Fall 2021 **- Week 2**

Fall 2021 - EE BIOL184-1 - SEARS

Started on	Wednesday, 6 October 2021, 3:56 PM PDT
State	Finished
Completed on	Wednesday, 6 October 2021, 4:41 PM PDT
Time taken	45 mins
Grade	**22.50** out of 22.50 (**100**%)

Question **1**

Correct

1.25 points out of 1.25

(Fill in the blank) One common method for making a transgenic animal discussed in the online "Differential Gene Expression Lecture" is to replace your gene of interest with a _____.

a. reporter gene ✔

b. zygotic gene

c. karyotype gene

d. gametic gene

The correct answer is:
reporter gene

Question **2**

Correct

1.25 points out of 1.25

Which of the following is a true statement about the RNAi technique?

a. In an RNAi treated animal, the genetic coding sequence has been modified or removed

b. RNAi relies on the use of double stranded RNA ✔

c. RNAi increases the expression levels of the gene under investigation

d. RNAi can only be used in Drosophila

The correct answer is:

RNAi relies on the use of double stranded RNA

Question **3**

Correct

1.25 points out of 1.25

Which of the following is an accurate statement about the "toolbox" of development?

a. It is dominated by housekeeping genes

b. It differs greatly from animal to animal in the animal kingdom

c. It contains many more genes than initially expected

d. It contains genes called transcription factors ✔

The correct answer is:

It contains genes called transcription factors

Question **4**

Correct

1.25 points out of 1.25

The drug thalidomide was given to pregnant human women in the late 1950's. Infants of pregnant women exhibited varying degrees of developmental disruption, with some infants missing ears, arms, and legs. Pregnant women also took thalidomide during different trimesters of their pregnancy. During which trimester would you expect thalidomide to have the largest impact on ear, arm, and leg development of the infant (i.e., the resulting infant would display the largest developmental disability)?

a. Second trimester (e.g., middle three months of pregnancy)

b. Third trimester (e.g., last three months of pregnancy)

c. First trimester (e.g., first three months of pregnancy) ✔

The correct answer is:
First trimester (e.g., first three months of pregnancy)

Question **5**

Correct

1.25 points out of 1.25

In which of the following choices are the developmental processes in the correct order from first occurring to last occurring?

a. Post-embryonic development, Cell division, Fusion of sperm and egg

b. Generation of diverse cell types, Cell division, Tissue organization

c. Cell division, Tissue organization, Generation of diverse cell types

d. Fusion of sperm and egg, Tissue organization, Post-embryonic development ✔

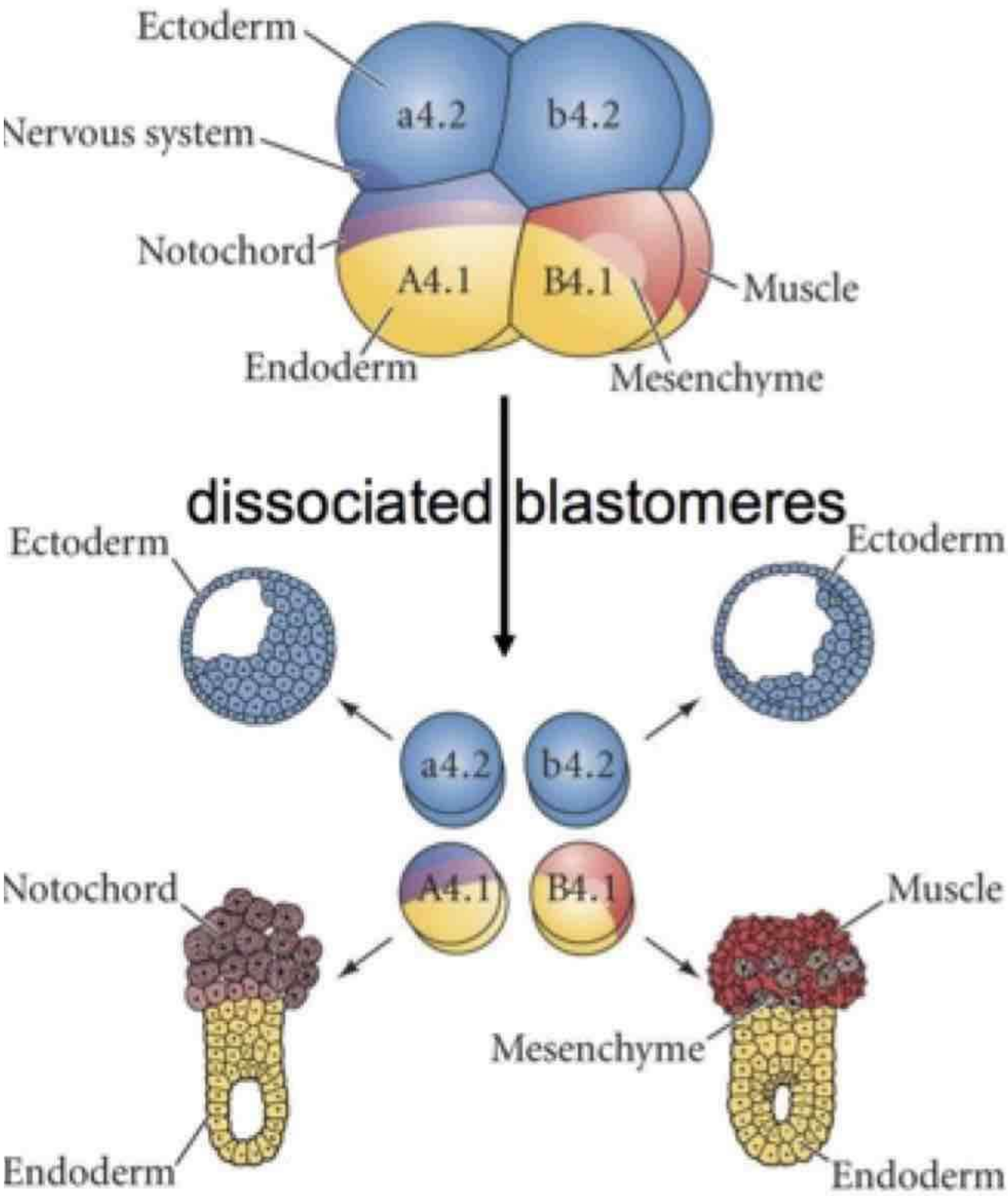
The correct answer is:
Fusion of sperm and egg, Tissue organization, Post-embryonic development

