Glencoe Science

Biology

Interactive Classroom

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Mc Graw Hill Glencoe

Chapter 37 Immune System

EXIT

Click on a lesson name to select.

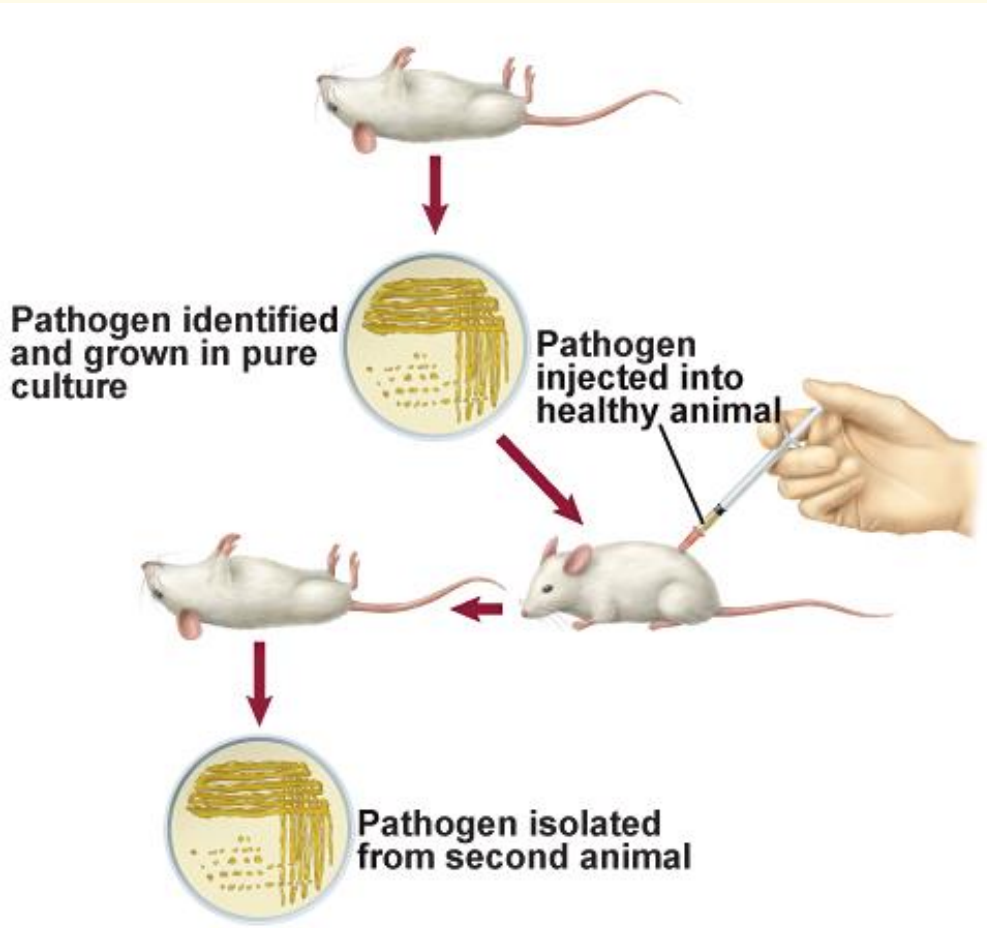
37.1 Infectious Diseases

Pathogens Cause Infectious Disease

- An infectious disease is a disease that is caused when a pathogen is passed from one organism to another.
- Pathogens are the cause of infectious disease.
  - Bacteria
  - Viruses
  - Protozoans
  - Fungi
  - Parasites

37.1 Infectious Diseases

Koch's Postulates



Postulate 1

The suspected pathogen must be isolated from the diseased host in every case of the disease.

Postulate 2

The suspected pathogen must be grown in pure culture on artificial media in the laboratory.

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The suspected pathogen from the pure culture must cause the same disease when placed in a healthy new host.

Postulate 4

The suspected pathogen must be isolated from the new host, grown again in pure culture, and shown to have the same characteristics as the original pathogen.

37.1 Infectious Diseases

Spread of Disease

- A disease reservoir is a source of the pathogen in the environment.
- Reservoirs might be animals, people, or inanimate objects, such as soil.

37.1 Infectious Diseases

Human Reservoirs

- Humans are the main reservoir for pathogens that affect humans.
- An individual that is symptom-free but capable of passing the pathogen is called a carrier.

