Diseases Related To Genes

Base your answers to questions 1 on the passage below and on your knowledge of biology.

Blood Doping

Some athletes who compete in endurance events, such as marathon runners or cyclists, believe that they will be more competitive if they can increase the number of red blood cells in their bloodstreams. One way of increasing the number of red blood cells in an athlete is to engage in blood doping.

Blood doping is an illegal practice in which athletes harvest their own blood months before a competition, isolate the red blood cells, and freeze them. Just before the date of the competition, the blood cells are returned to the athlete's bloodstream. Another type of blood doping involves using donated blood from another person (blood transfusions). In either case, the athlete will have more red blood cells available than competitors who do not engage in blood doping.

Athletes who use their own blood cells to blood dope often become anemic as a result. Anemia is a condition caused by a lack of red blood cells and/or iron in the blood. Iron is a necessary part of the pigment used to carry oxygen to the cells. Athletes who use donated blood to blood dope also run the risk of contracting a blood-borne disease.

1 An athlete who uses blood from another person for blood doping runs the risk of contracting a blood-borne disease because
(1) white blood cells are not passed on through blood transfusions
(2) blood is tested for pathogens before it is donated
(3) pathogens can exist in the blood and be passed on through transfusions
(4) iron is a pigment needed to carry oxygen

2 Sailors in the past may have heard the greeting from a passing ship, "Avast ye scurvy dogs." This greeting would be a reference to a disease known as scurvy, which is due to inadequate intake of vitamin C. Which row in the chart below correctly identifies the cause of this disease and a possible treatment for it?

Row	Cause	Treatment
(1)	inherited trait	gene manipulation
(2)	organ malfunction	antibiotic injections
(3)	poor nutrition	fresh fruit
(4)	virus	vaccination

(1) 1
(2) 2
(3) 3
(4) 4

3 Typhoid fever, a disease that causes headaches, digestive upset, and a high fever, is caused by the bacterium Salmonella typhi. Typhoid can be spread from person to person by contaminated water or food or by a lack of cleanliness. Since the 19th century, the number of individuals infected with this disease has decreased. Which statement best explains why the number of people with this disease and other bacterial diseases has decreased over the last 100 years?
(1) Scientists have corrected the damaged genes that cause typhoid fever and other infectious diseases.
(2) Public health officials have placed better controls on the use of the toxic substances that cause these diseases.
(3) Typhoid fever, like most other bacterial diseases, is often caused by a lack of proper nutrition.
(4) Personal habits, such as hand washing, have greatly reduced contamination from bacteria.

4 SCIDS (Severe Combined Immunodeficiency Syndrome) is a disorder where a genetic mutation inhibits the production and functioning of T-cells. T-cells are special types of white blood cells that play a role in the body's immune response. A possible symptom of SCIDS would be an increase in the
(1) number of antigens produced
(2) red blood cell count
(3) number of infections by pathogens
(4) ability to maintain homeostasis

5 Genetic researchers have discovered a number of different gene mutations that have led to the development of cancer. These mutations affect how frequently a cell reproduces. Which process would be directly influenced by these mutations?
(1) differentiation of cells in an embryo
(2) meiotic cell division
(3) division of sperm and egg cells
(4) mitotic cell division

6 People have been warned about the dangers of excessive exposure to radiation during certain medical procedures. The most likely reason for this warning is that radiation exposure might
(1) result in gene mutations and uncontrolled cell growth
(2) cause the rejection of transplanted organs
(3) increase body temperature by two to five degrees
(4) prevent the transport of materials into cells

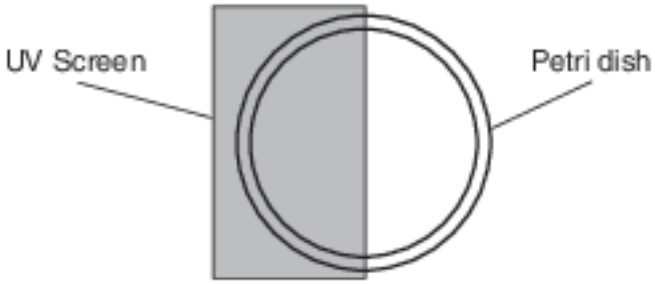
7 Nicotine is only one of the many toxic chemicals inhaled while smoking. What effect can such toxic chemicals have on the body?
(1) They stimulate an increase in height.
(2) They stimulate uncontrolled cell division.
(3) They eliminate carbon dioxide from cells.
(4) They eliminate chromosomes from many cells.

8 Studies have shown that children are especially vulnerable to the effects of ultraviolet (UV) radiation. Tanning beds expose the skin to nearly ten times as much UV radiation as natural sunlight. With that knowledge, a law was passed in New York State to prevent individuals under the age of 18 from using tanning beds. Which statement best explains why UV radiation is so harmful?
(1) Certain environmental factors can increase the occurrence of harmful gene mutations.
(2) Diseases are all caused by exposure to environmental factors.
(3) Homeostasis in an organism is increased by the presence of radiation.
(4) Radiation decreases the likelihood that infectious agents cause mutations.

9 Melanoma is a type of cancer in which abnormal skin cells divide uncontrollably. Some chemotherapy drugs, which stop the growth of the cancer, directly interfere with the process of
(1) meiosis
(2) coordination
(3) mitosis
(4) recombination

Base your answers to questions 10 on the information below and on your knowledge of biology.