Question **6**

Correct

1.25 points out of 1.25

The diagram below illustrates an experiment in sea squirts.



At the stage in development shown in the top image in the diagram, the developing sea squirt has 8 blastomeres (i.e., cells). If the blastomeres are split up (i.e., dissociated), each blastomere will continue developing and ultimately produce the original structures it would have produced had the blastomeres not been split. Based on this, you can say that the blastomeres in the top image in the diagram exhibit:

a. Conditional specification

b. Autonomous specification ✔

c. Syncytial specification

d. Undifferentiated specification

The correct answer is:
Autonomous specification

Question 7

Correct

1.25 points out of 1.25

You are a scientist working in a lab, studying the development of a newly discovered fish. The head of the lab asks you to determine whether the cells in a novel structure in the fish, the gold zone, are already determined at a given timepoint in development. During normal development, gold zone cells are found on the back of the fish and ultimately form the fish's ventral spine. To answer your lab head's question, you cut out and move the cells from the gold zone in the back of the fish to the head of the fish. Which of the following experimental outcomes would support the hypothesis that the gold zone cells are determined by the developmental timepoint at which you performed your experiment?

a. The transplanted gold zone cells contribute to the structures that normally make up the head.

b. The transplanted gold zone cells cease their growth and undergo massive cell death.

c. The transplanted gold zone cells form a structure that resembles a ventral spine. ✔

d. The transplanted gold zone cells migrate from the head to the back of the fish.

The correct answer is:
The transplanted gold zone cells form a structure that resembles a ventral spine.

Question 8

Correct

1.25 points out of 1.25

The gene *engrailed* is involved in many aspects of organismal development, including the determination of the hindbrain/midbrain border and segment polarization in bilaterian animals. Engrailed protein is found in the nucleus of cells where it binds to specific DNA sequences to drive expression of other genes. Based on these facts, what type of a gene is *engrailed*?

