Infectious Diseases and Koch's Postulates

تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الحادي عشر المتقدم ⇦ أحياء ⇦ الفصل الثالث ⇦ ملفات متنوعة ⇦ الملف

تاريخ إضافة الملف على موقع المناهج: 2026-07-02 12:41:07

المزيد من مادة أحياء: ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

إعداد: موسى زامل

التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم

صفحة المناهج الإماراتية على فيسبوك

المواد على تلغرام | التربية الاسلامية | اللغة العربية | اللغة الانجليزية | الرياضيات

المزيد من الملفات بحسب الصف الحادي عشر المتقدم والمادة أحياء في الفصل الثالث

1 اختبار نهاية الفصل2022م

THE IMMUNE SYSTEM

LESSON 1
INFECTIOUS DISEASES

11 EoT3 Questions Covered: 1, 2, 3, 4, 13, 14, 15, 16, 17, 18, 28

1	BIO. 3.1.01.087 Identify ways in which microorganisms can be beneficial	Information from text	3

Pathogens Cause Infectious Disease

What do a cold and athlete's foot have in common? They are both examples of an infectious disease. An **infectious disease** is a disease that is caused by a pathogen passed from one organism to another, disrupting homeostasis in the organism's body. Agents called **pathogens** are the cause of infectious diseases. Some, but not all, types of bacteria, viruses, protozoans, fungi, and parasites are pathogens.

Many types of these organisms present in the world around us do not cause infectious diseases. Your body benefits from organisms, such as certain types of bacteria and protozoans, that normally live in your intestinal and reproductive tracts. Other bacteria live on your skin, especially in the shafts of your hair follicles. These organisms keep pathogens from thriving and multiplying on your body.

Germ Theory and Koch's Experiments

Before the invention of the microscope, people thought "something" passed from a sick person to a well person to cause an illness. Then, scientists discovered microorganisms and Louis Pasteur demonstrated that microorganisms from the air are able to grow in nutrient solutions. With the knowledge gained from these and other discoveries, doctors and scientists began to develop the germ theory. The germ theory states that some microorganisms are pathogens. However, scientists were not able to clearly demonstrate this theory until Robert Koch developed his postulates.

Identification of the first disease pathogen

In the late 1800s, Robert Koch, a German physician, was studying anthrax (AN thraks)—a deadly disease that affects cattle and sheep and can also affect people.

1. Where are beneficial bacteria and protozoans normally located within the human body to support its function?
a. In the bloodstream and cardiac tissues
b. In the intestinal and reproductive tracts
c. Within the central nervous system
d. Inside the bone marrow and skeletal system

2.Beneficial bacteria living on human skin, particularly in the shafts of hair follicles, provide a defense mechanism by:
a. producing synthetic antibiotics for the body.
b. increasing the internal temperature to kill viruses.
c. keeping pathogens from thriving and multiplying.
d. assisting the body in the process of exocytosis.

3. Why are many microorganisms present in the world not classified as pathogens?
a. Because they are too small to be seen with a microscope.
b. Because they do not cause infectious diseases and provide benefits to the body.
c. Because they are only found in soil reservoirs.
d. Because they are unable to grow on artificial media.

4.Which statement best describes the relationship between beneficial microorganisms and human health?
a. They act as carriers for diseases like the flu and common cold.
b. They disrupt homeostasis to trigger an immune response.
c. They benefit the body by preventing the growth of harmful agents.
d. They are the primary causes of inflammatory allergic reactions.

5.A student is studying the bacteria that live in the shafts of their hair follicles. These specific bacteria are most likely:
a. pathogens causing a localized skin infection.
b. beneficial organisms that protect against pathogens.
c. vectors for transmitting diseases such as athlete's foot.
d. protozoans that help the body digest complex proteins.