37.1 Infectious Diseases

Animal Reservoirs

- Other animals also are reservoirs of pathogens that can be passed to humans.
- Influenza
- Rabies

37.1 Infectious Diseases

Other Reservoirs

- Soil
- Contaminated water or food

37.1 Infectious Diseases

Transmission of Pathogens

Direct contact

Indirect contact through air

Vectors

Indirect contact by objects

37.1 Infectious Diseases

Symptoms of Disease

- The virus multiplies in the cells and leaves the cells either by exocytosis or by causing the cell to burst.
- The virus damages tissues and even kills some cells.
- Harmful chemicals or toxins might be produced.

37.1 Infectious Diseases

Disease Patterns

- As outbreaks of diseases spread, certain patterns are observed.
- The Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO) monitor disease patterns to help control the spread of diseases.

37.1 Infectious Diseases

Treating and Fighting Diseases

- An antibiotic is a substance that can kill or inhibit the growth of other microorganisms.
  - *Penicillium*
  - Erythromycin
  - Neomycin
  - Gentamicin

37.2 The Immune System

Nonspecific Immunity

- The body has a number of defenses in the immune system that fight off pathogens.
- These defenses are nonspecific because they are not aimed at a specific pathogen.
- Helps to prevent disease
- Helps to slow the progression of the disease

37.2 The Immune System

Skin Barrier

- Dead skin cells help protect against invasion by microorganisms.
- Bacteria that live symbiotically on the skin digest skin oils to produce acids that inhibit many pathogens.

37.2 The Immune System

Chemical Barriers

- Saliva, tears, and nasal secretions contain the enzyme lysozyme.
- Lysozyme breaks down bacterial cell walls, which kills pathogens.
- Mucus acts as a protective barrier, blocking bacteria from sticking to the inner epithelial cells.

37.2 The Immune System

Nonspecific Responses to Invasion

- The body has nonspecific immune responses to pathogens that get beyond its barriers.
  - Cellular defense
  - Interferon
  - Inflammatory response

37.2 The Immune System

Cellular Defense

- Phagocytosis is the process by which phagocytic cells surround and internalize the foreign microorganisms.
- The phagocytes release digestive enzymes and other harmful chemicals from their lysosomes, destroying the microorganism.

