

Noninfectious Disorders



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المزيد من مادة
علوم:

إعداد: موسى زامل

التواصل الاجتماعي بحسب الصف الحادي عشر العام



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المزيد من الملفات بحسب الصف الحادي عشر العام والمادة علوم في الفصل الثالث

The Immune System: Infectious Diseases

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LESSON 3

NONINFECTIOUS DISORDERS

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Genetic Disorders

Not all diseases or body disorders are caused by pathogens. Some diseases, such as albinism, sickle cell anemia, Huntington's disease, and hemophilia, are caused by the inheritance of genes that do not function properly in the body. There are also disorders, such as Down syndrome and Turner syndrome, that result from abnormal chromosome numbers. Many diseases are complex and have both an environmental and a genetic cause.

Coronary artery disease (CAD) is an example of a condition with environmental and genetic origins. This cardiovascular disease can result in blockage of arteries, shown in Figure 15, that deliver oxygenated blood to the heart muscle. There is a genetic component that increases a person's risk of developing CAD. Environmental factors such as diet and inactivity contribute to the development of this complex disease. Families with a history of CAD have a two to seven times greater risk of having CAD than families without a history of CAD. The exact genetic factors, however, are not known.



Get It?

Summarize the factors that cause coronary artery disease.

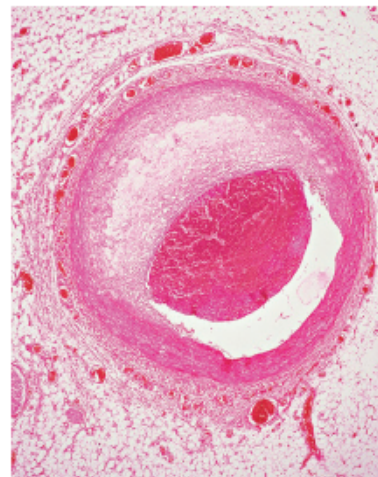


Figure 15 When blood cannot flow through a coronary artery, such as the diseased artery shown here, a heart attack or sudden death can result.

Degenerative Diseases

Diseases that are the result of the body wearing out or of the natural aging process are referred to as **degenerative** (dih JEH nuh ruh tihv) **diseases**.

Q1: Which of the following conditions is caused by an abnormal number of chromosomes rather than the inheritance of a single malfunctioning gene?

- A. Albinism
- B. Hemophilia
- C. Down syndrome**
- D. Sickle cell anemia

Q2: What is the primary cause of a degenerative disease?

- A. An error in a biochemical pathway
- B. Uncontrolled cell division in body tissues
- C. The body wearing out or the natural aging process**
- D. An unhelpful immune response to a common substance



Q3: A student is categorizing noninfectious disorders. Which group contains only examples of genetic disorders?

- A. Albinism, sickle cell anemia, and hemophilia**
- B. Arteriosclerosis, Type 2 diabetes, and cancer
- C. Arthritis, allergies, and coronary artery disease
- D. Huntington's disease, influenza, and tetanus

Q4: Why are some diseases like coronary artery disease (CAD) considered "complex"?

- A. They are caused by many different types of pathogens simultaneously.
- B. They only affect the nervous system and skeletal system.
- C. They have both an environmental and a genetic cause.**
- D. They are only found in ancient Egyptian mummies.

Q5: Which statement accurately differentiates between genetic and degenerative diseases?

- A. Genetic diseases are caused by pathogens; degenerative are caused by diet.
- B. Genetic diseases result from aging; degenerative result from inheritance.
- C. Genetic diseases result from gene or chromosome errors; degenerative result from body wear-and-tear.**
- D. There is no difference; all genetic diseases are also classified as degenerative.

Q6: A biology student learns that both genetic diseases and degenerative diseases are classified as noninfectious disorders. Which statement best explains why some individuals are more likely to develop certain degenerative diseases?

- A. Degenerative diseases are spread through contact with infected individuals.
- B. Degenerative diseases are caused only by environmental factors.
- C. Some individuals inherit genetic factors that increase their risk of developing degenerative diseases.**
- D. All noninfectious disorders are inherited directly from parents.

Q7: Which statement correctly links genetic diseases and degenerative diseases?

- A. Both are noninfectious disorders**
- B. Both are infectious disorders caused by pathogens.
- C. Degenerative diseases are noninfectious, but genetic diseases are infectious.
- D. Both disorders can be prevented through vaccination.