6.Four students were asked to give examples of pathogens. Their answers are listed in the table below. Who gave a correct answer?
A.1 B.2
C.3 D.4

Student	Examples of pathogens
1	Algae, parasites, fungi
2	Viruses, protozoa, earthworms
3	Grass, bacteria, protozoa
4	Viruses, bacteria, fungi

13	BIO.3.1.01.087 Explain how Koch proved the germ theory correct	Information from text 'Get it' question	3-4

Koch isolated bacteria, like those in **Figure 1**, from the blood of cattle that had died from anthrax. After growing the bacteria in the laboratory, Koch injected the bacteria into healthy cattle. These animals developed the disease anthrax. He then isolated bacteria from the blood of newly infected cattle and grew the bacteria in the laboratory. The characteristics of the two sets of cultures were identical, indicating that the same type of bacteria caused the illness in both sets of cattle. Thus, Koch demonstrated that the bacteria he originally isolated were the cause of anthrax.

Color-Enhanced SEM Magnification: unavailable

Figure 1 These rodlike bacteria cause the disease anthrax.

Get It?
Explain how Koch proved the germ theory correct.

Koch's postulates

Koch established and published experimental steps known as **Koch's postulates,** which are rules for demonstrating that an organism causes a disease. These steps are followed today to identify a specific pathogen as the agent of a specific disease. Follow the steps in **Figure 2** as you read each of the four postulates.

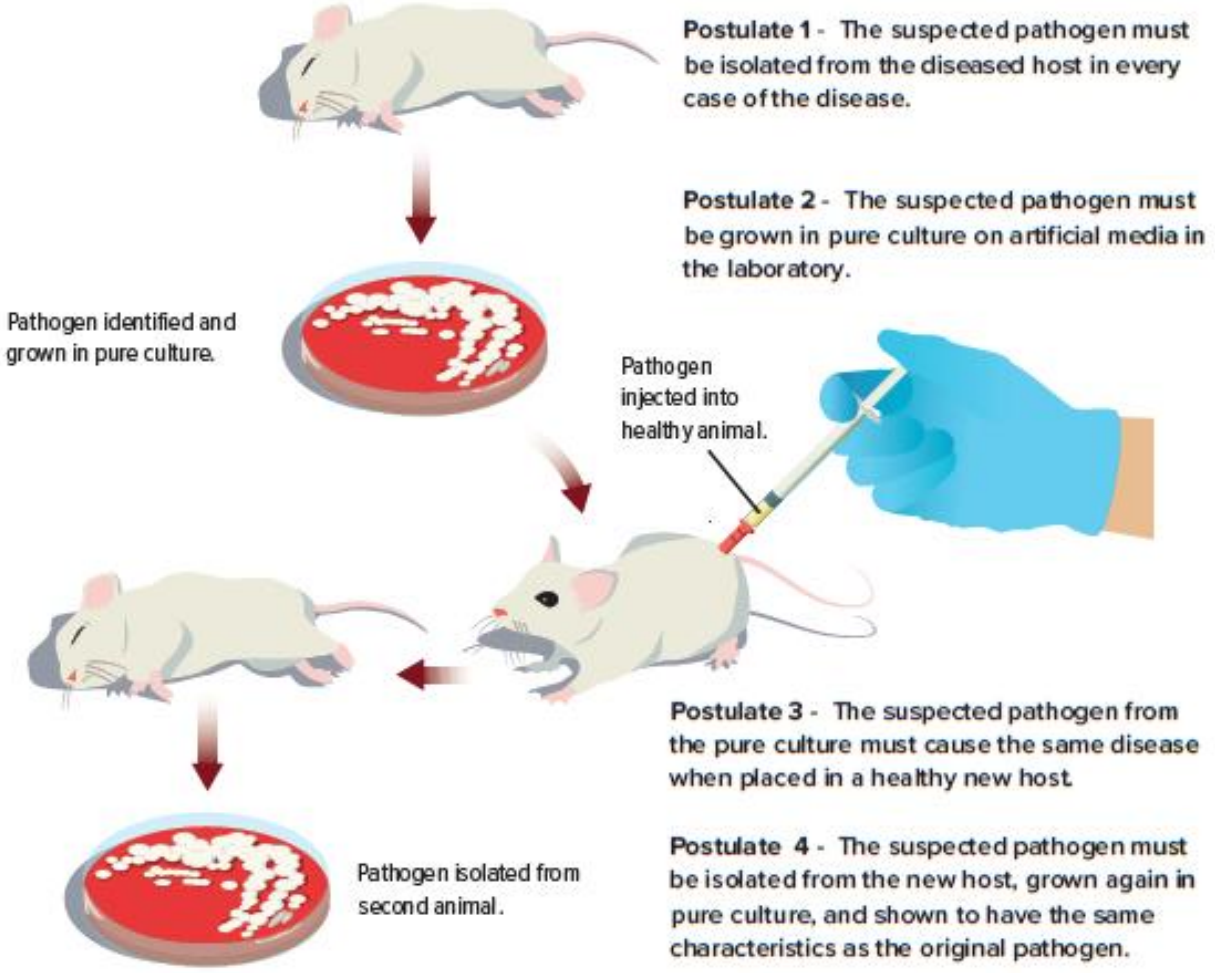
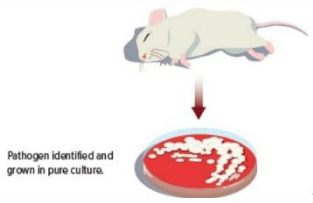