a. Signaling protein

b. Housekeeping gene

c. Transcription factor ✔

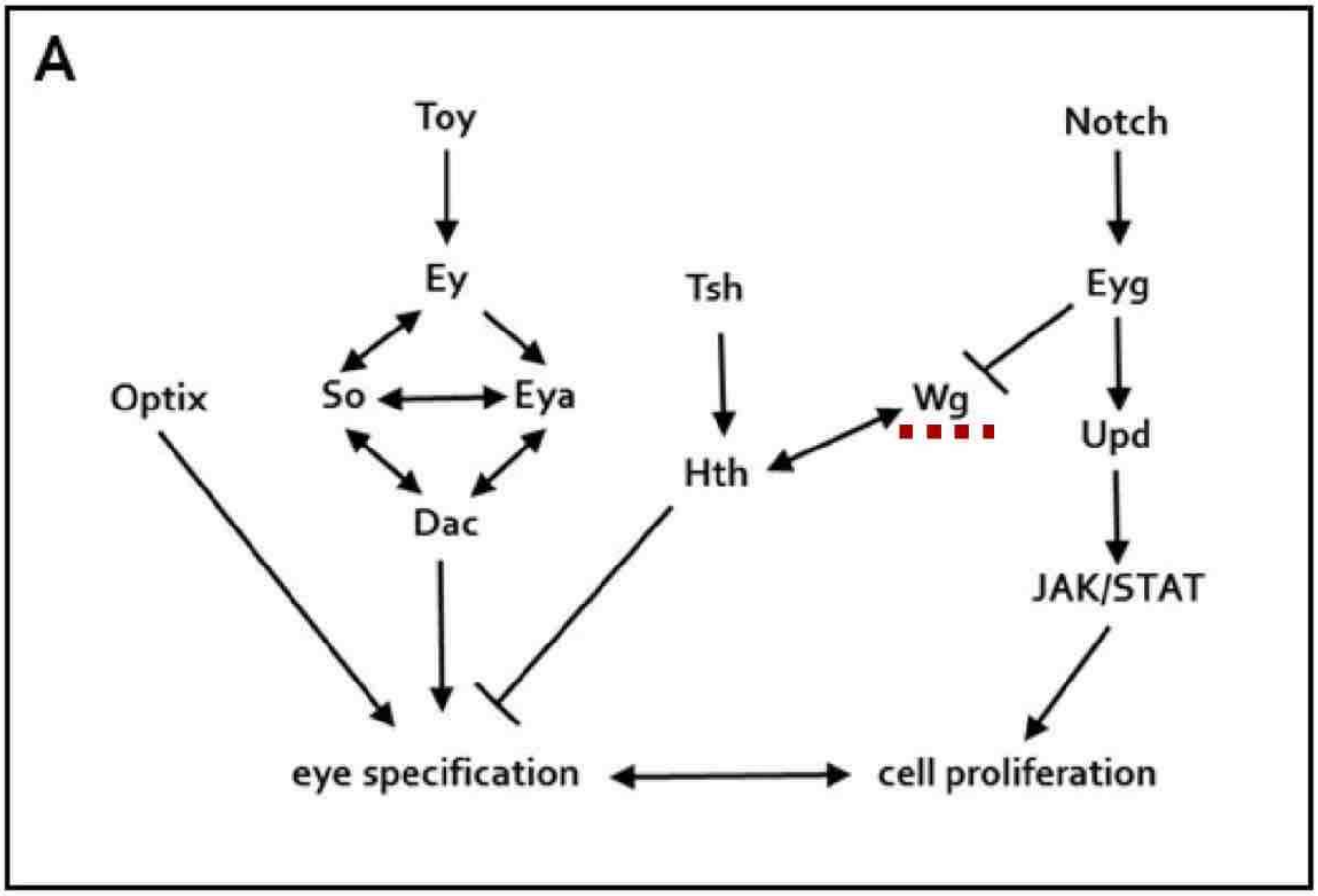
The correct answer is:
Transcription factor

Question **9**

Correct

1.25 points out of 1.25

The diagram below shows a gene interaction network for *Drosophila* head development.



Based on this diagram, which of the following outcomes would you expect to occur when expression levels of *Wg* (underlined with a broken line in the figure) are reduced?

- a. *Hth* expression levels go down ✔
- b. *Tsh* expression levels go down
- c. *Notch* expression levels go up
- d. *Eyg* expression levels go up

The correct answer is:
Hth expression levels go down

Question **10**

Correct

1.25 points out of 1.25

Patterning of the Drosophila anterior-posterior axis occurs through a complex set of hierarchical developmental processes. In which of the following choices are these developmental processes listed in the correct order from first occurring to last occurring?

a. The gap gene *knirps* is expressed, the pair-rule gene *fushi tarazu* defines the edge of individual segments, Bicoid (*bcd*) mRNA is deposited in the egg

b. The pair-rule gene *fushi tarazu* defines the edge of individual segments, *Nanos* (*nos*) restricts *hunchback* (*hb*) to the anterior of the developing embryo, Bicoid (*bcd*) mRNA is deposited in the egg

c. Wingless (*wg*) affects polarity of each developing segment, the pair-rule gene *fushi tarazu* defines the edge of individual segments, *Nanos* (*nos*) restricts *hunchback* (*hb*) to the anterior of the developing embryo

d. *Nanos* (*nos*) restricts *hunchback* (*hb*) to the anterior of the developing embryo, the gap gene *knirps* is expressed, Wingless (*wg*) affects polarity of each developing segment ✔