Q8: A family has several members affected by a degenerative disease. What is the most reasonable explanation for this observation?

- A. The disease is contagious and spread among family members.
- B. Family members may share genetic factors that increase susceptibility to the disease.**
- C. Degenerative diseases affect all family members equally.
- D. The disease must have been caused by a bacterial infection.

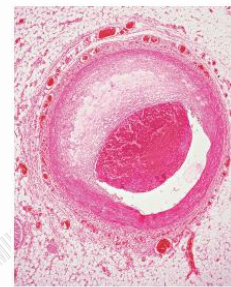


Figure 15 When blood cannot flow through a coronary artery, such as the diseased artery shown here, a heart attack or sudden death can result.

Q9: Examine Figure 15. What is the primary physical consequence when a coronary artery becomes diseased as shown in the image?

- A. The artery produces excess insulin for the heart.
- B. The artery walls become thinner to increase oxygen flow.
- C. Blockage restricts the delivery of oxygenated blood to the heart muscle.**
- D. The artery transforms into a tumor through uncontrolled cell division.

Q10: How much greater is the risk of developing CAD for an individual with a family history of the disease compared to one without?

- A. Two times lower
- B. Two to seven times greater**
- C. Exactly ten times greater
- D. There is no increased risk associated with family history.

Q11: Which of the following are cited as specific environmental factors that contribute to the development of coronary artery disease?

- A. Pathogens and viral infections
- B. High altitudes and cold weather
- C. Diet and inactivity**
- D. Exposure to latex and dust mites

Q12: Referring to Figure 15, what are the potential life-threatening results of total blood flow blockage in these arteries?

- A. Albinism or sickle cell anemia
- B. Rheumatoid arthritis and joint deformity
- C. Heart attack or sudden death**
- D. Metabolic errors in amino acid digestion

Q13: Coronary artery disease is described as a "complex" noninfectious disorder. This complexity arises from the interaction between:

- A. Bacteria and viruses
- B. Genetic components and environmental factors**
- C. White blood cells and histamine
- D. Ancient history and modern medicine

Q14: How does the cause of a degenerative disease like arteriosclerosis (Figure 15) differ from the causes of the other four categories of noninfectious disorders?

- A. It is caused by a pathogen, while metabolic and genetic diseases are caused by diet.
- B. It results from the body wearing out over time, whereas genetic is inherited, metabolic is a biochemical error, cancer is uncontrolled cell growth, and inflammatory is an immune response.**
- C. It is the only category that does not have a genetic component.
- D. It is caused by an unhelpful immune response, while cancer is caused by an error in a biochemical pathway.



10	BIO.3.1.01.087 Differentiate between the five categories of noninfectious diseases, in terms of cause and examples	Information from text	21-22
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However, a degenerative condition, such as degenerative arthritis, could occur sooner than would be expected if the person is genetically predisposed to the disease or if the person's joints have experienced an increased amount of wear and tear. Degenerative arthritis is common; most people have it by age 70. It is found in almost all vertebrate animals. Arteriosclerosis (ar tir ee oh skluh ROH sus), which is a hardening of the arteries, is another example of a degenerative disease. Because degenerative diseases also have a genetic component, some individuals might be more likely to develop such a disease because of their genetic makeup.

Metabolic Diseases

Metabolic disease results from an error in a biochemical pathway. Some metabolic diseases result in the inability to digest specific amino acids or to regulate body processes. The condition known as phenylketonuria (PKU) is an inherited disorder that creates the inability to break down part of a protein called phenylalanine. When the pancreas does not make the proper amount of insulin and glucose does not enter body cells normally, the condition is known as Type 2 diabetes. This results in high glucose levels in the bloodstream, which causes damage to many organs including the kidneys and the retinas of the eyes. Metabolic diseases can have a genetic component but also can involve environmental factors such as diet.

Cancer

Cancer is characterized by abnormal cell growth. Normally, certain regulatory molecules in the body control the beginning and end of the cell cycle. If this control is lost, abnormal cell growth results that could lead to various types of tumors, as shown in **Figure 16**. The abnormal cells can interfere with normal body functions and can travel throughout the body. Cancer can develop in any body tissue or organ, including the blood cells. Cancer in the blood cells is called leukemia. Both genetic and environmental factors have been shown to cause cancer.