Figure 2 Koch's postulates demonstrate that a specific pathogen causes a specific disease.
Infer *what Koch demonstrated when he isolated the same bacteria from the cattle the second time.*

1.Based on the historical development of the germ theory, what was the primary contribution of Robert Koch that distinguished his work from that of Louis Pasteur?
a. He was the first to demonstrate that microorganisms from the air could grow in nutrient solutions.
b. He identified that beneficial bacteria on the skin help maintain homeostasis.
c. He established a systematic set of experimental steps to prove that a specific microorganism causes a specific disease.
d. He discovered that illnesses were caused by a mysterious "something" passed between people.

2.Analyze Figure 2 regarding Koch's Postulate 2. Why is growing the suspected pathogen in a pure culture on artificial media—considered a vital part of the accepted procedure?



a. It allows the researcher to isolate and identify the specific agent of the disease without interference from other microorganisms.
b. It provides the nutrients necessary for viruses to reproduce without needing living cells.
c. It proves that the suspected pathogen is a beneficial organism found in the intestinal tract.
d. It demonstrates that the pathogen can only survive in a soil reservoir.

3.In his experiments with anthrax, Koch isolated bacteria from the blood of diseased cattle and injected them into healthy cattle. What was his final requirement to definitively prove causality according to Postulate 4?
a. The second animal had to recover fully without treatment.
b. He had to isolate the pathogen from the newly infected host show it had identical to the original.
c. He had to demonstrate that the bacteria could only be spread through a mosquito vector.
d. The pathogen had to mutate into a different type of microorganism to prove it was infectious.

4.A scientist is investigating a new respiratory illness. They find a specific bacterium in 90% of the cases. Does this finding satisfy the requirements of Koch's Postulate 1?
a. Yes, because 90% is a statistically significant number of cases.
b. No, because the suspected pathogen must be isolated from the diseased host in every single case of the disease.
c. Yes, because it proves the bacterium is a pathogen and not a beneficial microorganism.
d. No, because the bacterium must be rodlike in shape to be considered an agent of disease.

5. How did the use of Koch's postulates specifically "prove" the germ theory correct?
a. By showing that all bacteria found on a diseased animal are deadly pathogens.
b. By providing a logical framework to demonstrate that a specific pathogen causes a specific disease.
c. By demonstrating that pathogens can only disrupt homeostasis in cattle and sheep.
d. By proving that artificial media is the only place where pathogens can thrive and multiply.

6. Based on his landmark research with anthrax, explain how Koch proved the germ theory correct.
A. Koch demonstrated that microorganisms from the air are able to grow in nutrient solutions.
B. Koch was able to isolate the bacteria in infected cattle, grow them in a pure culture.
C. Koch identified that human reservoirs act as symptom-free carriers for diseases like the flu and HIV.
D. Koch proved that pathogens only disrupt homeostasis when they are passed through a vector like a mosquito

2	BIO. 3.1.01.087 Discuss the role of reservoirs in disease dispersal	Information from text Table 1	5
3	,BIO. 3.1.01.087 Identify the pathogens that cause infectious diseases to include bacteria, viruses, fungi protozoa, and parasites	Information from text Table 1	5
15	,BIO.3.1.01.087 Identify the pathogens that cause infectious diseases to include bacteria, viruses, fungi protozoa and parasites	Table 1	5

Some exceptions to Koch's postulates do exist. Some pathogens, such as the pathogen that is thought to cause syphilis (SIH fuh lus), cannot be grown in pure culture on artificial media. Artificial media are the nutrients that the bacteria need to survive and reproduce. Pathogens are grown on this media in the laboratory. Also, in the case of viruses, cultured cells are needed because viruses cannot be grown on artificial media.