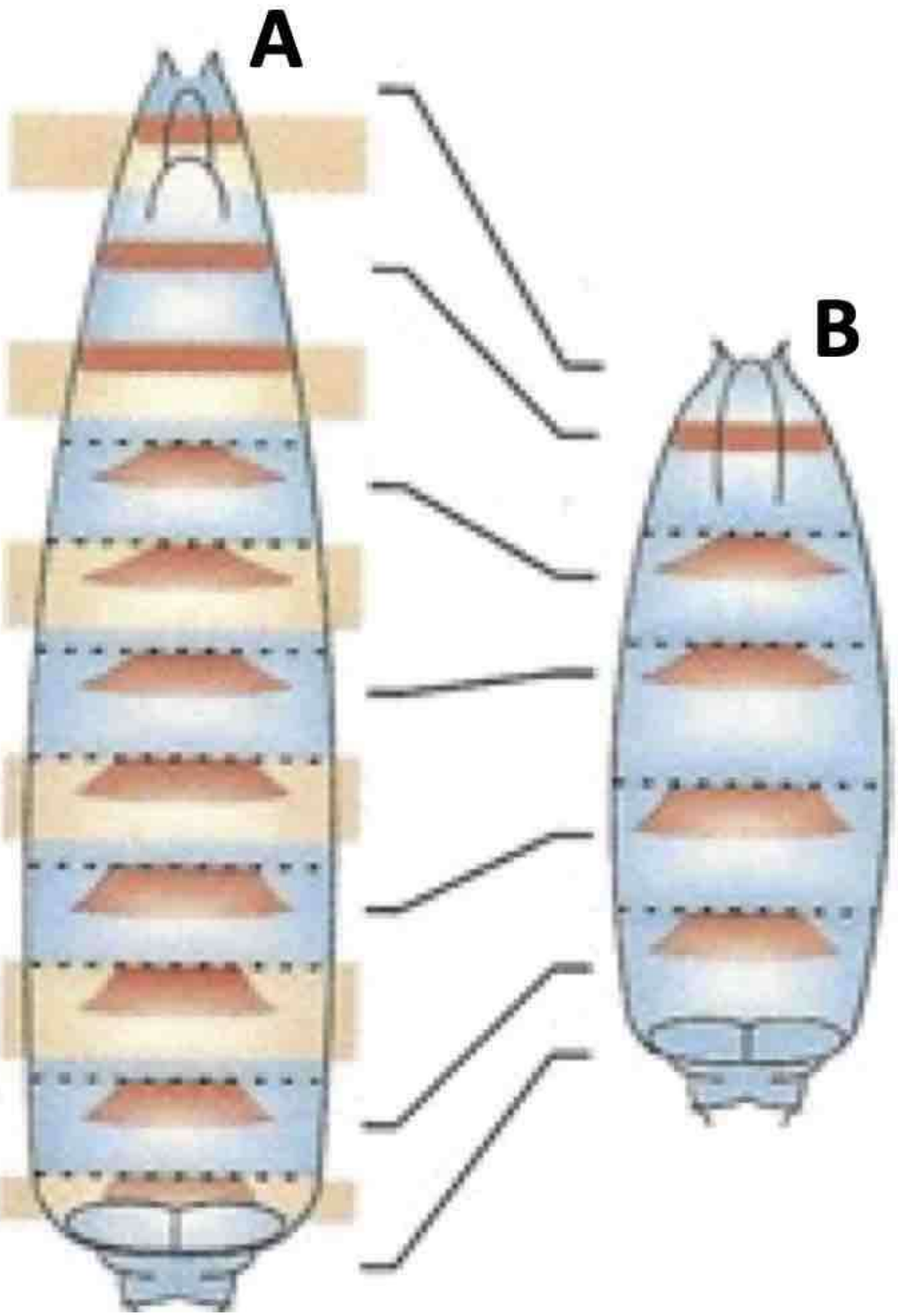
The correct answer is:
Nanos (*nos*) restricts *hunchback* (*hb*) to the anterior of the developing embryo, the gap gene *knirps* is expressed, Wingless (*wg*) affects polarity of each developing segment

Question **11**

Correct

1.25 points out of 1.25

The diagram below shows two *Drosophila* larvae.