HISTORY Connection Cancer is a disease that has affected humans since ancient times. Egyptian mummies show evidence of bone cancer, and ancient Greek scientists described different kinds of cancer. Medieval manuscripts have reported details about cancer.

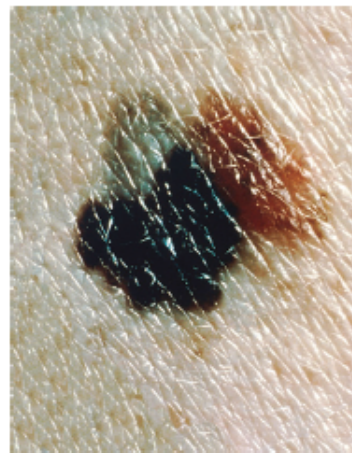


Figure 16 Cancer is due to an abnormal increase in cell division in the body, resulting in a tumor such as this skin tumor.

Infer why this growth is so life-threatening.

Inflammatory Diseases

Inflammatory diseases, such as allergies and autoimmunity, are diseases in which the body produces an inflammatory response to a common substance. Recall from Lesson 2 that infectious diseases also result in an inflammatory response. However, the inflammatory response in an infectious disease enhances the overall immune response. This inflammatory response is a result of the immune system removing bacteria or other microorganisms from the body. In inflammatory disease, the inflammatory response is not helpful to the body.

Q1: A metabolic disease, such as Phenylketonuria (PKU), is defined as resulting from which of the following?

- A. A localized response to environmental allergens
- B. An error in a biochemical pathway
- C. The natural hardening of the artery walls
- D. An abnormal increase in the rate of cell division

Q2: A student claims that degenerative diseases, metabolic diseases, cancer, and inflammatory diseases are all examples of noninfectious disorders. Which evidence best supports this claim?

- A. None of these diseases result from infection by microorganisms.
- B. All of these diseases are inherited.
- C. All of these diseases occur only in elderly individuals.
- D. All of these diseases can be prevented through vaccination.

Q3: Type 2 diabetes is classified as a metabolic disease because it involves the body's inability to regulate which process?

- A. digestion of phenylalanine
- B. proper use of insulin
- C. control of the cell cycle
- D. production of antibodies against joint proteins

Q4: Arteriosclerosis is categorized as a degenerative disease. Which physical characteristic defines this condition?

- A. A massive release of histamine in the blood
- B. The presence of extra chromosomes
- C. Hardening of the arteries
- D. Uncontrolled growth of tumors

Q5: What biological failure leads to the development of a tumor?

- A. The body forms autoantibodies that attack healthy tissue.
- B. Control is lost over the regulatory molecules that govern the cell cycle.
- C. The body becomes sensitized to environmental antigens like pollen.
- D. The heart valves leak or do not close properly.

Q6: Which pair correctly matches a noninfectious disorder with its primary cause?

- A. Degenerative disease — abnormal cell growth
- B. Metabolic disease — inflammatory response to harmless substances
- C. Cancer — loss of control of the cell cycle
- D. Inflammatory disease — hardening of the arteries

Q7: A patient has Type 2 diabetes, while another patient has arteriosclerosis. Which statement correctly compares these disorders?

- A. Both are caused by abnormal cell growth.
- B. Type 2 diabetes is a metabolic disease, whereas arteriosclerosis is a degenerative disease.
- C. Both are inflammatory diseases.
- D. Type 2 diabetes is infectious, whereas arteriosclerosis is noninfectious.

Q8: All of the following are noninfectious disorders. Which one is matched with the correct description?

- A. Cancer — hardening of the arteries
- B. Metabolic disease — error in a biochemical pathway
- C. Degenerative disease — abnormal cell growth
- D. Inflammatory disease — pathogen removal from the body

Q9: Differentiate the cause of rheumatoid arthritis from the cause of degenerative arthritis?

- A. Rheumatoid is caused by aging; degenerative is caused by pathogens.
- B. Rheumatoid is an autoimmune disease degenerative is caused by wear and tear.**
- C. Rheumatoid only affects humans; degenerative affects all vertebrate animals.
- D. There is no distinction; both are classified as metabolic disorders.

Q10: Which of the following conditions is specifically caused by the body wearing out?