Spread of Disease

Although there are a large number of microorganisms, only a few cause disease. Some might cause mild diseases, such as the common cold. Others cause serious diseases, such as meningitis, an infection of the coverings of the brain and spinal cord. **Table 1** lists some human infectious diseases. For a pathogen to spread, it must have both a reservoir and a way to spread. A disease **reservoir** is a source of the pathogen in the environment. Reservoirs might be animals, people, or inanimate objects, such as soil.

Human reservoirs

Humans are the main reservoir for pathogens that affect humans. Many pathogens might be passed on to other hosts before the person even knows he or she has the disease. An individual that is symptom-free but capable of passing the pathogen is called a carrier. Pathogens that cause colds, the flu, and sexually transmitted diseases, such as HIV, can be passed on without the person knowing he or she is infected.

Animal reservoirs

Other animals also are reservoirs of pathogens that can be passed to humans. Influenza and rabies are examples of human diseases listed in **Table 1** that are caused by pathogens passed to humans from other animals. Influenza can infect pigs. Rabies is found in domestic dogs and many wild animals, such as bats, skunks, and raccoons.

Table 1 Human Infectious Diseases

Disease	Cause	Affected Organ System	How Disease is Spread
Tetanus	Bacterium	Nervous system	Soil in deep puncture wound
Strep throat	Bacterium	Respiratory system	Droplets/direct contact
Lyme disease	Bacterium	Skeletal and nervous systems	Vector (tick)
Chicken pox	Virus	Skin	Droplets/direct contact
Rabies	Virus	Nervous system	Animal bite
Influenza (the flu)	Virus	Respiratory system	Droplets/direct contact
Hepatitis B	Virus	Liver	Direct contact with exchange of body fluids
Giardia	Protozoan	Digestive tract	Contaminated water
Malaria	Protozoan	Blood and liver	Vector (mosquito)
Athlete's foot	Fungus	Skin	Direct contact or contaminated objects

1. Which of the following is the most accurate scientific definition of a disease reservoir?
a. A biological vector that transmits pathogens through bites.
b. A laboratory media used to grow pure cultures.
c. A source of the pathogen in the environment, such as animals, people, or soil.
d. An individual who has developed active immunity through vaccination.

2.Why are "carriers" considered particularly dangerous for the dispersal of infectious diseases like HIV or the flu?
a. They produce more potent toxins than symptomatic individuals.
b. They act as vectors that carry pathogens between different species.
c. They are symptom-free but capable of passing the pathogen to others.
d. They are inanimate objects that can harbor bacteria for several years.

3.A patient contracts a serious infection after a deep puncture wound is contaminated by bacteria found in the field. What type of reservoir is involved in this dispersal?
a. A human carrier.
b. An animal reservoir.
c. An inanimate environmental reservoir, specifically the soil.
d. A biological vector such as a mosquito.

4.Public health initiatives like sewage treatment plants are designed to manage environmental reservoirs. What is the primary goal of these facilities in preventing disease dispersal?
a. To produce synthetic antibiotics to kill pathogens in the water.
b. To ensure the safe disposal of human feces to prevent contamination of the water supply.
c. To monitor the population growth rate of animal reservoirs like pigs and bats.
d. To provide artificial media for the identification of viruses.

5.Which of the following statements regarding animal reservoirs is correct?
a. Birds are the main reservoir for all pathogens that affect humans.
b. Animals only transmit pathogens through contaminated water sources.
c. Diseases like rabies and influenza can be passed from animals such as dogs to humans.
d. Animal reservoirs are only found in high-density hospitals and healthcare facilities.