The larva on the left (A) is a wild-type (normal) larva. The expression of a single gene has been disrupted in the larva on the right (B). Given the form of the larva on the right, what type of gene has been disrupted (B)? Hint: the light bars on highlight the parts of the body of the wildtype larva (A) that are not present in the larva on the right (B).

a. Gap gene

b. Segment polarity gene

c. Pair-rule gene ✔

d. Maternal effect gene

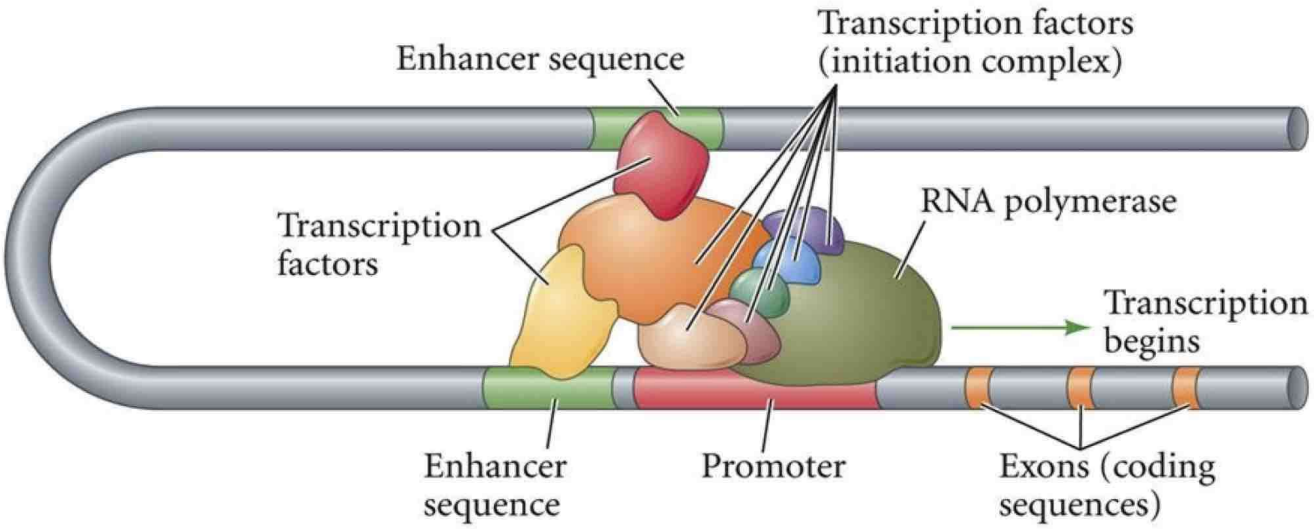
The correct answer is:
Pair-rule gene

Question 12

Correct

1.25 points out of 1.25

Each cell has its own unique set of genes that are transcribed. How does the machinery shown below generate different transcription patterns in different cells (i.e., what could be different)?



a. The transcription factors present in the nucleus differ from cell to cell ✔

b. The promoter sequences differ from cell to cell

c. The levels of RNA polymerase differ from cell to cell

d. The enhancer sequences differ from cell to cell

The correct answer is:
The transcription factors present in the nucleus differ from cell to cell

Question **13**

Correct

1.25 points out of 1.25

As animals age, their cells may show an increase in the level and activity of histone methyltransferase. Which of the following would be an expected outcome of this increase?