- A. Degenerative arthritis**
- B. Sickle cell anemia
- C. Leukemia
- D. Lupus

Q11: Which characteristic best distinguishes this condition from a metabolic disease such as PKU?

- A. Degenerative arthritis results from abnormal cell growth.
- B. Degenerative arthritis is associated with the wear and tear of body structures.**
- C. Degenerative arthritis is caused by an inflammatory response to common substances.
- D. Degenerative arthritis is always caused by pathogens.

Q12: A student creates a chart comparing noninfectious disorders. Which statement should be placed under both degenerative diseases and cancer?

- A. Both can be influenced by genetic factors.**
- B. Both result from errors in biochemical pathways only.
- C. Both are caused by inflammatory responses to harmless substances.
- D. Both always occur as a result of aging.

Q13: A disease develops because the body produces an inflammatory response to a harmless substance. Which type of noninfectious disorder is being described?

- A. Degenerative disease
- B. Metabolic disease
- C. Cancer
- D. Inflammatory disease**

Q14: A medical researcher is categorizing the following conditions: Down syndrome, arteriosclerosis, Type 2 diabetes, leukemia, and rheumatoid arthritis. What is the correct sequence of categories for these diseases?

- A. Metabolic, Cancer, Genetic, Degenerative, Inflammatory
- B. Genetic, Degenerative, Metabolic, Cancer, Inflammatory**
- C. Inflammatory, Metabolic, Degenerative, Cancer, Genetic
- D. Genetic, Cancer, Metabolic, Inflammatory, Degenerative

Q15: Which of the following rows correctly matches each category of noninfectious disease with its primary cause?

	Genetic	Degenerative	Metabolic	Cancer	Inflammatory
A	Pathogen infection	Uncontrolled cell growth	Aging process	Inherited genes	Biochemical error
B	Inherited genes	Aging process	Biochemical error	Uncontrolled cell growth	Unhelpful immune response
C	Aging process	Inherited genes	Immune response	Pathogen infection	Biochemical error
D	Biochemical error	Pathogen infection	Inherited genes	Aging process	Uncontrolled cell growth

26	BIO. 3.1.01.087 Infer why cancer is life threatening	Information from text	22
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Q1: Why is this type of growth considered life-threatening to an individual?

- A. It represents a helpful inflammatory response that removes bacteria.
- B. It is a localized reaction to environmental antigens that is easily treated.
- C. Abnormal cells can interfere with normal body functions and travel throughout the body.**
- D. It is a natural part of the aging process and does not affect homeostasis.

Q2: In a healthy individual, regulatory molecules control the cell cycle. what direct consequence leads to the development of cancer?

- A. The immune system begins attacking its own proteins.
- B. Control over the regulatory molecules that govern the cell cycle is lost.**
- C. The body becomes unable to digest amino acids like phenylalanine.
- D. Arteries begin to harden, restricting oxygenated blood flow.

Q3: What historical evidence is provided to show that cancer has affected humans for thousands of years?

- A. Evidence of bone cancer found in Egyptian mummies.**
- B. Descriptions of allergies in ancient Roman manuscripts.
- C. Archaeological evidence of insulin use in ancient Greece.
- D. Records of degenerative arthritis in medieval Europe.

Q4: Cancer can develop in any body tissue or organ. When this uncontrolled growth occurs specifically in the blood cells, it is known as:

- A. Arteriosclerosis
- B. Albinism
- C. Leukemia**
- D. Autoimmunity

Q5: Referring to Figure 16, what is the primary biological characteristic of the skin tumor shown?

- A. It is caused by the inheritance of a single malfunctioning gene.
- B. It is due to an abnormal and uncontrolled increase in cell division.**
- C. It is a helpful response by the immune system to remove pathogens.
- D. it is a result of the body's inability to regulate glucose.

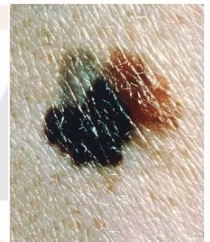


Figure 16 Cancer is due to an abnormal increase in cell division in the body, resulting in a tumor such as this skin tumor.

Q6: Which noninfectious disorder is most directly associated with a loss of normal regulation of the cell cycle?

- A. PKU
- B. Degenerative arthritis
- C. Cancer**
- D. Allergy



Q1: What is the primary difference between the inflammatory response in an infectious disease versus an inflammatory disease?