6.A doctor identifies that a patient’s nervous system has been affected by a pathogen. According to Table 1, which of the following could be the cause if the disease is Tetanus?
a. A bacterium
b. A virus
c. A protozoan
d. A fungus

7.Which infectious disease is caused by a fungal pathogen and primarily affects the skin?
a. Chicken pox
b. Malaria
c. Athlete’s foot
d. Lyme disease

8.Analyze the "Cause" and "Affected Organ System" columns in Table 1. Which pair correctly identifies a viral disease and the system it impacts?
a. Strep throat — Respiratory system
b. Giardia — Digestive tract
c. Hepatitis B — Liver
d. Malaria — Blood and liver

9.A patient is diagnosed with an infection caused by a protozoan. Based on the classification of pathogens in Table 1, which disease might the patient have?
a. Tetanus or Strep throat
b. Rabies or Chicken pox
c. Malaria or Giardia
d. Athlete's foot or Influenza

10.Lyme disease is spread via a tick vector and affects the skeletal and nervous systems. What type of pathogen is responsible for this disease according to the resources?
a. Virus
b. Protozoan
c. Bacterium
d. Parasitic fungus

11.According to Table 1, which of the following infectious diseases is caused by a bacterial pathogen?
a. Malaria
b. Lyme disease
c. Chicken pox
d. Athlete’s foot

12.A patient presents with symptoms affecting the liver. Based on the classification in Table 1, which viral pathogen is most likely responsible?
a. Influenza
b. Rabies
c. Hepatitis B
d. Tetanus

13.Analyze the "Cause" column of Table 1. Which of the following diseases is correctly paired with its fungal pathogen?
a. Giardia
b. Strep throat
c. Chicken pox
d. Athlete’s foot

14.Which of the following human body systems and organs does the Rabies virus affect?
a. The Respiratory system
b. The skin
c. The Nervous system
d. Blood and liver

15. According to Table 1, which of the following pairs of infectious diseases specifically affects the respiratory system, and what are their respective causes?
A. Strep throat caused by a virus and influenza caused by a bacterium.
B. Strep throat caused by a bacterium and influenza caused by a virus.
C. Tetanus caused by a bacterium and rabies caused by a virus.
D. Lyme disease caused by a bacterium and malaria caused by a protozoan.

16. Which of the following pairs correctly identifies an infectious disease, its specific pathogen type, and the organ system it malfunctions?
A. Strep throat — Virus — Respiratory system.
B. Hepatitis B — Bacterium — Liver.
C. Malaria — Protozoan — Blood and liver.
D. Tetanus — Fungus — Skeletal system.

17. A patient presents with a severe infection of the digestive tract after drinking unfiltered stream water. Based on the classification of pathogens in Table 1, what is the most likely causative agent? A. A virus similar to the one that causes Hepatitis B.
B. A fungus that typically causes Athlete's foot.
C. A protozoan, specifically *Giardia*.
D. A bacterium that causes Strep throat

18. Which of the following human body systems and organs does the Chicken pox virus affect?
a. Respiratory system
b. The skin
c. Nervous system
d. Blood and liver

19. Which of the following human body systems and organs does the Hepatitis B virus affect?
a. Respiratory system
b. The skin
c. Nervous system
d. Liver

20. Which of the following human body systems and organs does the protozoan that causes Giardia affect?
a. Respiratory system
b. Digestive tract
c. Nervous system
d. Blood and liver

14	BIO.3.1.01.087 Analyze how diseases are transmitted	Information from text 'Get it' question	6-7
16	BIO.3.1.01.087 Explain different ways pathogens can cause diseases including viruses, bacteria and fungi	Information from text	7

Other reservoirs

Some bacteria normally found in the soil, such as tetanus bacteria, can cause disease in humans. The tetanus bacteria can cause a serious infection if it contaminates a deep wound in the body. Contamination of wounds by bacteria was a major cause of death during wars before the development of antibiotics and vaccinations.

Contaminated water or food is another reservoir of pathogens for human disease. One of the main purposes of sewage treatment plants is the safe disposal of human feces, which prevents contamination of the water supply by pathogens. Contaminated water used in growing or preparing food can transfer pathogens. Food also can become contaminated through contact with humans or insects such as flies.

