Asexual Reproduction - ONE organism divides into two or more offspring

*Offspring are genetically identical to the parent

*Mitotic cell division (mitosis) is used to produce 2 identical cells. A clone is genetically identical to the parent organism.

*unicellular organisms (single celled) divide by mitosis to produce 2 identical cells. Ex.) amoeba + bacteria

*Multicellular organisms - mitotic cell division produces a mass of cells or replaces/renews lost cells that later bud off to form the offspring. Ex.) Hydra, flatworm, starfish

Steps in mitosis:
1. Chromosomes and genes are copied (DNA replicated)
2. Each copy goes into a new cell
3. Every cell has the same chromosomes as the original cell

*No variation within the population

-Can't adapt to changes that happen in the environment (there may not be any survivors if the environment contains a factor that the original parent is not adapted to)

Ex.) no natural selection/evolution of population

*Fitness/High Adaptive Value - the genes that allow it to survive are passed on to the next generation.

Ex). Resistance genes (antibiotic/pesticide) passes to the offspring

Sexual Reproduction - 2 organisms donate 50% of their genes/DNA to form a new individual.

*Meiotic cell division (meiosis) produces sex cells - makes a cell with only half the DNA/Chromosomes/Genes as the original cell

*Gametes (sex cells/Sperm/Egg) transfer half of the genetic materials/DNA/Chromosomes.

*Fertilization - fusion of two gametes to form the zygote cell, maintaining the correct chromosome number from one generation to the next.
*New offspring is a combination of the genes from the parents (not identical to them)

* Increases variation (genetic differences)- new offspring may inherit fitness/high adaptive value from the genes that allow it to survive....From both of parents

EX. Inherits resistance from mom or dad or both....but, there’s no guarantee that genes with high adaptive value will be inherited

Human Reproduction- regulated by hormones (estrogen & testosterone are two examples)

Female Structures:

1. Ovary - produces egg (released during ovulation) and secretes hormones (estrogen + progesterone) to regulate the cycle

2. Fallopian tube - connects ovary area to uterus; where fertilization happens.

3. Uterus - protects fetus (where baby develops/grows)

   * Placenta - a temporary organ that provides nutrients, gas exchange, & waste removal for the baby/fetus. Anything (good or bad) that is dissolved in the mother's blood will diffuse into the baby's blood through the placenta.

   * Umbilical cord - carries baby blood to the placenta then back to baby

4. Cervix - the bottom of the uterus which opens into the vagina.

5. Vagina - also called the birth canal

Male Structures:

1. Testis - produces sperm and provides hormone (testosterone) for male traits (beard, voice, muscle mass)

2. Epididymis- where sperm mature

3. Vas deferens - carry sperm from testes to urethra; "snipped" in a vasectomy

   * Semen - mixture of sperm and fluids. Fluid is needed for

4. Urethra - passageway leading out of the body for semen & urine
Embryonic Development: (one cell turns into two...then 100 billion)

* Mitosis - every cell has identical DNA/chromosomes/genes

* Differentiation - cells become different/specialize depending on what genes are turned on or off. (Ex. nerve cell, skin cell, liver cell...)

* Environmental factors (hormones, cell location) can influence how genes are turned "on" or "off"

* If the mother is exposed to chemicals or disease during early pregnancy, the embryo development may be affected in a negative way. Ex.) Alcohol effects brain development

Embryonic Development (remember...this is cell division by mitosis)
Topic 4
Homework Questions

Base your answers to questions 1 through 4 on the diagram below and on your knowledge of biology. The diagram represents a single-celled organism, such as an ameba, undergoing the changes shown.

1. As a result of these processes, the single-celled organism accomplishes
   1) gamete production
   2) energy production
   3) sexual reproduction
   4) asexual reproduction

2. Process 1 is known as
   1) replication
   2) meiosis

3. Process 1 and process 2 are directly involved in
   1) meiotic cell division
   2) mitotic cell division

4. The genetic content of C is usually identical to the genetic content of
   1) B but not D
   2) both B and D
   3) D but not A
   4) both A and D

5. The diagram below shows two different cells undergoing mitotic cell division.

Which statement best describes these cells?
1) A and B are different types of animal cells.
2) A and B are different types of plant cells.
3) A is a plant cell and B is an animal cell.
4) A is an animal cell and B is a plant cell.

6. In animals, the process which results in haploid gametes is known as
   1) meiosis
   2) mitosis
   3) fertilization
   4) fission

7. A dogfish shark contains 24 chromosomes in each of its muscle cells. How many chromosomes are normally found in each of its gametes?
   1) 6
   2) 12
   3) 24
   4) 48

8. Some cells involved in the process of reproduction are represented in the diagram below.

The process of meiosis formed
1) cell 1, only
2) cells 1 and 2
3) cell 3, only
4) cells 2 and 3

9. In an environment that undergoes frequent change, species that reproduce sexually may have an advantage over species that reproduce asexually because the sexually reproducing species produce
1) more offspring in each generation
2) identical offspring
3) offspring with more variety
4) new species of offspring in each generation

10. The greatest degree of genetic variation would be found in offspring that result from
1) binary fission
2) fertilization
3) regeneration
4) grafting
11. The diagram below represents structures found in a human female.