- A. In an inflammatory disease, the response helps remove microorganisms
- B. In an infectious disease, the response is helpful; in an inflammatory disease, it is not helpful**
- C. Only infectious diseases result in an inflammatory response
- D. There is no biological difference between the two types of responses

Q2: Why is an allergy categorized as an inflammatory disease?

- A. The body produces an inflammatory response to a common, non-pathogenic substance**
- B. It is caused by the same bacteria that cause strep throat
- C. It involves the body wearing out over time due to aging
- D. It results in the destruction of regulatory molecules in the cell cycle

Q3: In a healthy immune response to an infection, the inflammatory response serves which function?

- A. To cause the hardening of the artery walls
- B. To trigger the uncontrolled division of cells
- C. To enhance the overall immune response and remove pathogens**
- D. To cause autoantibodies to attack healthy body tissues

Q4: Which chemical, released by certain white blood cells, is responsible for the symptoms (sneezing, itchy eyes) of an inflammatory disease like an allergy?

- A. Insulin
- B. Phenylalanine
- C. Histamine**
- D. Autoantibodies

Q5: Which of the following is an example of an inflammatory disease?

- A. Leukemia
- B. Albinism
- C. Autoimmunity**
- D. Arteriosclerosis

Your Guide to Success



Allergies

Certain individuals might have an abnormal reaction to environmental antigens. A response to environmental antigens is called an **allergy**. These antigens are called allergens and include things such as plant pollens, dust, dust mites, and various foods, as shown in **Table 4**. An individual becomes sensitized to the allergen and has a localized inflammatory response with swollen itchy eyes, stuffy nose, sneezing, and sometimes a skin rash. These symptoms are the result of a chemical called histamine, released by certain white blood cells. Antihistamine medications can help alleviate these symptoms.



Get It?

Explain how allergies are related to the immune system.

Severe allergic reactions to particular allergens can result in **anaphylactic** (an uh fuh LAK tik) **shock**, which causes a massive release of histamine. In anaphylactic shock, the smooth muscles in the bronchioles contract, which restricts air flow into and out of the lungs.

Common allergens that cause severe allergic reactions are bee stings, penicillin, peanuts, and latex, which is used to make balloons and surgical gloves. People who are extremely sensitive to these allergens require prompt medical treatment if exposed to these agents, because anaphylactic reactions are life-threatening. Allergies and anaphylactic reactions are known to have an inherited component.

Table 4 Common Allergens

Allergen	Example	Description
Dust mite	Color-enhanced SEM, magnification × 44 	Dust mites are found in mattresses, pillows, and carpets. Mites and mite feces are allergens.
Plant pollen	Color-enhanced SEM, magnification × 1000 	Different parts of the country have very different pollen seasons. People can react to one or more pollens, and a person's pollen allergy season might be from early spring to late fall.
Animal dander	Color-enhanced SEM, magnification × 100 	Dander is skin flakes. Cat and dog allergies are the most common, but people also are allergic to pets such as birds, hamsters, rabbits, mice, and gerbils.
Peanut		Allergic reaction to peanuts can result in anaphylactic shock. Peanut allergy is responsible for more fatalities than any other type of allergy.
Latex		Latex comes from the milky sap of the rubber tree, found in Africa and Southeast Asia. The exact cause of latex allergy is unknown.

Q1: What is the fundamental relationship between allergies and the immune system?

- A. Allergies are caused by a lack of white blood cells.
- B. Allergies are a helpful response that removes harmful bacteria.
- C. Allergies are an overactive immune response to environmental antigens.**
- D. Allergies occur when the immune system fails to produce any antibodies.

Q2: During the process of anaphylactic shock, what physiological change occurs in the respiratory system due to a massive release of histamine?

- A. The bronchioles expand to increase oxygen intake.
- B. Smooth muscles in the bronchioles contract, restricting air flow.**
- C. The lungs begin to produce excess insulin to combat the allergen.
- D. Heart valves begin to leak, causing blood to move backward.

Q3: Based on the descriptions in Table 4, which allergen is specifically noted for being responsible for more fatalities than any other type of allergy?

- A. Plant pollen
- B. Animal dander
- C. Peanuts**
- D. Dust mites

Q4: Referring to Table 4, which statement correctly describes the origin of latex as an allergen?