a. Increase in the overall rate of gene transcription

b. Decrease in the overall rate of diffusion of signaling proteins

c. Decrease in the overall rate of gene transcription ✔

d. Increase in the overall rate of diffusion of signaling proteins

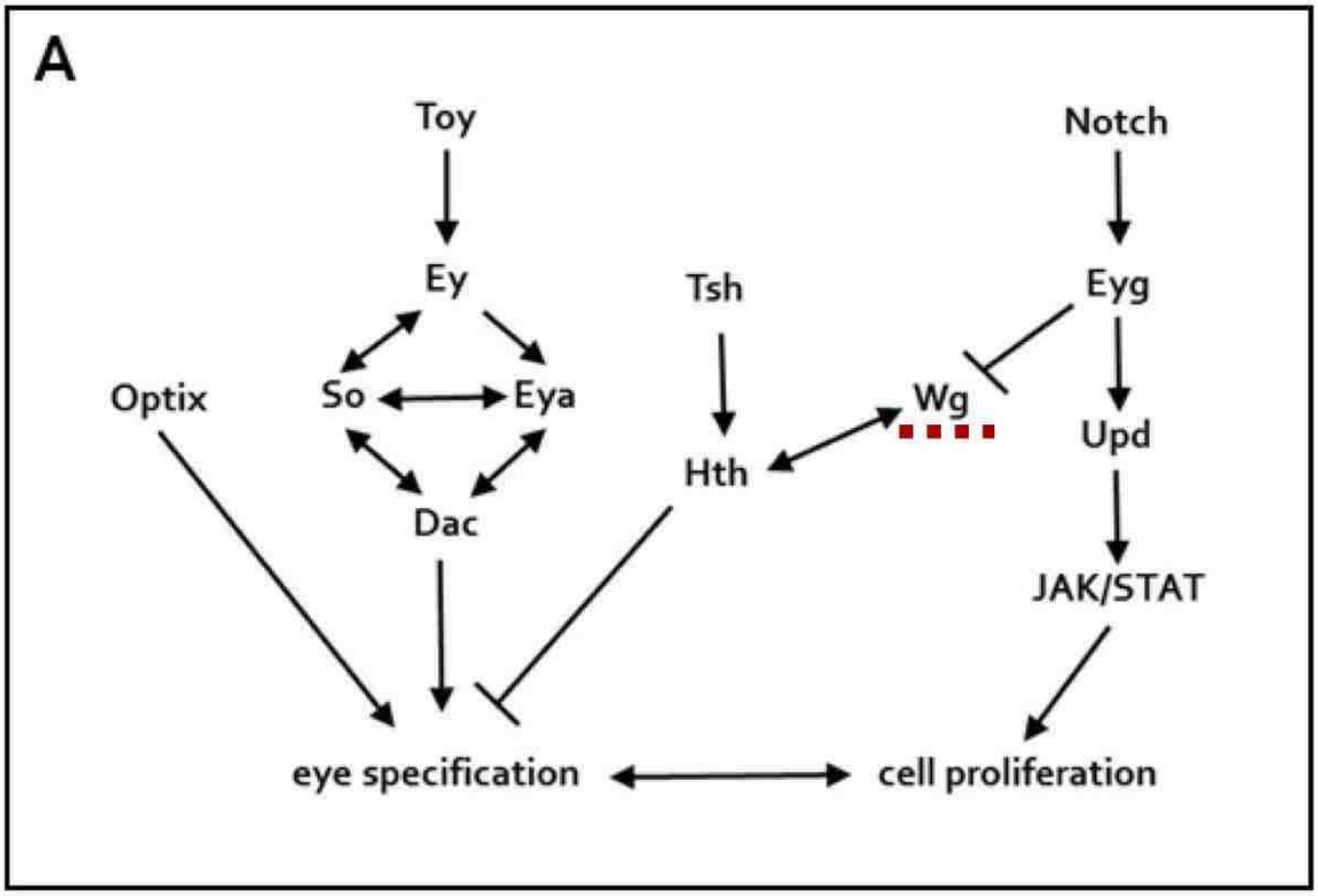
The correct answer is:
Decrease in the overall rate of gene transcription

Question **14**

Correct

1.25 points out of 1.25

The diagram below shows a gene interaction network for *Drosophila* head development.



Which of the following is a correct statement about the interaction between *Hth* and *Tsh* in this network?