Transmission of pathogens

Pathogens are transmitted to humans in four main ways: direct contact, indirectly through the air, indirectly through touching contaminated objects, or by organisms called vectors that carry pathogens. **Figure 3** illustrates some of the ways pathogens can be transmitted to humans.

Figure 3 Diseases can be transmitted to humans in various ways.

Identify *ways to prevent contracting diseases if contact cannot be avoided.*

Direct contact Direct contact with other humans is one of the major modes of transmission of pathogens. Diseases such as colds, infectious mononucleosis (mah noh new klee OH sus) (commonly referred to as mono, or the "kissing disease"), herpes (HUR peez), and sexually transmitted diseases are caused by pathogens passed through direct contact, even if the person is a carrier.

Indirect contact Some pathogens can be passed through the air. When a person with an infectious disease sneezes or coughs, pathogens can be passed along with the tiny mucus droplets. These droplets then can spread pathogens to another person or to an object.

Many organisms can survive on objects handled by humans. Cleansing of dishes, utensils, and countertops with detergents, as well as careful hand-washing help prevent the spread of diseases that are passed in this manner. As a result, there are various food rules that restaurants must abide by that are based on preventing the spread of disease.

Vectors Certain diseases can be transmitted by vectors. The most common vectors are arthropods, which include biting insects such as mosquitoes and ticks. Recall from **Table 1** on the previous page that Lyme disease and malaria are diseases that are passed to humans by vectors. The Zika virus is another exmple of a disease that can be passed to humans by a vector. The Zika virus, which is currently spreading across South America and North America, is transmitted to humans by infected mosquitoes. The mosquitoes become infected when they bite a person who is already infected with the Zika virus. The West Nile virus, cases of which were reported in 47 states in 2016, is transmitted from horses and other mammals to humans by mosquitoes. Flies can transmit pathogens by landing on infected materials, such as feces, and then landing on materials handled or eaten by humans.

Get It?
Describe how diseases are spread to humans.

Symptoms of Disease

When you become ill with a disease such as the flu, why do you feel aches and pains, and why do you cough and sneeze? The pathogen, such as the influenza virus or bacteria, has invaded some of the cells of your body. The virus multiplies in the cells and leaves the cells either by exocytosis, or by causing the cell to burst. Thus, the virus damages tissues and even kills some cells. When pathogenic bacteria invade the body, harmful chemicals or toxins might be produced. The toxins can be carried throughout the body via the bloodstream and damage various parts of the body.

CCC CROSSCUTTING CONCEPTS
Patterns Koch's research established the idea that some microorganisms cause infectious diseases. Summarize the historical evidence that lead to the germ theory. Present your summary in the form of a news report that starts with the following sentence: "People have known for some time that 'something' passes from a sick person to a well person to cause an illness."

SCIENCE USAGE v. COMMON USAGE
carrier
Science usage: person who spreads germs while remaining well
Typhoid fever was spread by a carrier known as "Typhoid Mary."
Common usage: a person or corporation in the transportation business
Freight is shipped by carriers.

1. Which of the following best describes how pathogens are spread to humans via indirect contact through the air?
a. Pathogens are passed by shaking hands with an infected individual.
b. Pathogens are transferred when a person handles contaminated objects like countertops.
c. Pathogens are passed along with tiny mucus droplets when an infected person sneezes or coughs.
d. Pathogens are carried by a biological vector that bites a healthy person.

2.Based on Figure 3, which transmission method is specifically prevented by the rigorous implementation of hand-washing and detergent use in restaurants?
a. Direct contact through skin-to-skin interactions.
b. Indirect contact through handling contaminated objects like utensils or dishes.
c. Vector transmission from biting insects such as ticks.
d. Transmission via animal reservoirs like skunks or raccoons.

3.Analyze the transmission of the Zika virus. What makes this vector-borne transmission unique compared to direct contact?
a. It only spreads when humans touch infected soil.
b. The mosquito vector must first bite an infected person before it can pass the virus to a healthy person.
c. It is an endemic disease spread only through respiratory droplets.
d. It is transmitted solely through the exchange of body fluids between humans.