- A. It is found in the feces of dust mites.
- B. It comes from the milky sap of the rubber tree.**
- C. It is composed of skin flakes from household pets.
- D. It is produced by plants only during the spring and fall seasons.

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Allergen	Example	Description
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Q5: What is the primary difference between a common allergic reaction and anaphylactic shock?

- A. Common allergies involve histamine, while anaphylactic shock does not.
- B. Anaphylactic shock involves a massive release of histamine that is life-threatening, whereas common allergies are localized.**
- C. Common allergies affect the skeletal system, while anaphylactic shock affects only the skin.
- D. There is no biological difference; the terms are used interchangeably.



27

BIO. 3.1.01.087 Explain autoimmune disorders, to include rheumatoid arthritis, rheumatic fever and lupus

Information from text

Figure 17

24

Autoimmunity

During the development of the immune system, the immune system learns not to attack proteins produced by the body. However, some people develop autoimmunity (aw toh ih MYOON ih tee) and do form antibodies to their own proteins, which injures their cells. Figure 17 shows the hands of a person with rheumatoid arthritis—a form of arthritis in which antibodies attack the joints. Degenerative arthritis, the form of arthritis that you read about earlier in the section on degenerative diseases, is not caused by autoimmunity.

Rheumatic fever and lupus (LEW pus) are other examples of autoimmune disorders. Rheumatic fever is an inflammation in which antibodies attack the valves of the heart. This can lead to damage to the heart valves and cause the valves to leak or not close properly as blood moves through the heart. Lupus is a disorder in which autoantibodies are formed and attack healthy tissue. As a result, many organs are vulnerable to attack by the body's own immune system.



Figure 17 The large knobs and deformities of these fingers are due to rheumatoid arthritis, an autoimmune disease.

Q1: Examine Figure 17. What biological mechanism is responsible for the large knobs and deformities shown in the joints of the hand?

- A. The natural wear and tear of joints due to the aging process
- B. A bacterial infection that has spread into the skeletal system
- C. Antibodies attacking the body's own joint proteins**
- D. A metabolic error in the digestion of specific amino acids

Q2: Distinguish degenerative arthritis from rheumatoid arthritis?

- A. Degenerative arthritis is an autoimmune condition, while rheumatoid is not
- B. Rheumatoid arthritis is an autoimmune disease, whereas degenerative arthritis is caused by aging and wear**
- C. There is no difference; they are both caused by the same health conditions
- D. Rheumatoid arthritis only affects the heart, while degenerative affects the joints

Q3: A patient's medical tests reveal that their antibodies are attacking their heart valves, causing them to leak. Which condition does this patient likely have?

- A. Lupus
- B. Rheumatic fever**
- C. Coronary artery disease
- D. Arteriosclerosis

Q4: What characterizes lupus as a particularly dangerous autoimmune disorder?

- A. It only affects the large joints of the hands and feet
- B. Autoantibodies attack healthy tissue, making many organs vulnerable**
- C. It is caused by a massive release of histamine in the bronchioles
- D. It results in an abnormal number of chromosomes in body cells



Figure 17 The large knobs and deformities of these fingers are due to rheumatoid arthritis, an autoimmune disease.



Q5: Which statement best summarizes the cause of all autoimmune disorders?

- A. They are caused by environmental allergens like plant pollen
- B. They result from the loss of control over the cell cycle
- C. The immune system fails to distinguish between "self" and "nonself," attacking the body's own proteins**
- D. They are infectious diseases passed from one organism to another

Q6. Figure 17 shows the hands of a person with rheumatoid arthritis. Why is this condition classified as an inflammatory disease rather than a degenerative disease?

- A. It is caused solely by the joints wearing out due to age.
- B. It involves forming antibodies that attack body's own proteins and joints.**
- C. It is caused by an inherited error in the production of insulin.
- D. It results from an abnormal increase in cell division in the bone tissue.



Figure 17 The large knobs and deformities of these fingers are due to rheumatoid arthritis, an autoimmune disease.

Q7. In lupus, multiple organs are at risk of damage. What is the underlying cause for this weakness?

- A. A massive release of histamine in the bronchioles.
- B. Uncontrolled cell growth traveling through the bloodstream.
- C. Autoantibodies attacking healthy body tissues.**
- D. The body's inability to regulate glucose levels.

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