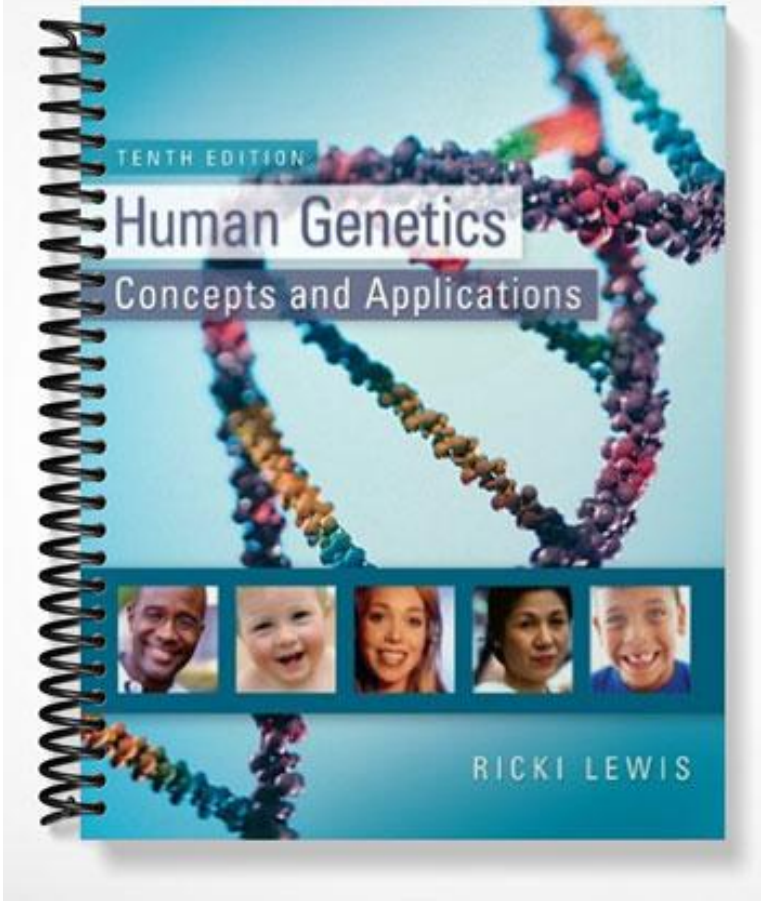
SOLUTIONS MANUAL



ANSWERS TO REVIEW QUESTIONS **CHAPTER 2**

1. a. 4
   b. 6
   c. 2
   d. 1
   e. 7
   f. 3
   g. 5

2. Compartmentalization separates biochemicals that could harm certain cell constituents. It also organizes the cell so it can function more efficiently.

3. a. Tubulin forms microtubules and actin forms microfilaments, which comprise the cytoskeleton.
   b. Caspases carry out apoptosis.
   c. Changing levels of cyclins and kinases regulate the cell cycle.
   d. Checkpoint proteins provide choices during the cell cycle.
   e. Cellular adhesion molecules allow certain cell types to stick to each other.

4. Telomere length, crowding, checkpoint proteins, and outside signals (hormones, growth factors, cyclins and kinases).

5. Specialized cells express different subsets of all the genes that are present in all cell types, except for red blood cells.

6. a. A bacterial cell is usually small and lacks a nucleus and other organelles. A eukaryotic cell contains membrane-bound organelles, including a nucleus, that compartmentalize biochemical reactions.
   b. During interphase, cellular components are replicated. During mitosis, the cell divides, distributing its contents into two daughter cells.
   c. Mitosis increases cell number. Apoptosis eliminates cells.
   d. Rough ER is a labyrinth of membranous tubules, studded with ribosomes that synthesize protein. Smooth ER is the site of lipid synthesis. It is a membranous labyrinth but lacks ribosomes.
   e. Microtubules are tubules (hollow) of tubulin pairs and microfilaments are solid rods of actin. Both form the cytoskeleton.
   f. A stem cell has greater developmental potential than a progenitor cell.
   g. A totipotent cell can differentiate as any cell type; a pluripotent cell's fates are more restricted.

7. Intermediate filaments are similar to microtubules and microfilaments in that they are all composed of protein subunits. Intermediate filaments come in several varieties, differing in size and protein composition. Microfilaments are the smallest and are all composed mainly of actin. Microtubules are the largest, and are composed of tubulin. Intermediate filaments are intermediate in size between microfilaments and microtubules.

8. The plasma membrane is the scaffold that holds many of the molecules that intercept incoming signals and consort in ways that amplify and/or spread the message.

9. Embryonic stem (ES) cells are derived in a dish from pluripotent stem cells taken from the inner cell mass of a very early stage embryo. Induced pluripotent stem (iPS) cells are pluripotent stem cells created from non-pluripotent somatic cells by manipulating the expression of a few

key genes. Adult stem cells are found throughout the body from embryonic development onward. They can reproduce and differentiate to repair and replace specialized cells. Pros and Cons: ES cells are naturally pluripotent and self-renewing. However, use of human ES cells is more controversial than that of iPS cells or adult stem cells and countries vary in their policies regarding such research. The full potential of iPS and adult stem cells is not yet known. Adult stem cells are multipotent rather than pluripotent. Potential risks involve rejection of implanted somatic cells and induction of cancer.

ANSWERS TO APPLIED QUESTIONS

1. a. Lack of cell adhesion can speed the migration of cancer cells.
   b. Impaired signal transduction can block a message to cease dividing.
   c. Blocking apoptosis can cause excess mitosis, and an abnormal growth.
   d. Lack of cell cycle control can lead to too many mitoses.
   e. If telomerase is abnormal, a cell might not cease to divide when it normally would.

2. Stem cells maintain their populations because mitosis produces a daughter cell that differentiates, as well as one that "self-renews," remaining a stem cell

3. A cell in an embryo would not be in G_0 because it has to divide frequently to support the tremendous growth rate.

4. Mitochondria

5. Peroxisome

6. A sodium channel is a protein-lined opening in a plasma membrane that regulates the movement of sodium into and out of cells.

7. Signals from outside the cell interact with receptors embedded in the plasma membrane, and the plasma membrane's interior face contacts the cytoskeleton.

8. Stem cells could be used to treat severe burns or baldness

9. A fibroblast from healthy skin could be reprogrammed to differentiate as cardiac muscle and used to patch dead cells in a person's heart.

10. a. No. There is no evidence that the material rejuvenates skin.
    b. Research should show that topical delivery induces intracellular change within the skin.

ANSWERS TO WEB ACTIVITIES

1. Answers vary with website selected. CryoCell Intl doesn't mention that some governments provide the service for free, and stresses banking but not uses, which are limited.

2. a. Belgium
   b. Norway
   c. Austria

3. They affect cilia.

ANSWERS TO FORENSIC FOCUS

1. All cell types from a person have the same DNA profile.

ANSWERS TO CASE STUDIES AND RESEARCH RESULTS

1. Nucleus and lysosomes.

2. A study of male air traffic controllers. Degree of stress and rate of telomere shortening.

11. DNA profiling