4.Public health officials classify infectious mononucleosis (mono) as a disease of:
a. Direct contact transmission.
b. Indirect air transmission.
c. Vector transmission.
d. Environmental reservoir transmission.

5.Which of the following describes a carrier in the context of disease dispersal?
a. A mosquito that transports a protozoan from a reservoir to a host.
b. A contaminated object, like a needle, that passes bacteria between people.
c. An individual who is symptom-free but capable of passing a pathogen to others.
d. A sick animal that serves as the primary source of a virus in a community.

6.How do viruses typically damage host tissues after invading a body cell?
a. They secrete penicillin to kill surrounding cells.
b. They multiply inside the cell and leave by exocytosis or by causing the cell to burst.
c. They block the host's bloodstream with physical barriers.
d. They produce oxygen that inhibits the host's metabolism.

7.In contrast to viruses, how do most pathogenic bacteria cause damage to the human body?
a. By consuming the host's red blood cells.
b. By hiding in the hair follicles to avoid the immune system.
c. By producing harmful chemicals or toxins that damage various body parts.
d. By transforming into protozoans during the lag phase of growth.

8.How are bacterial toxins usually dispersed throughout the body to affect specific organ systems?
a. Through the nervous system's electrical impulses.
b. Via the bloodstream.
c. Through direct movement between hair follicles.
d. Only through the respiratory system's mucus.

9.The tetanus bacterium (*Clostridium tetani*) causes severe symptoms by producing a toxin that specifically targets:
a. The liver's ability to filter blood.
b. The skin's protective barrier.
c. Voluntary muscles, causing violent spasms.
d. The respiratory system's ability to exchange oxygen.

10.Which of the following statements about botulism is true according to the text?
a. It is caused by a virus that makes cells burst.
b. It can only be contracted through the bite of an infected animal.
c. The toxin can cause disease in humans even when the actual bacteria are no longer present.
d. The toxin causes muscle spasms similar to those seen in tetanus patients.

11. Which of the following common ways of diseases transmission do the humans acquire the coronavirus through?
a. Contaminated water
b. Mosquito bites
C. Contact with infected humans
d. Sick animals

12. Which of the following occurs when pathogenic bacteria invade the body?
a. The bacteria multiply in the cells
b. The bacteria damages tissues
C. It causes the cell to burst
d. It produces harmful chemicals or toxins

13. The table below shows different diseases and their causes. Which of the following diseases are transmitted through vectors?
A. Tetanus and chicken Pox B. Lyme disease and Malaria
C. Giardia and Malaria D. Rabies and Hepatitis B

Table 1 Human Infectious Diseases

Disease	Cause
Tetanus	Bacterium
Strep throat	Bacterium
Lyme disease	Bacterium
Chicken pox	Virus
Rabies	Virus
Influenza (the flu)	Virus
Hepatitis B	Virus
Giardia	Protozoan
Malaria	Protozoan
Athlete's foot	Fungus

14. Rabies is found in domestic dogs and many wild animals, such as bats, foxes, skunks, and raccoons. Rabies can be transmitted from.....
A. animal reservoir B. contaminated water
C. soil D. insects

15. Lyme disease, malaria, and West Nile virus are diseases that are passed to humans by.....
A. direct contact B. indirectly through the air
C. indirectly through touching contaminated objects
D. organisms called vectors that carry pathogens.

16. MOE-Q: The figure below shows various ways of diseases transmission to humans. Which of the following letters indicates the transmission of diseases through vector?

A B C D

17. MOE-Q: The figure above shows various ways of diseases transmission to humans. Which of the following letters indicates the transmission of diseases through direct contact?

A B C D

18. MOE-Q: Which of the following common ways of transmission do the humans acquire the coronavirus through?

A. Contaminated water B. Mosquito bites
C. Contacting infected humans D. Sick animals

19. Which type of disease transmission is shown below:

A. direct contact B. air transmission
C. object transmission D. vector transmission

20. Tetanus bacteria are commonly found in the environment and can cause serious infection if they contaminate a deep wound. Tetanus can be transmitted from a(n).....

a. animal reservoir b. contaminated water c. soil reservoir d. human carrier

21. Zika virus and West Nile virus are complex infectious diseases that are passed to humans by.....

a. direct contact between humans b. indirectly through the air
c. indirectly through touching contaminated objects
D. organisms called vectors, specifically mosquitoes.

