

PROBLEM SET #6 (lectures 31-33; overlaps with Problem Set 5)

1. Understand the following terms regarding animal development and evolution

homeotic	segmentation	gene complex
homeobox	combinatorial control	gradient
DNA-binding protein	gene duplication and divergence	spatial regulation
activator	genetic hierarchy	pattern formation
repressor	morphogen	dominant mutation
cis-regulatory element	helix-turn-helix	gene family
selector gene		

NOTE: Some of these questions are to make you think. They may not have one “right” answer)

2. Can you imagine ways in which Arthropods acquired different segment numbers and appendages?
3. Butterflies have two pairs of wings (forewing and hindwing) and occasionally a specimen is found where one part of a hindwing resembles a forewing. Sometimes both hindwings resemble a forewing. Can you explain the two cases?
4. You have isolated mutants in a gene that you think specifies the development of the fly antenna. How would you test your idea further?
5. You believe that the product of your antenna gene turns on other genes in the antenna. How would you test this idea? What materials would you need? What parts of the regulated genes must you identify? How would you verify a direct interaction *in vitro* and *in vivo*, between the protein and candidate target genes?
6. You find that your “antenna” gene is closely linked to genes involved in leg and proboscis formation. What might you predict about the structure, function, and evolution of this gene?