a. *Tsh* is an indirect upstream repressor of *Hth*

b. *Tsh* is a direct downstream repressor of *Hth*

c. Tsh is an indirect downstream activator of Hth

d. *Tsh* is a direct upstream activator of *Hth* ✔

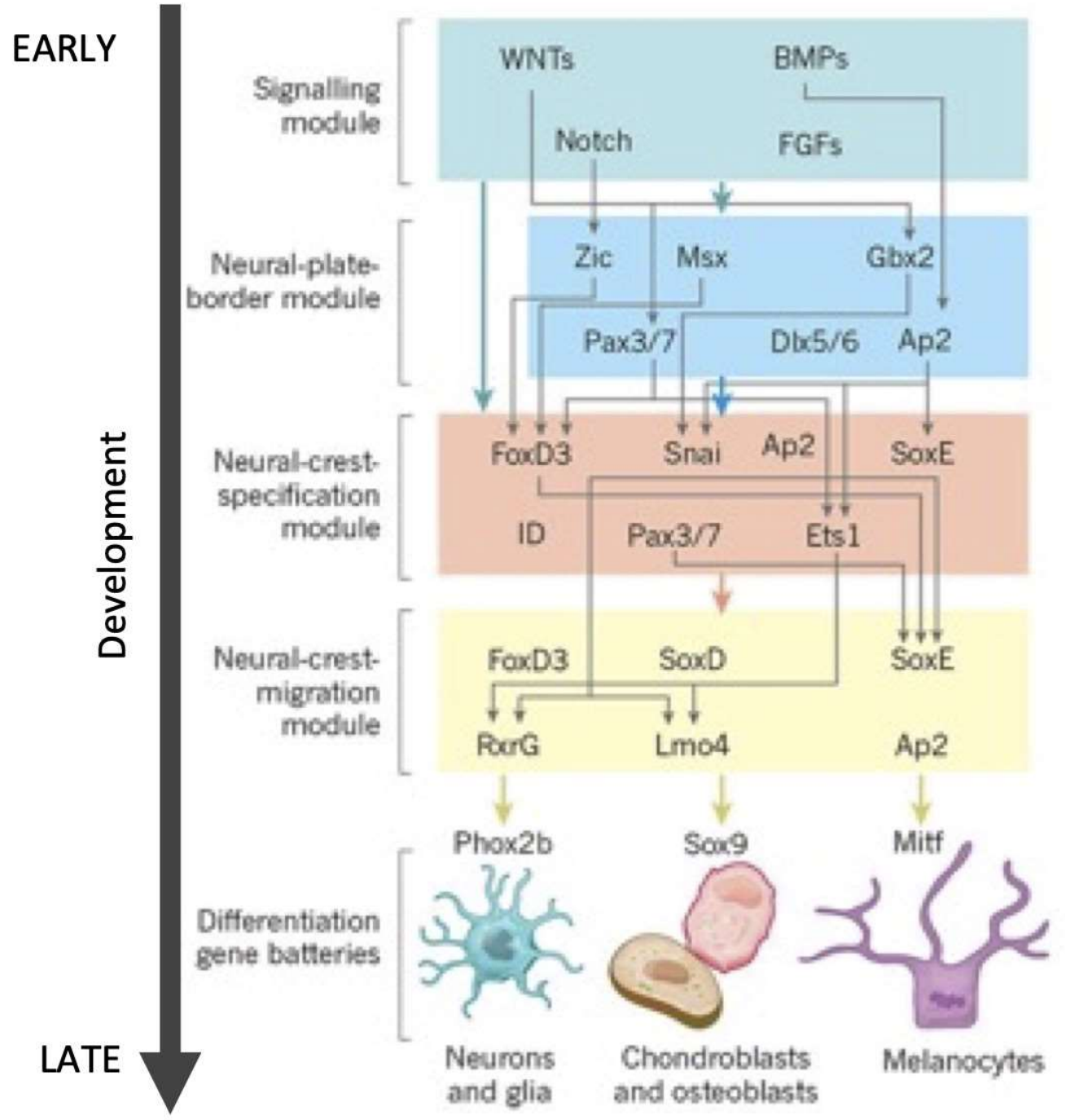
The correct answer is:
Tsh is a direct upstream activator of *Hth*

Question **15**

Correct

1.25 points out of 1.25

The diagram below shows a gene regulatory network for neural crest cell development, going from earlier in development at the top to later in development at the bottom.



Based on what we learned in class and the information provided in the diagram, which of the following genes would you expect to have the most pleiotropic impact on neural crest cell development?

