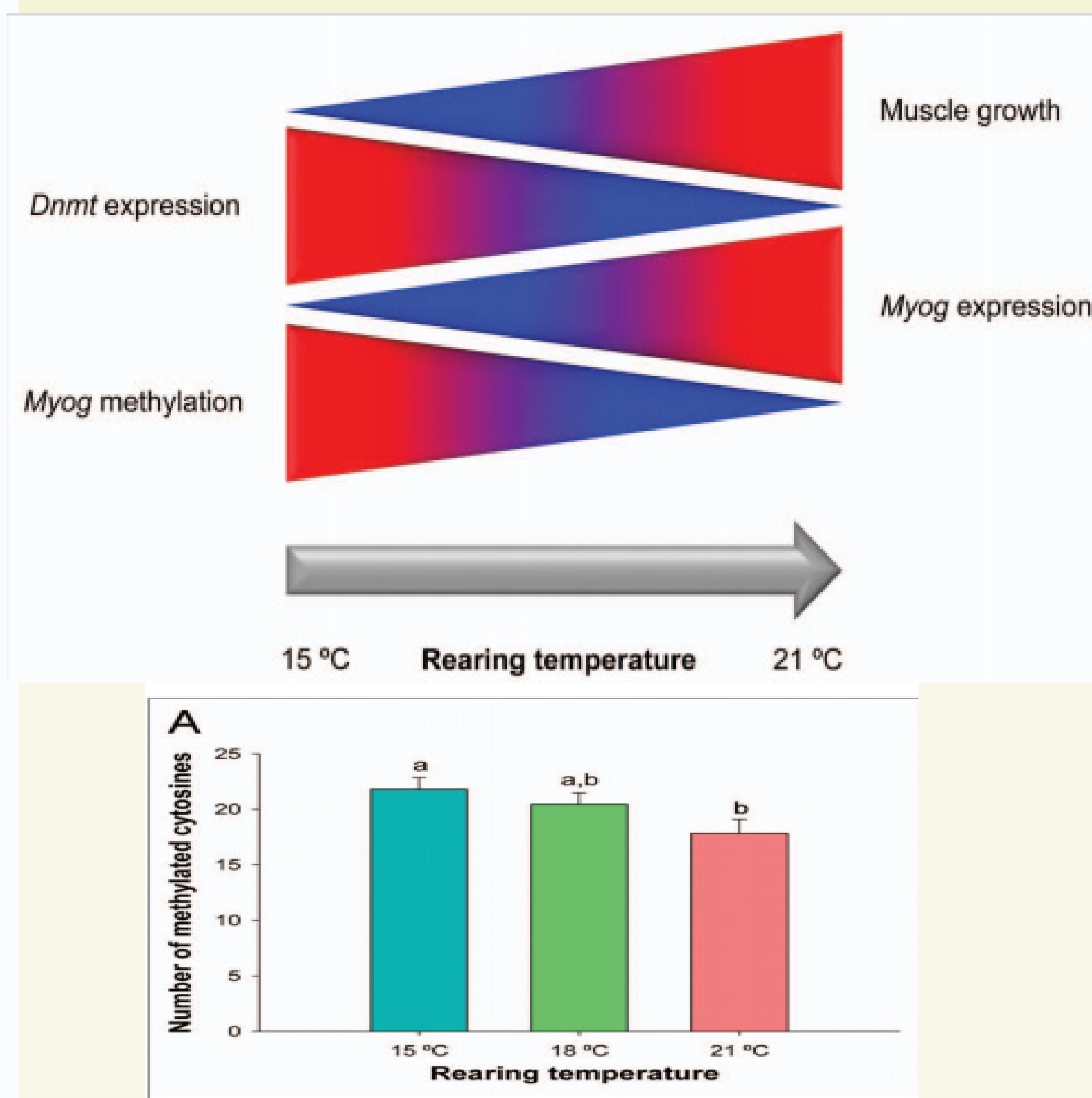
Epigenomics is the study of the complete set of epigenetic modifications on the genetic material of the cell. Epigenetic changes are heritable and reversible modifications on the cell's DNA or histones that affect the host phenotype without altering the DNA sequence. Epigenetic changes can be triggered by environmental factors, and lead to permanent changes in gene expression, affecting the phenotype of an organism.

DNA cytosine methylation is performed by a group of DNA Methyltransferases. DNMT1 maintains existing methylation, whereas DNMT3a and 3b are essential for de novo methylation.

Temperature has a profound effect on the biology and life history of fishes, regulating development, growth, physiology and sex ratio. Whole-genome methylation levels are inversely correlated with temperature across teleost taxa. Temperature is also shown to induce epigenetic changes during critical development periods.