37.2 The Immune System

Interferon

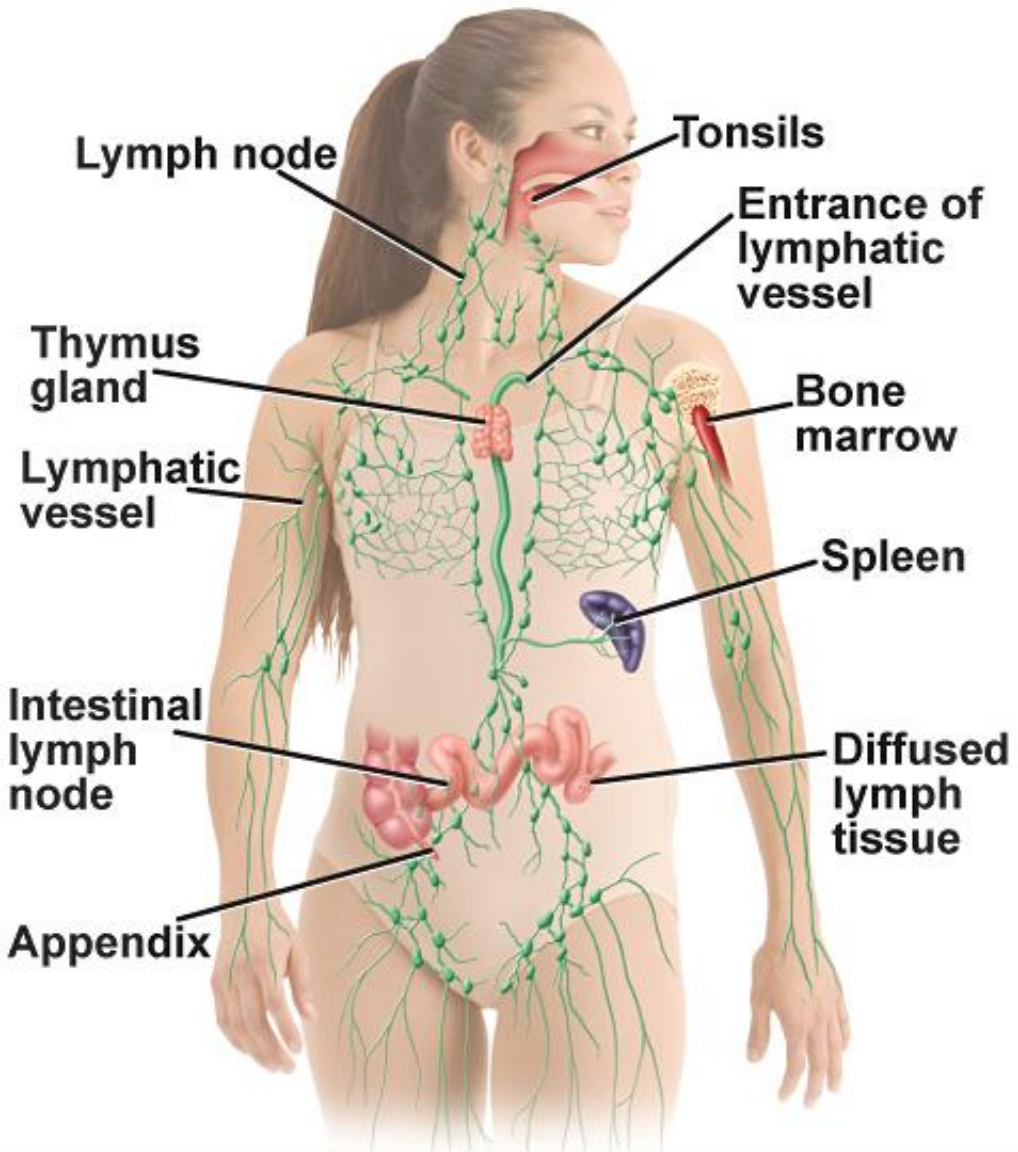
- Virus-infected cells secrete a protein called interferon. 
- Interferon binds to neighboring cells and stimulates these cells to produce antiviral proteins which can prevent viral replication in these cells.

37.2 The Immune System

Inflammatory Response

- Increased blood flow to the infected area makes blood vessels more permeable to allow white blood cells to escape into the infected area.

37.2 The Immune System



Specific Immunity

- Lymphatic system
  - Organs and cells that filter lymph and blood and destroy foreign microorganisms

37.2 The Immune System

Lymphatic Organs

- Lymphatic tissue
- Lymphocytes
  - Lymphocytes are a type of white blood cell that is produced in red bone marrow.

Concepts In Motion

Table 37.2 Cells of the Immune System

Type of Cell	Function
	Phagocytosis: blood cells that ingest bacteria
	Phagocytosis: blood cells that ingest bacteria and remove dead neutrophils and other debris
	Specific immunity (antibodies and killing of pathogens): blood cells that produce antibodies and other chemicals

Lymphocytes | Macrophages | Neutrophils

Drag each option to its corresponding function

Reset | Submit | Show me

37.2 The Immune System

- These lymphatic organs include
  - Lymph nodes
  - Tonsils
  - Spleen
  - Thymus gland
  - Diffused lymphatic tissue found in mucous membranes of the intestinal, respiratory, urinary, and genital tracts

37.2 The Immune System

B Cell Response

- Antibodies are proteins produced by B lymphocytes that specifically react with a foreign antigen.
- B lymphocytes, often called B cells, are located in all lymphatic tissues and can be thought of as antibody factories.

37.2 The Immune System

B Cell Response

- The activated helper T cell reproduces, binds processed antigens, and attaches to a B cell.
- The new helper T cells continue the process of binding antigens, attaching to B cells, and reproducing.

37.2 The Immune System

B Cell Response

- Once an activated helper T cell binds to a B cell holding an antigen, the B cell begins to manufacture antibodies that specifically bind to the antigen.
- The antibodies can enhance the immune response by binding to microorganisms, making them more susceptible to phagocytosis and by initiating the inflammatory response, helping promote the nonspecific response.

37.2 The Immune System

T Cell Response

- Helper T cells bind to and activate cytoxic T cells.
- Activated cytotoxic T cells destroy pathogens and release chemicals called cytokines. Cytokines stimulate the cells of the immune system.