a. *SoxD*

b. *Sox9*

c. *WNTs* ✔

d. *Snai*

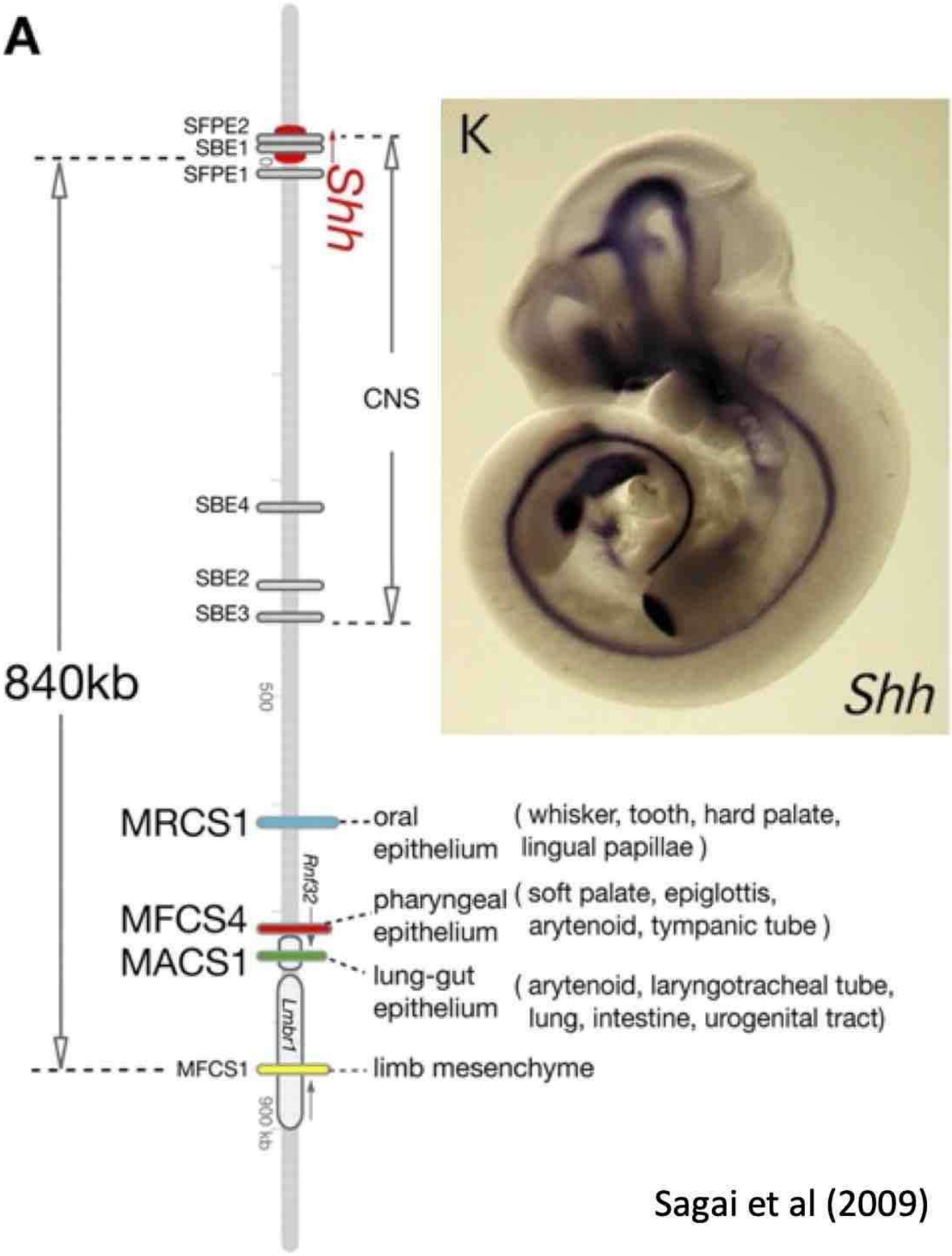
The correct answer is:
WNTs

Question **16**

Correct

1.25 points out of 1.25

The following information should be used to answer questions 16, 17, and 18. The figure below shows how the gene *Shh* is regulated in several mouse tissues: CNS (central nervous system; SBE1-4 switch), oral epithelium (MRCS1 switch), pharyngeal epithelium (MFCS4 switch), lung-gut epithelium (MACS1 switch), and the limb mesenchyme (MFCS1 switch). The mouse embryo in K has been stained to show the areas in which *Shh* is expressed.



Question 16: Assume a mouse inherits a deletion mutation in the CNS switch which inactivates that switch. You isolate DNA from the CNS, oral epithelium, pharyngeal epithelium, lung-gut epithelium, and limb mesenchyme. In the DNA of which tissue(s) would you expect to find the CNS switch mutation?

a. Just the CNS and epithelial (oral, pharyngeal, lung-gut) tissues

b. Just the CNS tissues

c. None of the tissues

d. Just the epithelial (oral, pharyngeal, lung-gut) and limb mesenchyme tissues

e. All of the tissues ✔

The correct answer is:
All of the tissues

Question 17

Correct

1.25 points out of 1.25

Please refer to the image in Question 16 to answer this question.

Question 17: Assume a mouse inherits a deletion mutation in the CNS switch which inactivates that switch. In tissue(s) would you expect *Shh* to be expressed?

a. Just the CNS and epithelial (oral, pharyngeal, lung-gut) tissues

b. Just the CNS tissues

c. All of the tissues

d. Just the epithelial (oral, pharyngeal, lung-gut) and limb mesenchyme tissues ✔

e. None of the tissues

The correct answer is:
Just the epithelial (oral, pharyngeal, lung-gut) and limb mesenchyme tissues

Question **18**

Correct

1.25 points out of 1.25

Please refer to the image in Question 16 to help answer this question.

Question 18. Adult snakes lack limbs. However, most snakes initially develop limb buds that are subsequently lost. Researchers have found that *Shh* is expressed normally (e.g., as would be expected in limbed animals) in the limbs of some basal snakes (e.g., boa) but that *Shh* expression is lost (e.g., cobra) or shows a much different pattern from all other limbed animals (e.g., rattlesnake) in more advanced snakes. *Shh* is expressed normally in other snake tissues (e.g., epithelial tissues and CNS). Based on these findings, in which of the following elements would you expect the mutation that led to the change in *Shh* expression in advanced snakes to be located?

- a. Limb mesenchymal enhancer of *Shh* ✔
- b. Protein-coding region of Shh
- c. Promoter of Shh
- d. CNS enhancer of SHH

The correct answer is:
Limb mesenchymal enhancer of *Shh*

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