

Type: multiple choice question

Title: Chapter 01 - Question 01

01) Which of these terms refers to the “generation of form?”

a. Developmental biology

Feedback: No, developmental biology is the field of biology focused on understanding how animals and plants develop.

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b. Embryogenesis

Feedback: No, embryogenesis is the development of an embryo from a fertilized egg.

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*c. Morphogenesis

Feedback: Yes, morphogenesis is the development of form. The meaning comes from the words “morph” (form) and “genesis” (generation of).

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d. Embryology

Feedback: No, embryology is an outdated term to describe the study of developmental biology. Modern developmental biologists appreciate that development of an organism continues after embryogenesis.

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Type: multiple choice question

Title: Chapter 01 - Question 02

02) Which of these is true of meiosis?

*a. Germ cells are formed through this process.

Feedback: Yes, this is true. Germ cells, sperm and egg, are formed when a diploid cell undergoes meiosis to give rise to four cells containing half the number of chromosomes (haploid).

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b. A zygote is formed through this process.

Feedback: No, this is not true. A zygote is formed when fusion of a haploid egg nucleus with a haploid sperm nucleus takes place.

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c. This process is carried out during cleavage stage.

Feedback: No, this is not true. Cleavage stage is when a single-celled zygote undergoes rapid mitotic cell divisions.

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d. Daughter somatic cells are formed containing the same number of chromosomes as the parental cell.

Feedback: No, this is not true. Mitosis is the type of cell division somatic cells use to keep the number of chromosomes constant from parental cell to daughter cells.

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Type: multiple choice question

Title: Chapter 01 - Question 03

03) What is the key hypothesis of a mosaic model for developmental fate regulation?

a. Normal development occurs even if cells are removed.

Feedback: No, if normal development proceeds even after cell removal this highlights an embryo’s ability to regulate for this cell loss. This is the opposite of mosaic development where cytoplasmic determinants are specific to a subset of embryonic cells.

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b. Zygotic proteins and RNAs are equally distributed to daughter cells

Feedback: No, zygotic cytoplasmic determinants are expected to be unequally distributed among daughter cells during cleavage events. This is how subpopulations of embryonic cells would establish different characteristics within the context of a mosaic model.

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*c. Patterns of cell division control embryonic cell fate.

Feedback: Yes, cytoplasmic determinants within the zygote are distributed unequally within daughter cells during cleavage stage. Each cell's determinants control the future fate of that cell.

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d. Cells within an early embryo communicate with each other.

Feedback: No, cell-cell communication is a key expectation of cells within an embryo capable of regulating for cell loss. It is understood that communication is necessary for sensing cell loss.

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Type: multiple choice question

Title: Chapter 01 - Question 04

04) The influence of one cell over another neighbouring cell's development is called.

a. Interaction

Feedback: No, induction is where one cell, or tissue, directs the development of another neighbouring cell or tissue through cell-cell signalling.

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b. Communication

Feedback: No, induction is where one cell, or tissue, directs the development of another neighbouring cell or tissue through cell-cell signalling.

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c. Organization

Feedback: No, induction is where one cell, or tissue, directs the development of another neighbouring cell or tissue through cell-cell signalling.

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*d. Induction

Feedback: Yes, induction is where one cell, or tissue, directs the development of another neighbouring cell or tissue through cell-cell signalling.

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Type: multiple choice question

Title: Chapter 01 - Question 05

05) Which of the options given is not true of the Spemann-Mangold organizer experiment?

a. The transplanted tissue is the dorsal lip of the blastopore.

Feedback: No, this is true. The transplanted tissue is the dorsal lip of the blastopore from an unpigmented embryo.

Page reference: 8

b. A secondary body axis developed, containing neural tube and somites.

Feedback: No, this is true. The dorsal blastopore lip transplantation into the ventral surface of another embryo induced a secondary axis.

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c. The transplanted tissue resides near the region where gastrulation begins.

Feedback: No, this is true. The blastopore is the site where gastrulation begins in the newt. The dorsal lip of the slit-like invagination is the organizer tissue.

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*d. Every induced tissue was pigmented.

Feedback: No, this is not true. Tissues within the induced secondary axis contained cells of graft (unpigmented) and host (pigmented) origin. This suggests that cells within the graft tissue send inductive signals to the host tissue.