37.2 The Immune System

Passive Immunity

- Temporary protection occurs when antibodies are made by other people or animals and are transferred or injected into the body.

37.2 The Immune System

Active Immunity

- Active immunity occurs after the immune system is exposed to disease antigens and memory cells are produced. Active immunity can result from having an infectious disease.
- Immunization is the deliberate exposure of the body to an antigen so a primary response and immune memory cells will develop.

Concepts In Motion

Table 37.3 Common Immunizations

Immunization	Disease	Contents
	Diphtheria, tetanus, pertussis (whooping cough)	Inactivated toxin, Inactivated bacteria
Inactivated polio		
	Measles, mumps, rubella	All three inactivated viruses
Varicella		Inactivated virus
HIB		
	Hepatitis B	

DPT | Inactivated virus | Haemophilus influenzae (flu) type b | Portions of bacteria cell wall covering

MMR | Chicken pox

HBV | Poliomyelitis | Subunit of virus

Drag each option to its corresponding category

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37.2 The Immune System

- The secondary response to the antigen has a number of different characteristics.
- The response is more rapid than the primary response.
- The overall response, both B and T cell response, is greater during the second exposure.
- The overall memory lasts longer after the second exposure.

37.2 The Immune System

Immune System Failure

- Some diseases can affect the immune system's effectiveness.
- Acquired immunodeficiency syndrome (AIDS)
- HIV infects mainly helper T cells.
- The helper T cells become HIV factories, producing new viruses.
- The number of helper T cells in an infected person decreases.

37.3 Noninfectious Disorders

Genetic Disorders

- Diseases caused by the inheritance of genes that do not function properly in the body
  - Albinism
  - Sickle cell anemia
  - Huntington disease
  - Hemophilia

37.3 Noninfectious Disorders

Degenerative Diseases

- Degenerative diseases are the result of a part of the body wearing out sooner than would be expected in a person's lifetime.
- Arthritis
- Arteriosclerosis

37.3 Noninfectious Disorders

Metabolic Diseases

- Metabolic disease results from an error in a biochemical pathway.
- Type I diabetes

Cancer

- Cancer is characterized by abnormal cell growth.

37.3 Noninfectious Disorders

Inflammatory Diseases

- Inflammatory diseases are diseases in which the body produces an inflammatory response to a common substance.

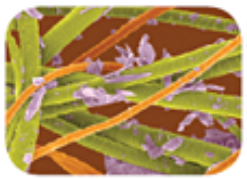
37.3 Noninfectious Disorders

Allergies

- Plant pollens
- Dust
- Dust mites
- Various foods

37.3 Noninfectious Disorders

Common Allergens

Allergen	Example	Description
Dust mite	 Color-Enhanced SEM Magnification: 170×	Dust mites are found in mattresses, pillows, and carpets. Mites and mite feces are allergens.
Plant pollen	 Color-Enhanced SEM Magnification: 2300×	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: 80×	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 anaphylaxis. 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.

Concepts In Motion

Table 37.4 Common Allergens

Allergen		Description
Plant pollen	A	Found in mattresses, pillows, and carpets.
Dust mite	B	Allergy season might be from early spring to late fall.
Latex	C	Skin flakes
Animal dander	D	Allergic reaction can result in anaphylaxis responsible for more fatalities than any other type of allergy.
Peanut	E	Comes from the milky sap of the rubber tree, found in Africa and Southeast Asia.

Drag each Allergen label to its corresponding description

Reset Submit Show me

37.3 Noninfectious Disorders

Autoimmunity

- Form antibodies to their own proteins, which injures their cells
- Rheumatoid arthritis
- Rheumatic fever
- Lupus

Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

CheckPoint

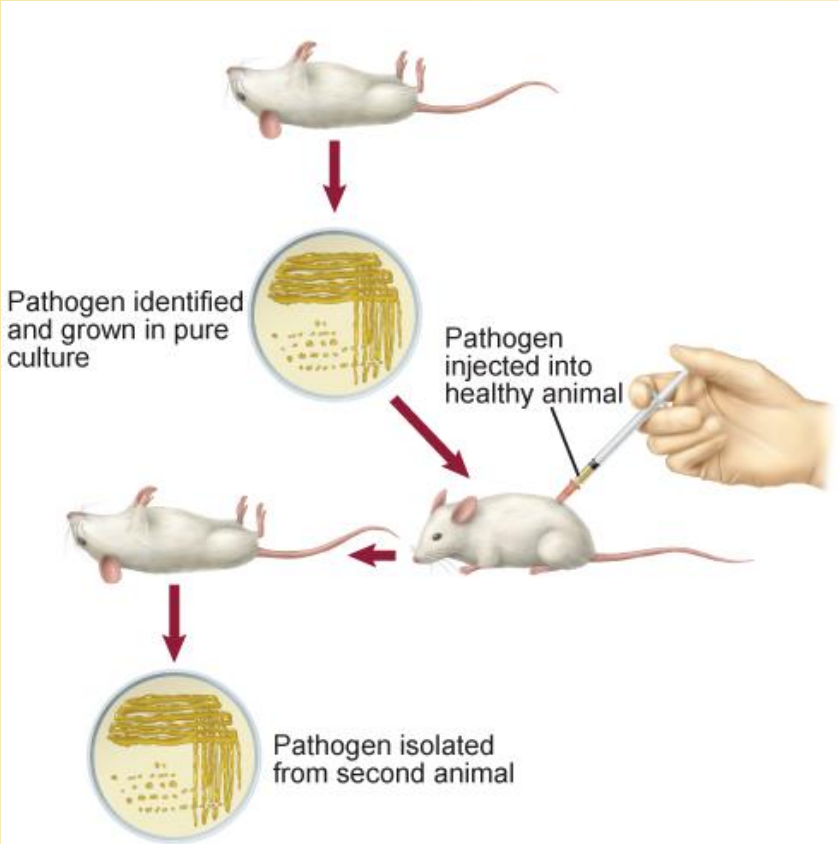
True or False

All bacteria and viruses cause disease.

Chapter Diagnostic Questions

CheckPoint

What do Koch's postulates prove?



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Chapter Diagnostic Questions

CheckPoint

A. anthrax is harmful to humans

B. a specific pathogen causes a specific disease

C. pathogens can be grown in the lab

D. all bacteria are pathogens

Chapter Diagnostic Questions

CheckPoint

West Nile Virus is an example of a disease which is spread by _____.

A. direct contact

B. indirect contact by objects

C. indirect contact through the air

D. vectors

37.1 Formative Questions

CheckPoint

Which help keep pathogens from thriving and multiplying on your skin?

A. bacteria

B. histamines

C. natural antibiotics

D. red blood cells

37.1 Formative Questions

CheckPoint

What is a disease reservoir?

A. the source of a pathogen

B. the organ the pathogen infects

C. the medium that transmits the pathogen

D. the set of symptoms caused by the pathogen

37.1 Formative Questions

CheckPoint

What are the most common vectors that transmit diseases?

A. arthropods

B. mammals

C. chemical toxins

D. tiny mucus droplets

37.1 Formative Questions

CheckPoint

What is the source of most antibiotics?

A. bacteria
B. fungi
C. protists
D. plants

37.2 Formative Questions

CheckPoint

Which is true of nonspecific immunity?

A. It takes time to develop.

B. It involves helper T cells.

C. It is the first line of defense.

D. It is the most effective immune response.

37.2 Formative Questions

CheckPoint

Which substance kills pathogens by breaking down bacterial cell walls?

A. cytokine

B. hydrochloric acid

C. interferon

D. lysozyme

37.2 Formative Questions

CheckPoint

How do neutrophils and macrophages defend the body?

A. they ingest bacteria

B. they produce antibodies

C. they recruit lymphocytes

D. they secrete cytotokines

37.2 Formative Questions

CheckPoint

Which white blood cells are the antibody factories?

A. B cells

B. T cells

C. cytotoxic T cells

D. macrophages

37.2 Formative Questions

CheckPoint

What can be injected into a person that will inactivate the venom from a snakebite or scorpion sting?

A. antibodies
B. cytokines
C. lymphocytes
D. macrophages

37.3 Formative Questions

CheckPoint

True or False

Noninfectious disorders can have both an environmental and a genetic cause.

37.3 Formative Questions

CheckPoint

What is an abnormal inflammatory response to an environmental antigen that is *not* pathogenic?

A. an allergy

B. an autoimmunity

C. an anaphylactic reaction

D. a metabolic response

37.3 Formative Questions

CheckPoint

What causes anaphylactic shock?

