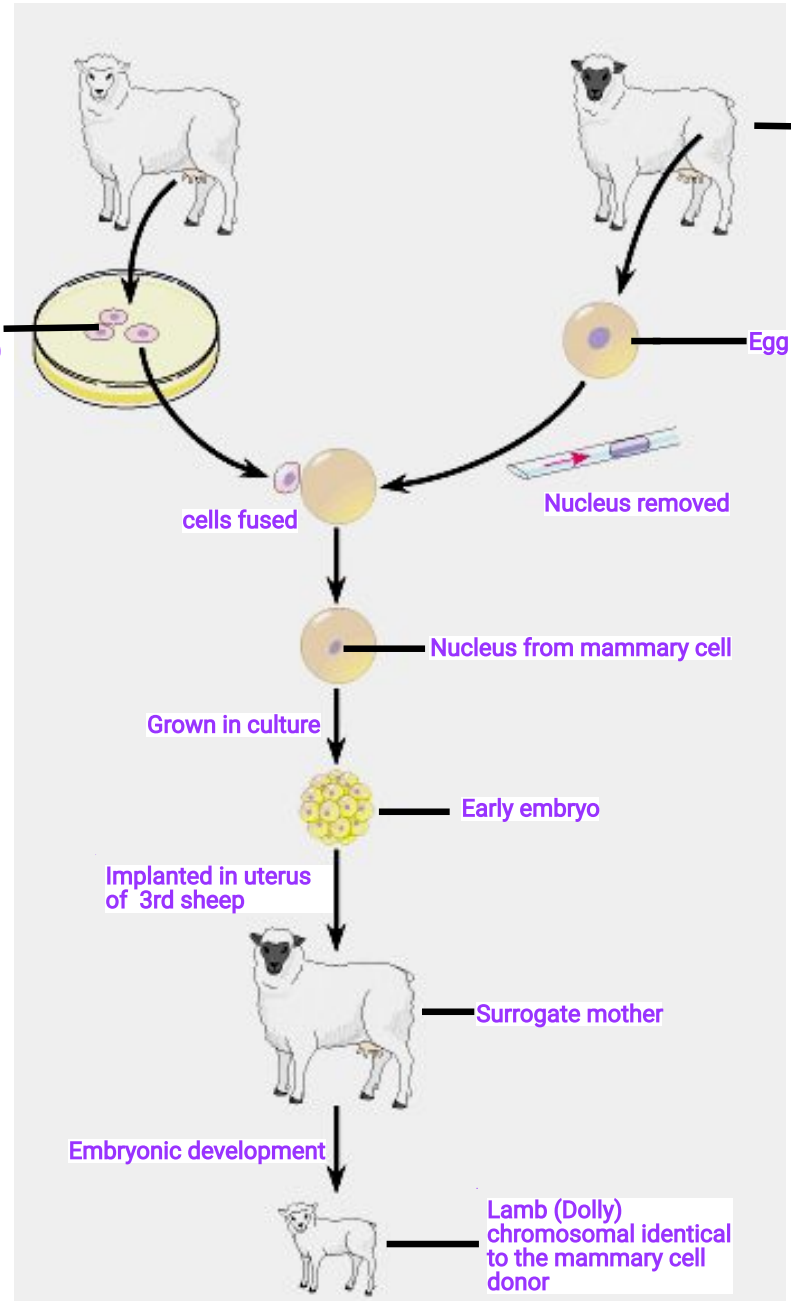
Guided Reading: Chapter 21

(p.399) **39.** Label the diagram below and use it to describe the process of cloning in mammals. (Animation)



(p.409) **40.** In most cases, only a tiny percentage of cloned embryos develop normally. Why is this?

Only a tiny percentage of cloned embryos develop normally due to improper methylation, often having an extra methyl group (-CH3). Because DNA methylation helps regulate gene expression, an appropriate gene expression is KEY to embryological development, it makes sense that misplaced methyl groups could interfere with embryological development.

41. Embryonic development involves ***cell division*** (mitosis + cytokinesis), ***cell differentiation*** and ***morphogenesis***. Define ***cell differentiation*** and ***morphogenesis.***

Cell differentiation is when a cell becomes specialized when they express genes that encode tissue-specific proteins.

Morphogenesis is the process when a cell, tissue or organ develop its specific shape.

(p.409) **42.** What is a ***totipotent*** cell?

A totipotent cell is an embryonic stem cell capable of giving rise to any cell type in a developing embryo.
Totipotent embryonic stem cells can differentiate into a hundred different cell types specialized to form such tissues as skin, marrow, and muscle.