Expression of myogenic regulatory factors on muscle differentiation in Senegalese Sole



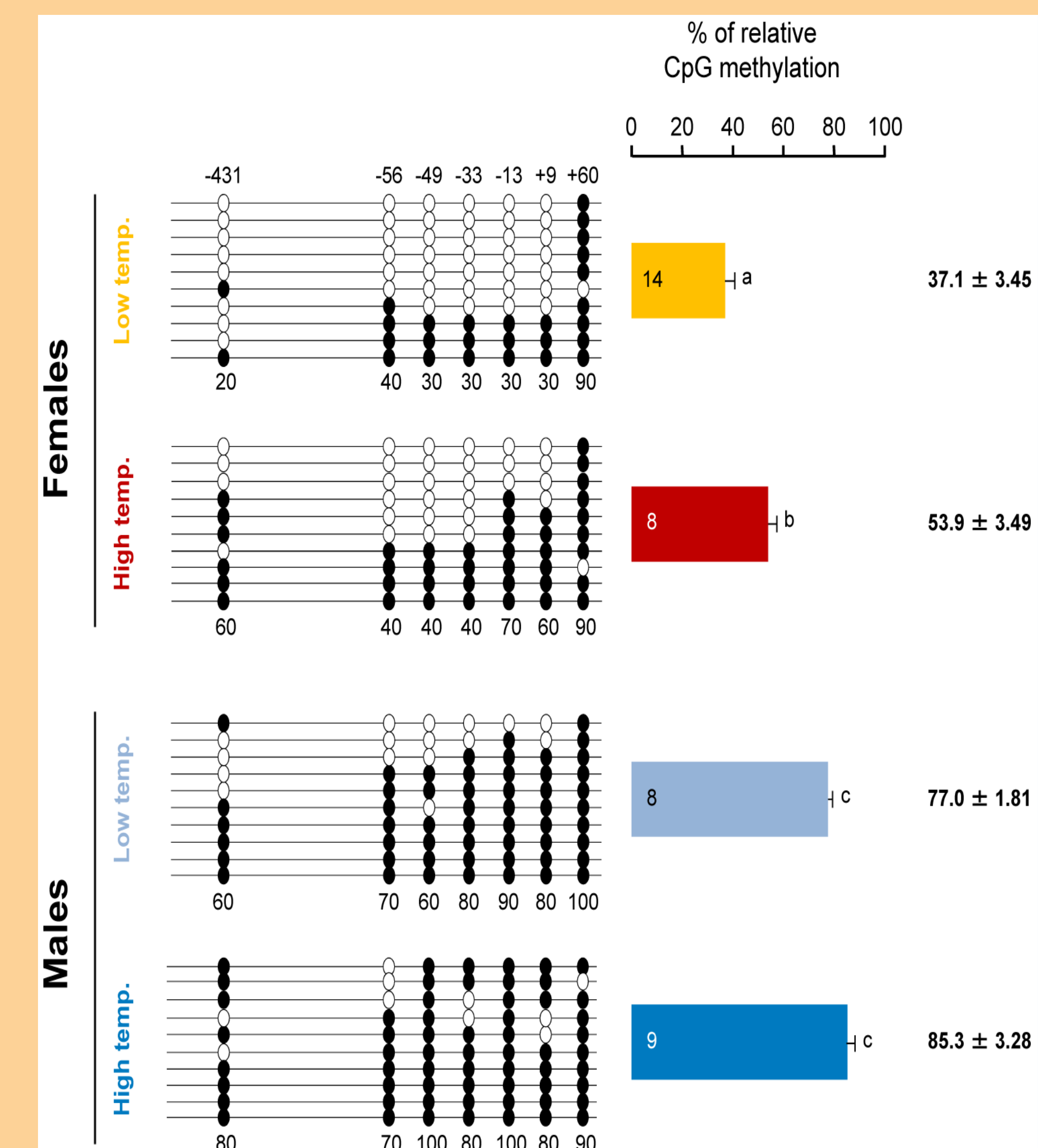
Methylation of cytosines within the myog promoter helps regulate the transcription of the myogenin regulatory factor which is involved in terminal muscle differentiation.

- Increased muscle growth at higher temperatures is well-documented in fish.
- Compared fish reared at three temperatures during larval stage (15, 18, 21°C).
- Lower temperatures increased myog promoter methylation in skeletal muscle.
- Myog transcription was downregulated at low temperatures, whereas dnmt1 and dnmt3b were upregulated.
- Muscle fibres were larger at high temperature.

Sex ratio in European Sea Bass

Many species of marine teleosts have temperature-mediated sex determination. Aromatase, an enzyme that transforms androgens into estrogens, can be blocked during the critical period for gonadal formation by methylation of the gonadal aromatase promoter (cyp19a).

- Two groups of European sea bass larvae were exposed to different temperatures, during their first weeks of life.



- High temperature exposure increased methylation of cyp19a promoter.
- Genetic females with the highest levels of DNA methylation developed as males due to aromatase inhibition.