An experiment was carried out to determine the effect of exposure to UV light on the growth of bacteria. Equal quantities of bacteria were spread on 5 petri dishes containing nutrient agar. Half of each petri dish was exposed to UV light for various amounts of time, and the other half was protected from the UV light with a UV screen. After the UV treat- ment, the bacteria were grown in an incubator for 24 hours, and the number of colonies was counted. The diagram below represents the initial set up.



The table below contains the data collected by counting the number of bacterial colonies growing on both the screen-covered side and the unscreened side.

Growth of Bacterial Colonies

Petri Dish	Exposure Time to UV Light	Number of Bacterial Colonies on Screened Side	Number of Bacterial Colonies on Unscreened Side
1	No exposure (0.0 minutes)	17	18
2	1.0 minute	18	15
3	2.0 minutes	17	11
4	5.0 minutes	18	4
5	10.0 minutes	16	1

Directions: Using the information in the data table, construct a line graph on the grid below, following the directions below.

10 The diagram below represents cellular growth that can occur in human skin after prolonged exposure to ultraviolet light.

Which statement provides a possible explanation for this growth pattern?
(1) Manipulation of genes caused the movement of embryonic skin cells.
(2) Exposure to light stimulated the development of cells containing ozone.
(3) Uncontrolled mitotic division occurred as a result of gene mutations.
(4) An immune reaction triggered the formation of excess blood cells.

11 Which row in the chart below accurately identifies two causes of mutations and the cells that must be affected in order for the mutations to be passed on to offspring?

Row	Cause of Mutations	Cells Affected
(1)	infections and antigens	body cells
(2)	meiosis and mitosis	body cells
(3)	disease and differentiation	sex cells
(4)	chemicals and radiation	sex cells

(1) 1
(2) 2
(3) 3
(4) 4

Base your answers to questions 12 on the passage below and on your knowledge of biology.

Medical Mystery

Recently, an elderly man went to a hospital. He felt tired and was coughing and dehydrated. At first, the doctor thought he had pneumonia, but an x ray showed a spot on his lung. Because the man was a smoker, the doctor expected to find a tumor.

Instead, the surgeon discovered a pea seed growing inside the man's lung. When the pea seedling was removed, the patient quickly regained his health.

12 When he first arrived at the hospital, the man reported feeling unusually tired. Explain why damage to the man's lung caused fatigue. [1]

Base your answers to questions 13 on the illustration and information below and on your knowledge of biology. The illustration is of a Tasmanian devil.

Source: http://www.statelibrary.tas.gov.au

The Tasmanian devil is the largest surviving carnivorous marsupial in Australia. It is in danger of extinction due to an unusual type of cancer called Devil Facial Tumor Disease (DFTD). It can be passed from one individual to another through wounds that occur when they fight over food. Tumor cells in the mouth of an infected animal break off and enter the wound on an uninfected animal. The tumor cells multiply in the body of the newly infected devil, forming new tumors that eventually kill the animal.

Recent research has shown that the immune system of a Tasmanian devil accepts tumor cells from another devil as if they were cells from its own body. The tumor cells are ignored by the immune system. No immune response develops against them, and the cancerous cells multiply. Scientists predict that DFTD could wipe out all the remaining Tasmanian devils in 25 years, unless a treatment is developed.

13 Explain how cancer cells differ from normal cells. [1]

Base your answers to questions 14 on the information below and on your knowledge of biology.

Breast Cancer Research

Most deaths that are a result of breast cancer occur because the cancer cells metastasize (spread) from the breast to other organs. As they metastasize, cancer cells travel through the bloodstream.

MicroRNA molecules are involved in both the movement and control of metastasized cells. One microRNA, known as miR-7, shuts down a protein that helps cancer cells travel through the blood.

Understanding how miR-7 interacts with cancer cells may lead to new treatments for certain types of cancer. Since certain levels of miR-7 expression can also stimulate the development of cancer cells, the use of miR-7 to treat cancer will have to be studied in more detail. Researchers are hoping that eventually levels of miR-7 will be used to diagnose, treat, and prevent the spread of cancer in an individual.

14 State one way cancer cells are different from normal body cells. [1]

Answer Keys

1 3

2 3

3 4

4 3

5 4

6 1

7 2

8 1

9 3

10 3

11 4

12 Allow 1 credit. Acceptable responses include, but are not limited to:
- — If the lungs do not function well, less oxygen is available to release energy in his cells.
- — He wouldn’t get as much oxygen/air into his blood.
- — The damage to the man’s lung resulted in a decrease in his ability to breathe.
- — Less carbon dioxide would be released and would build up.

13 Allow 1 credit. Acceptable responses include, but are not limited to:
- — Cancer cells undergo uncontrolled cell division.
- — Cancer cells have more mutations.
- — Cancer cells are more harmful and disrupt homeostatis.

14 Allow 1 credit. Acceptable responses include, but are not limited to:
- — They can metastasize to other organs.
- — Cancer cells keep dividing.
- — Cancer cells can be larger/shaped differently than normal cells.
- — Some have more than one nucleus.
- — Cancer cell division is uncontrolled.
- — They have more mutations.
- — The cancer cells are deformed.