A. a large influx of antibodies

B. a massive release of histamine

C. an extreme autoimmune reaction

D. toxic environmental agents

37.3 Formative Questions

CheckPoint

What is the term for the formation of antibodies to the body's own proteins?

A. cancer

B. leukemia

C. autoimmunity

D. antipeptide disorder

Chapter Assessment Questions

CheckPoint

Identify the term used to describe a large outbreak of a disease in one area.

A. endemic

B. epidemic

C. pandemic

D. systematic

Chapter Assessment Questions

CheckPoint

Explain how bacteria become resistant to antibiotics.

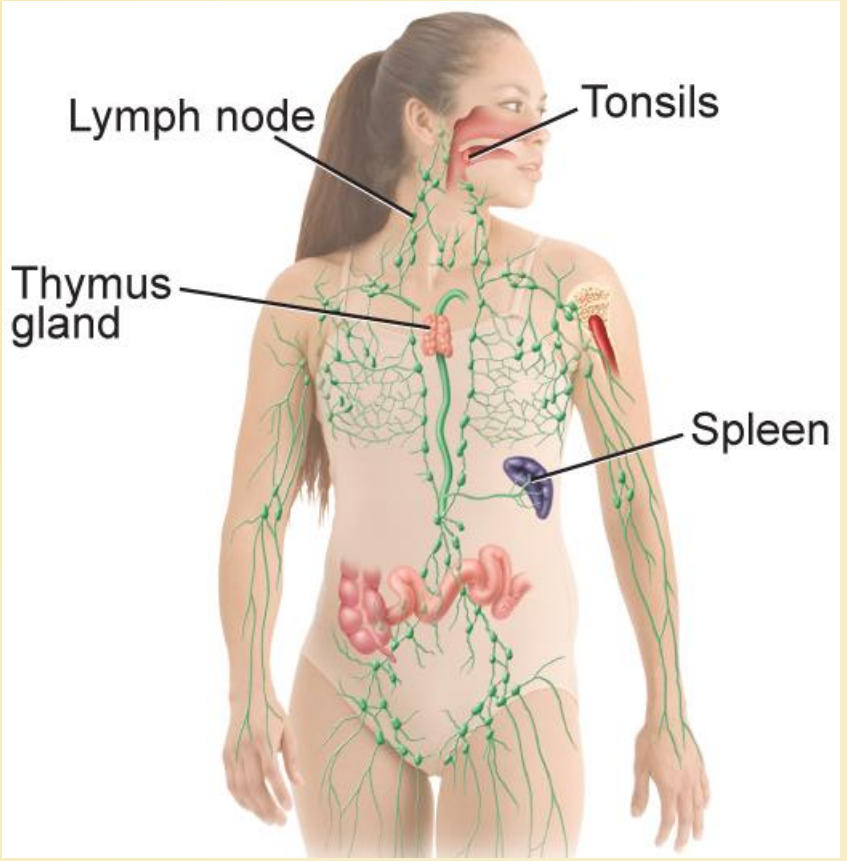
Answer: If a bacterium contains a trait that enables it to survive when an antibiotic is present, it will reproduce and pass that same survival trait to its offspring. This will create more bacteria also resistant to that antibiotic.

Chapter Assessment Questions

CheckPoint

Which lymphatic organ stores blood and destroys damaged blood cells?

