

Name: _____

SSN (last 4 digits): _____

UNIVERSITY OF HOUSTON

FALL SEMESTER, 2004

BIOLOGY

BIOL4397 — Evolution of Development

NOTE: The maximum score is **100 points**. An incorrect, non-blank answer to a true/false or multiple choice question will incur a deduction of 25% of its score. Time allowed: **45 minutes**. You are advised to spend 20 minutes on questions 1–5 and 25 minutes on question 6.

1. Which of the following statements best describes Haeckel's Biogenetic Law? **[3 points]**

- (a) Development determines the course of evolution. []
- (b) Early developmental stages of related organisms are more similar to each other than are later developmental stages. []
- (c) The development of every organism recapitulates major events from its evolutionary history. [×]
- (d) Evolution occurs by the natural selection of developmental programs. []

2. Evaluate the following statements about the field of evolutionary developmental biology (EDB): **[2 points each]**

- (a) The resurgence of interest in EDB during the 1980s was partly motivated by the discovery that several important developmental mechanisms are conserved among distantly related groups of organisms. True [×] False []
- (b) Scientists such as von Baer, Haeckel and Waddington were not interested in any of the questions studied in modern EDB. True [] False [×]
- (c) The relative lack of progress in EDB from the 1940s to the 1970s was partly caused by the fact that Darwin was not interested in developmental biology. True [] False [×]
- (d) Traditionally, evolutionary biologists and developmental biologists view the phenomenon of variation in fundamentally different ways. True [×] False []
- (e) EDB aims to understand how developmental mechanisms affect the course of evolution. True [×] False []
- (f) EDB resulted from the coming together of evolution, systematics, genetics and paleontology during the 1930s. True [] False [×]

3. In the fruit fly *D. melanogaster*, the number of bristles on the scutellum is essentially an invariant trait: nearly all wild-type individuals in wild-type populations have 4 bristles. Indeed, this trait is diagnostic for the genus *Drosophila*. However, a mutation in the sex-linked gene *scute* reduces the number of bristles to an average of 2 in females and 1 in males. In addition, the number of scutellar bristles is highly variable in *scute* mutants, ranging between 0 and 4 in females, and between 0 and 3 in males. These results suggest that: **[3 points each]**

- (a) Wild-type flies show strong phenotypic plasticity in scutellar bristle number. True [] False [x]
- (b) Scutellar bristle number has a high environmental variance in wild-type flies. True [] False [x]
- (c) *Scute* acts pleiotropically on scutellar bristle number. True [] False [x]
- (d) The *scute* mutation causes an increase in either the genetic variance or the environmental variance in scutellar bristle number. True [x] False []
- (e) *Scute* mutants are more canalized than wild-type flies. True [] False [x]

4. After 22 generations of artificial selection for high scutellar bristle number in *scute* mutants, it was observed that mean bristle number increased from 1 to 2.8 in males and from 2 to 3.3 in females. These results suggest that: **[3 points each]**

- (a) The low degree of canalization of *scute* mutants had a genetic basis. True [x] False []
- (b) Directional selection for high scutellar bristle number was ineffective due to the high degree of canalization of the base population. True [] False [x]
- (c) The response to selection for scutellar bristle number did not have a genetic basis. True [] False [x]
- (d) There was cryptic genetic variation for scutellar bristle number in the wild-type population that was released in *scute* mutants. True [x] False []
- (e) The wild-type scutellar bristle phenotype was genetically assimilated into *scute* mutants. True [] False [x]

5. Imagine that when wild-type flies are exposed to geldanamycin (the specific inhibitor of the Hsp90 chaperone) they do not show a significantly different range of scutellar bristle number, when compared to untreated controls. This observation would suggest that: **[3 points each]**

- (a) The degree of canalization in scutellar bristle number does not have a genetic basis. True [] False [x]
- (b) Hsp90 does not affect the canalization of scutellar bristle number. True [x] False []
- (c) Hsp90 and *scute* act epistatically on scutellar bristle number. True [] False [x]