

Science 10 Connections Textbook Answers

Section 1.1 (pg. 21, #1-11, 13, 15)

1. They would likely look identical to our eyes but be genetically different. We as humans are not used to seeing geese and telling them apart (vs. we would be much better at telling apart other people). However, there is diversity in all species, even if not readily apparent to our eyes, and this diversity stems from differences in DNA...i.e. genetic differences. Some examples of diversity in geese might be: size, personality, pitch/frequency of their calls, eye colour, attractiveness to members of the opposite sex, wing length, etc.
2. DNA is a nucleic acid with a double-helix structure consisting of two strands of nucleotides. Each nucleotide in turn consists of a sugar, phosphate, and nitrogenous base (cytosine, guanine, adenine, or thymine). The 'backbone' or 'sides' of the DNA ladder is made of sugars and phosphates chemically bonded together. The 'rungs' of the DNA ladder are made of the nitrogenous bases of nucleotides which are bonded with their complementary bases (A with T and C with G) via weaker hydrogen bonds.

(Although the textbook publisher does not ask about chromatin vs chromosomes, here is additional information about DNA packaging.)

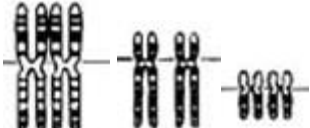
During interphase, DNA exists as a loosely coiled form called chromatin. This form allows for easier access of genes, e.g. for transcription. In preparation for mitosis or meiosis, DNA exists as chromosomes, which are tightly coiled and exhibit a characteristic "X-shaped" structure made of two sister chromatids. (Each sister chromatid is made of one copy of DNA. After replication, there are two sister chromatids.)

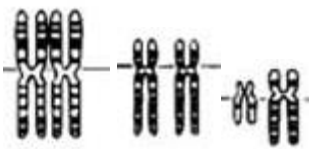
3. DNA contains the instructions for cells to create proteins. Proteins in turn are responsible for everything in cells, from signaling to growth to producing structure for the cell. Thus, DNA contains the instructions for everything the cell needs to function and reproduce.
4.
 - a. 23%
 - b. 27%
 - c. 23%
5. A genome is all of an organism's DNA. (This is somewhat different from a karyotype, which is a 'picture' of an organism's chromosomes, all paired with their homologous pairs and arranged from longest to shortest.)
6.
 - DNA is made of nucleotides (e.g. adenine, thymine, guanine, cytosine)
 - DNA is packaged differently depending on the stage of the cell cycle.

- During interphase, DNA is chromatin: loose and spaghetti-like. Chromatin is easy to unwind and access to make proteins, for example.
- In preparation for cell division (mitosis, meiosis), DNA condenses into chromosomes: dense structures which are easy to transport, in order to ensure that daughter cells have the proper amount of DNA. Human cells have 46 chromosomes.
- Chromosomes have genes on them. Genes are sections of DNA that code for proteins.
- Chromosomes may have different versions of genes, called alleles. Alleles differ in DNA sequence, and produce different characteristics.

7. Homologous chromosomes are not identical. While they look very much the same, are the same length, and have the same genes at the same locations, they may differ in their alleles: that is, the specific versions of the genes that they carry. Also, the DNA in each chromosome comes from a different parent. For example, one homologous chromosome from the biological father may contain the blue eye allele, while the other homologous chromosome from the biological mother may contain the brown eye allele.

8. Homologous chromosomes are similar in that they have the same appearance, same size, and same genes at the same locations. They differ in that they may have different alleles, and come from different sources. (Note that the X and Y chromosomes are technically not considered homologous because they are different sizes.)

9.  for an *asexual* organism OR:

 for a *sexual* organism.

10. They are called the sex chromosomes because they contain genes responsible for making organs and other structures/hormones relating to sex. Generally speaking, females will have XX sex chromosomes while males will have XY sex chromosomes. However, there are some exceptions where individuals will have different numbers of sex chromosomes.

11. DNA replication ensures that daughter cells have identical DNA to the parent cell. DNA is responsible for producing proteins. Therefore, DNA replication ensures that daughter cells are able to produce all the same proteins that the parent cell was able to, and thus that the daughter cells can carry out the same functions as the parent cell did.

13. A gene is a part of DNA that codes for a trait (e.g. eye colour, hair colour). An allele is a version of a gene (e.g. blue eye allele, brown eye allele).

15.

- a. This is a karyotype. It is prepared by taking a picture of cells in metaphase of mitosis, and organizing the homologous chromosome pairs by length (longest to shortest).
- b. This individual appears to be genetically male, as they have XY sex chromosomes.
- c. Yes. They have 23 pairs of chromosomes...46 chromosomes in total.