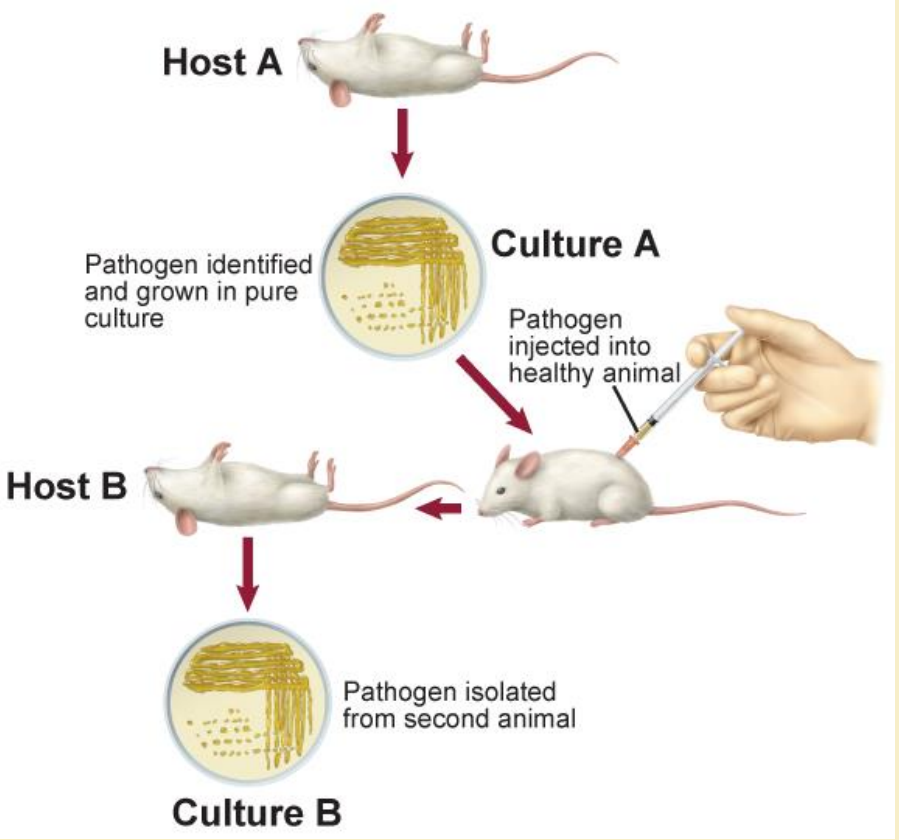
A. lymph nodes
B. tonsils
C. spleen
D. thymus



Standardized Test Practice

CheckPoint

Which provides the strongest evidence that a specific pathogen has been identified as the disease agent?



Standardized Test Practice

CheckPoint

A. Host B also dies of the disease.

B. Host B shows similar symptoms as host A.

C. Culture B shows characteristics of a known pathogen.

D. Culture B shows the same characteristic as Culture A.

Standardized Test Practice

CheckPoint

How are most viral diseases fought?

A. with antibiotics

B. with antiviral drugs

C. with chemical agents

D. by the body's immune system

Standardized Test Practice

CheckPoint

What is the most likely reason for bacterial resistance to the antibiotic penicillin?

A. The bacteria have been grown in pure culture media.

B. The bacteria have weakened the affects of penicillin.

Standardized Test Practice

CheckPoint

What is the most likely reason for bacterial resistance to the antibiotic penicillin?

C. The human population has doubled in the last 30 years.

D. Penicillin has been used to treat bacterial infections since World War II.

Standardized Test Practice

CheckPoint

What is the main cause of aches and pains associated with the flu?

A. The pathogen affects the nervous system.

B. The pathogen invades and lives inside cells.

C. The pathogen produces chemical toxins.

D. The pathogen triggers an immune response.

Standardized Test Practice

CheckPoint

Which term best describes the function of interferon?

A. antigenator

B. messenger

C. supporter

D. virus-killer

Standardized Test Practice

CheckPoint

What is the purpose of immunization?