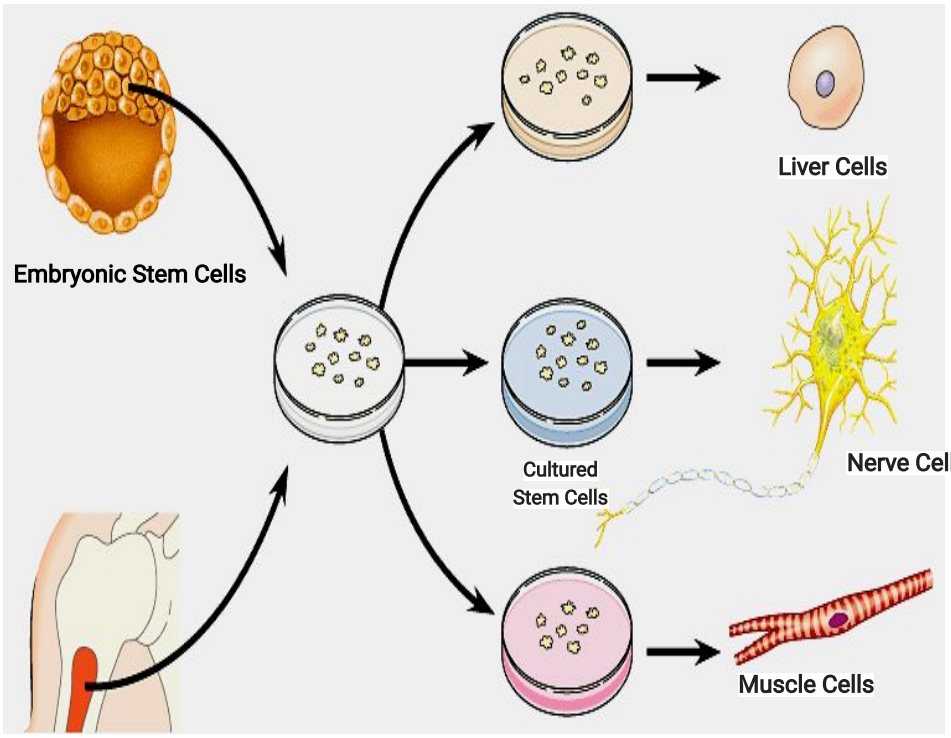
(p.409) **43.** What are ***stem cells*** and what two important properties do they possess? (Animation) (Animation-II)

Stem cells are special human cells that are able to develop into many different cell types. As relatively unspecialized cells, they continually reproduce themselves; and under appropriate conditions, they differential into specialized cells of one or more types.

(p.409) **44.** Label the diagram below and use it to describe the benefits of stem cell research.

(Animation)

Benefits:



(1) Valuable means of studying DIFFERENTATION.

(2) Supply cells for the reair of damaged or diseased organs.

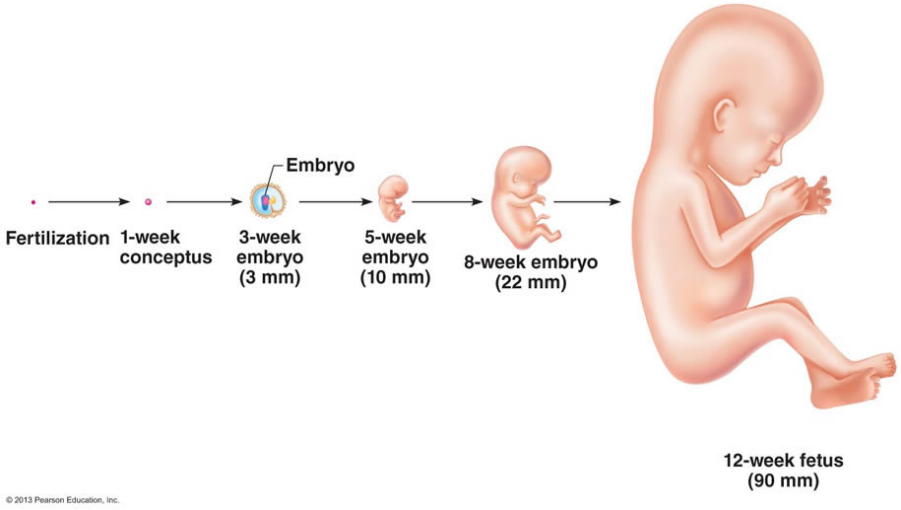
(p.409) **45.** What are ***pluripotent*** stem cells?

A pluripotent cell is a stem cell that can give rise to multiple cell types.

(p.409) **46.** What is the major difference between *embryonic stem cells* and *adult stem cells*? (Video: Types of Stem Cells)

The major difference between embryonic stem cells and adult stem cells is embryonic stems cell are "immortal" and give rise to any cell type?

47. Why does *embryonic* stem cell research raise a number of ethical and political concerns?



(p.417) **48.** What are **homeotic genes**? (Video)

Homeotic genes are master regulatory genes that set the anatomical identity of the segments in Drosphilia or fruit flies. Homeotic genes specify the types of appendages (arms, legs, wings, tail, etc.) and other structures that each segment will form.

(p.417) **49.** Homeotic genes produce transcription factors or regulatory proteins. What do these regulatory proteins control?

These regulatory proteins control the expression of the genes responsible for specific anatomical structures such as leg development or in a head segment specifies "antennae go here."