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Type: multiple choice question

Title: Chapter 01 - Question 06

06) Which developmental process establishes a coordinate system whereby cells "know" their location within an embryo?

a. Morphogenesis

Feedback: No, morphogenesis is the generation of form through cell shape change and movements.

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b. Cell differentiation

Feedback: No, differentiation is the process of cells becoming structurally and functionally different from each other, ending up as distinct specialized cell types.

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***c. Pattern formation**

Feedback: Yes, pattern formation involves the establishment of a body plan with defined main body axes. Cells with knowledge of their spatial position along the antero-posterior, dorso-ventral, and right-left axes can develop accordingly.

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d. Growth

Feedback: No, growth is the increase in size. Growth can occur through increases in cell number or size.

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Type: multiple choice question

Title: Chapter 01 - Question 07

07) Pancreatic and muscle cells are specialized to perform distinct functions but contain the exact same set of genetic instructions. Which of the options given does not represent a mechanism to accomplish this?

***a.** Differentiated cells lose genes that are unrelated to their function.

Feedback: Yes, this is not a proper mechanism. Animal cloning experiments, such as the one performed by John Gurdon, suggest that adult differentiated cells contain the same set of genetic instructions as cells within the early embryo.

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b. Differentiated cells contain distinct gene-regulatory proteins

Feedback: No, this is a proper mechanism. Gene regulatory proteins, in different combinations, determine the list of genes that are expressed in specific cell types within the organism.

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c. Differentiated cells use distinct gene control regions.

Feedback: No, this is a proper mechanism. Gene regulatory proteins, in different combinations, bind to and activate or repress specific DNA control regions. This creates a bank of expressed cell-specific genes that dictates a cell's function.

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d. Differentiated cells undergo specific types of post-translational protein modification.

Feedback: No, this is a proper mechanism. Even if a gene is expressed and the protein produced, cells can modify the same protein differently between cell types. This can lead to differences in cellular behaviour.

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Type: multiple choice question

Title: Chapter 01 - Question 08

08) What do we call a group of cells that differentiates according to its normal fate after it has been isolated from the embryo and cultured in a neutral environment?

a. Determined

Feedback: No, determination is assessed by transplanting cells from their normal embryonic region to an ectopic embryonic region and observing their fate.

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b. Chimeric

Feedback: No, a chimera is a mosaic of cells with different genetic make-up.

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***c. Specified**

Feedback: Yes, an isolated cell is said to be specified if its final differentiated state in isolation mimics its expected embryonic fate.

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d. Competent

Feedback: No, competence is a term used to describe a cell's ability to receive and respond to an inductive signal.

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Type: multiple choice question

Title: Chapter 01 - Question 09

09) Which of the options given is not true of the French flag mechanism of pattern formation?

***a.** Differing concentrations of a teratogen provide positional values.

Feedback: Yes, this is not true. Differing concentrations of morphogens provide positional values by diffusing away from a source. Teratogens are chemicals that cause abnormal development.

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b. Cells develop according to threshold concentrations of a molecule.

Feedback: No, this is true. Cells that receive a morphogen above a particular concentration develop differently than nearby cells that receive a morphogen below that concentration threshold.

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c. Experiments using amphibian and insect limbs were among the first to lend support to this model.

Feedback: No, this is true. Regenerating amphibian and insect limbs, in which they regenerated missing tissues, played a key part in the establishment of this model. It is understood that regenerating tissues must acknowledge their position in order to know what is missing and to replace it in the correct spatial position.

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d. The model gets its name from the three colors of the French flag (blue, white, red).

Feedback: No, this is true. The three domains of color within the flag represent three regions of cells receiving differing concentration thresholds of a morphogen along a line. Cells within each domain establish distinct genetic programs that define their fate.

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Type: multiple choice question

Title: Chapter 01 - Question 10

10) A human zygote, which has the potential to give rise to a complete new human, is often described as what type of cell?

a. Unipotent

Feedback: No, a unipotent cell can only give rise to one type of cell.

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b. Multipotent

Feedback: No, a multipotent cell has the potential of differentiating into many, but not all cell types. Its fate is far more restricted than a pluripotent cell.

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***c.** Totipotent

Feedback: Yes, a human zygote is the only cell known to have the potential of giving rise to a complete new human. We refer to the zygote as totipotent.

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d. Pluripotent

Feedback: No, pluripotent cells have the potential to give rise to all the cells in the body but haven't been shown to be able to give rise to a complete new human on their own.

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