A. to desensitize the immune system

B. to cause memory cells to develop

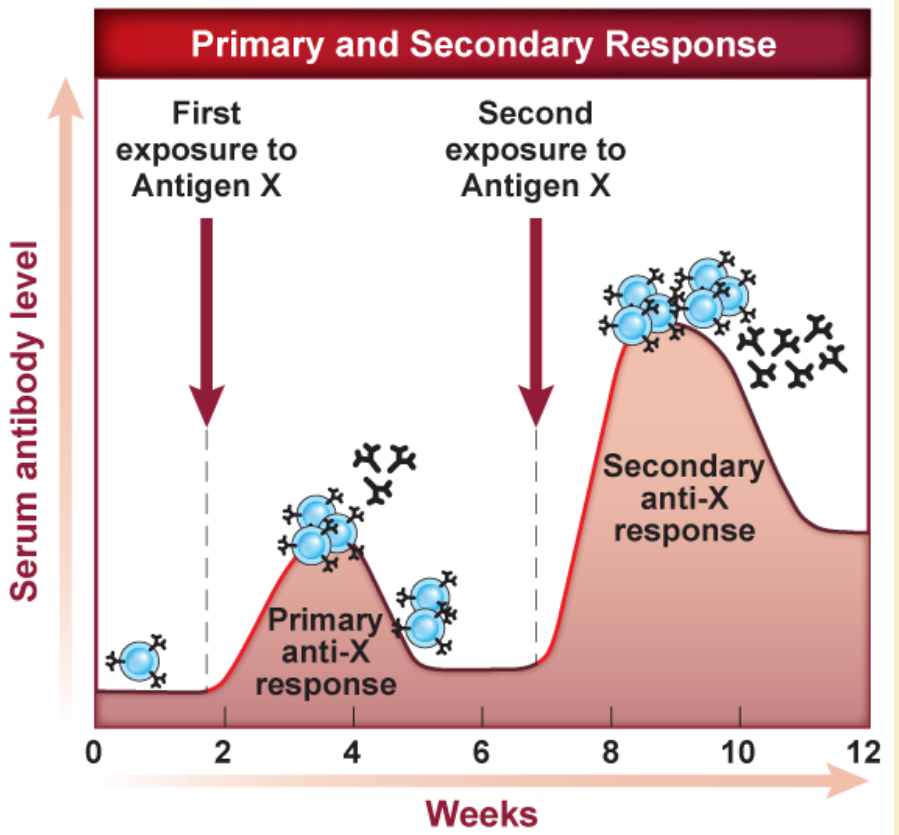
C. to destroy competing pathogens

D. to stimulate interferon production

Standardized Test Practice

CheckPoint

What enables the secondary response to the antigen to be more rapid and stronger than the primary response to the antigen?



Standardized Test Practice

CheckPoint

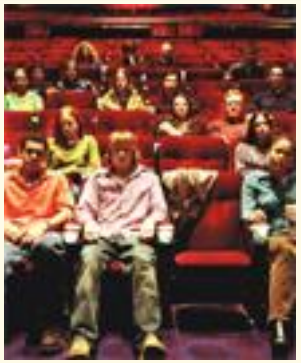
A. activated T cells

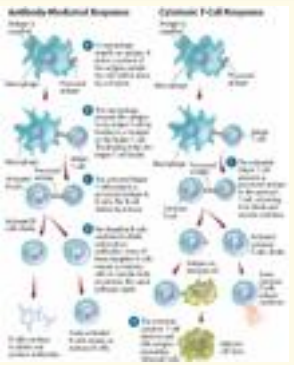
B. antihistamines

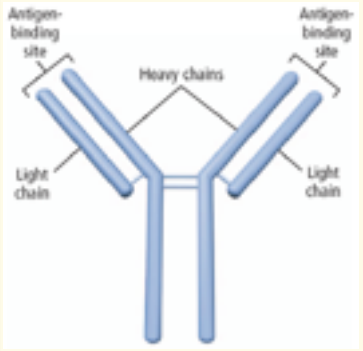
C. memory B cells

D. secondary antibodies

Glencoe Biology Transparencies







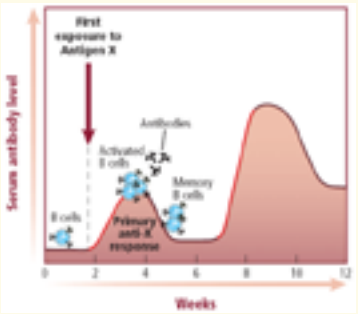
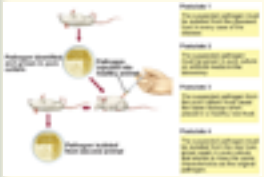
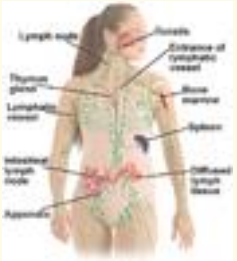


Image Bank




Lymph node
Tonsils
Entrance of lymphatic vessel
Thymus gland
Lymphatic vessel
Bone marrow
Spleen
Intestinal lymph node
Diffused lymph tissue
Appendix


Common Allergens

Vocabulary

Section 1

- infectious disease
- pathogen
- Koch's postulates
- reservoir
- endemic disease
- epidemic
- pandemic
- antibiotic

Vocabulary

Section 2

- complement protein
- interferon
- lymphocyte
- antibody
- B cell
- helper T cell
- cytotoxic T cell
- memory cell
- immunization

Vocabulary

Section 3

- degenerative disease
- metabolic disease
- allergy
- anaphylactic shock

Animation

Concepts In Motion

- Visualizing Immune Response