(p.417) **50.** What is a **homeobox**? (Video)

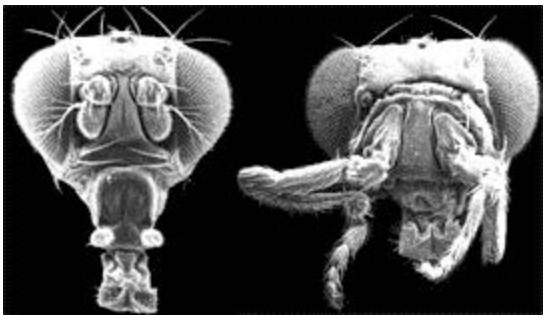
In Drosphilia, a homeobox is a 180-nucleotide sequence found in a homeotic genes which specifies a 60-amino acid sequence called homeodomain.

(p.417) **51.** Homeobox-containing genes are often called Hox genes, especially in mammals.

Hox genes, a subset of homeobox genes, are a group of related genes that specify regions of the body plan of an embryo along the head-tail axis of animals. Hox proteins encode and specify the characteristics of 'position', ensuring that the correct structures form in the correct places of the body.

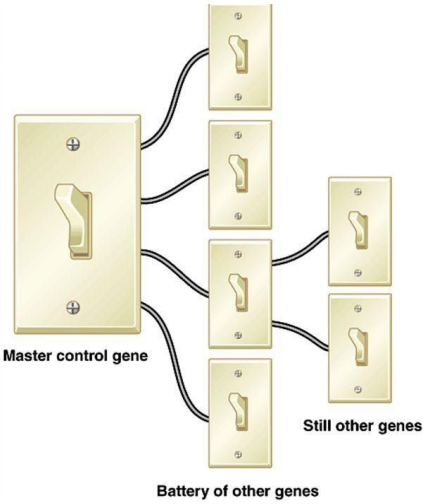
(p.409) **52.** Use the diagram to the right to help you explain the effects of mutations in homeotic genes.

Homeotic mutations cause a misplacement of structures in an animal. Small antennae are located in the normal position in the fruit on the left, one homeotic mutation causes a leg to grow where the antennae should be in the fly on the right.



(p.418) **53.** Use the diagram to the right to help you explain other functions of Hox genes.

How a particular cell differentiates in the animal's body depends on how many of these switches are thrown - that is, which homeobox proteins are made within a cell. A single MASTER SWTICH may control a number of subordinate switched, which in turn controls others. Here the wires represent the action of the proteins that are the products of the genes.



Base your answer each of the following questions on the video CRISPR located on the AP Biotechnology page of Collea's Corner.

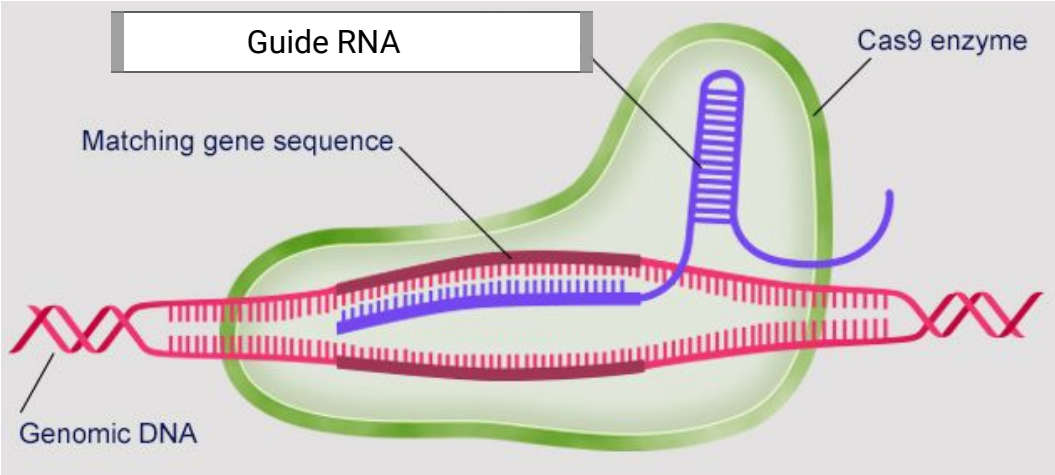
54. What does **CRISPR** stand for? **Clustered Regularly Interspaced Short Palindromic Repeats**

A palindrome is a region of DNA in which the sequence of nucleotides is identical with an inverted sequence in the complimentary strand. Ex: GAATTC is a palindrome of CTTAAG

55. Name the 2 components that make up **CRISPR** and briefly describe their functions.

The 2 components that make up CRISPR are the CAS9 protein that can cut DNA and a Guide RNA that can recognize the sequence of DNA to be edited.

56. Label the **CRISPR** diagram below. CRISPR Video



57. List and briefly describe the main steps in the **CRISPR** process.

(1) Recognize the sequence of DNA that is causing a health problem.

(2) Create a guide RNA to recognize that piece of problematic DNA.

(3) The guide RNA is attached to the DNA cutting enzyme CAS9 and introduced to the target cells..

(4) CAS9 locates the target sequence (problematic piece of DNA) and cuts it.

(5) Scientists can then edit the existing genome by either modifying, deleting or inserting new sequences.

58. What do scientist hope to use **CRISPR** for in the future? GATTACA Video

In the future, scientist hope to use CRISPR to develop critical advances in patient care or even cure and prevent lifelong inherited diseases.