Which process results in the formation of structure X?
1) mitosis
2) meiosis
3) recombination
4) cloning

12. Which statement is true of both mitosis and meiosis?
1) Both are involved in asexual reproduction.
2) Both occur only in reproductive cells.
3) The number of chromosomes is reduced by half.
4) DNA replication occurs before the division of the nucleus.

13. Which characteristic of sexual reproduction has specifically favored the survival of animals that live on land?
1) fusion of gametes in the outside environment
2) male gametes that may be carried by the wind
3) fertilization within the body of the female
4) female gametes that develop within ovaries

14. Base your answer to the following question on the diagram below. Select the part of the human female reproductive tract that is best described by that statement.

15. External fertilization occurs most often in
1) mammals and birds
2) reptiles and birds
3) amphibians and reptiles
4) fish and amphibians

16. The diagram below represents a system in the human body.

The primary function of structure X is to
1) produce energy needed for sperm to move
2) provide food for the sperm to carry to the egg
3) produce and store urine
4) form gametes that may be involved in fertilization

17. Which situation involves a risk to a fetus due to the mother smoking during pregnancy?
1) decreased digestive activity in the stomach of the fetus
2) a decrease in the amount of oxygen in the ovary of the mother
3) inhalation of secondhand smoke by the fetus
4) toxins in the bloodstream of the mother
18. Which phrase best describes a process represented in the diagram below?

-  a zygote dividing by mitosis
-  a zygote dividing by meiosis
-  a gamete dividing by mitosis
-  a gamete dividing by meiosis

Fertilized egg

Base your answers to questions 19 and 20 on the diagram below, which represents some stages in the development of an embryo, and on your knowledge of biology.

- 19. Which stage represents a zygote?
  - 1) A  
  - 2) B
  - 3) C
  - 4) D

- 20. Which stage represents a blastula?
  - 1) A
  - 2) B
  - 3) C
  - 4) D
Topic 4

Base your answers to questions 21 and 22 on the information below and on your knowledge of biology.

Stem Cells

If skin is cut, the wound closes within days. If a leg is broken, the fracture will usually mend if the bone is set correctly. Almost all human tissue can repair itself to some extent. Much of this repair is due to the activity of stem cells. These cells resemble those of a developing embryo in their ability to reproduce repeatedly, forming exact copies of themselves. They may also form many other different kinds of cells. Stem cells in bone marrow offer a dramatic example. They can give rise to all of the structures in the blood: red blood cells, platelets, and various types of white blood cells. Other stem cells may produce the various components of the skin, liver, or intestinal lining.

The brain of an adult human can sometimes compensate for damage by making new connections among surviving nerve cells (neurons). For many years, most biologists believed that the brain could not repair itself because it lacked stem cells that would produce new neurons.

A recent discovery, however, indicates that a mature human brain does produce neurons routinely at one site, the hippocampus, an area important to memory and learning. This discovery raises the prospect that stem cells that make new neurons in one part of the brain might be found in other areas. If investigators can learn how to cause existing stem cells to produce useful numbers of functional nerve cells, it might be possible to correct a number of disorders involving damage to neurons such as Alzheimer's disease, Parkinson's disease, stroke, and brain injuries.

21. Stem cells may be similar to the cells of a developing embryo because both cell types can
1) produce only one type of cell
2) help the brain to learn and remember things
3) divide and differentiate
4) cause Alzheimer's and Parkinson's diseases

22. What is the process by which stem cells produce exact copies of themselves?
1) cell division by mitosis
2) cell division by meiosis
3) sexual reproduction
4) glucose synthesis
23. The human female reproductive system is represented in the diagram below.

Complete boxes 1 through 4 in the chart below using the information from the diagram.

<table>
<thead>
<tr>
<th>Name of Structure</th>
<th>Letter on Diagram</th>
<th>Function of Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>ovary</td>
<td>C</td>
<td>produces gametes</td>
</tr>
<tr>
<td>uterus</td>
<td>D</td>
<td>where fetus/baby develops</td>
</tr>
<tr>
<td>placenta</td>
<td>B</td>
<td>transports oxygen directly to the embryo</td>
</tr>
</tbody>
</table>
Base your answer to the following question on the information and data table below and on your knowledge of biology.

Three biology students wanted to find out if adding fertilizer to some potting soil would affect the germination of radish seeds. Each student added an equal amount of potting soil from the same bag to each of 10 cups. Student A added 1 gram of fertilizer to each cup of soil in group A. Student B added 2 grams of fertilizer to each cup of soil in group B. Student C added 3 grams of fertilizer to each cup of soil in group C. After stirring the mixture to obtain an even distribution of fertilizer, 8 radish seeds were placed in each cup and covered with 0.5 centimeter of soil. Over the next 6 days, all conditions, including the amounts of water and sunlight, were kept the same. The results are recorded in the data table below.

<table>
<thead>
<tr>
<th>Days After Planting</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>52</td>
<td>0</td>
</tr>
</tbody>
</table>

Plot the data for group B on the grid. Surround each point with a small triangle and connect the points.