22. The source material identifies four main ways pathogens are transmitted. Which method includes the spread of disease through tiny mucus droplets passed when a person sneezes?

a. Direct contact b. Indirect contact through air c. Indirect contact by objects d. Vector transmission

23. Which of the following scenarios indicates the transmission of diseases through indirect contact by objects?

a. A person touching a contaminated credit card machine keypad b. Two people shaking hands
c. A mosquito biting a person's arm d. An individual inhaling droplet from a cough

24. Which of the following common ways of diseases transmission do the humans acquire the coronavirus through?

a. Contaminated water
b. Mosquito bites
C. Contact with infected humans
d. Sick animals

4	BIO. 3.1.01.087 Differentiate between disease patterns to include endemic, epidemic and pandemic	Information from text 'Get it' question	8
18	BIO.3.1.01.087 Recognize that symptoms are caused by the host's immune system response to invasion of pathogens	Information from text	7-8

Toxins produced by some pathogens can affect specific organ systems. The tetanus bacteria produce a potent toxin that causes spasms in voluntary muscles. The disease botulism (BAH chuh lih zum) usually is caused when a person consumes food in which the botulism bacteria have grown and produced a toxin. This toxin paralyzes nerves. The toxin from the botulism bacteria can cause disease in humans even when no bacteria are present.

Some types of bacteria, some protozoans, and all viruses invade and live inside cells, causing damage. Because the cells are damaged, they might die, causing symptoms in the host. Some disease symptoms, such as coughing and sneezing, are triggered by the immune system, as discussed later in this module. For a closer look at research on the immune system, examine **Figure 4**, on the next page.

Get It?
Describe what happens when a person consumes food that contains botulism bacteria.

Disease Patterns

As outbreaks of diseases spread, certain patterns are observed. Agencies such as community health departments, the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO) continually monitor disease patterns to help control the spread of diseases. The CDC, with headquarters in Atlanta, Georgia, receives information from doctors and medical clinics and publishes a weekly report about the incidence of specific diseases, as shown in **Figure 5**. The WHO similarly watches disease incidence throughout the world.

TABLE 2. Reported cases of notifiable diseases,* by geographic division and area – United States, 2014

Area	Total resident population (in thousands)	Lyme disease
UNITED STATES	318,856	33,461
NEW ENGLAND	14,681	11,292
Connecticut	3,597	2,360
Maine	1,330	1,401
Massachusetts	6,745	5,304
New Hampshire	1,327	724
Rhode Island	1,055	904
Vermont	627	599
MID. ATLANTIC	41,471	14,509
New Jersey	8,938	3,286
New York (Upstate)	11,255	2,887
New York City	8,491	849
Pennsylvania	12,787	7,487
E.N. CENTRAL	46,740	1,950
Illinois	12,881	233
Indiana	6,597	110
Michigan	9,910	127
Ohio	11,594	119

Figure 5 The Centers for Disease Control and Prevention publish reports on the incidence of certain diseases.

Infer *how these reports are helpful in understanding disease patterns.*

Some diseases, such as the common cold, are known as **endemic diseases** because small numbers of incidents are continually found within the population. Sometimes, a particular disease will have a large outbreak in an area and afflict many people, causing an **epidemic.** In 2003, there was an epidemic of severe acute respiratory syndrome (SARS). If an epidemic is widespread throughout a large region, such as a country, continent, or the entire globe, it is described as **pandemic.** HIV is an example of a pandemic. Influenza has led to several pandemics throughout history, including the Spanish flu in 1918, the Asian flu in 1957, and the Hong Kong flu in 1968. Each of the these flu pandemics killed millions of people worldwide.

Get It?
Compare and contrast an epidemic and a pandemic.

1. Which of the following best summarizes the difference between an epidemic and a pandemic?
a. An epidemic is found continually in small numbers, while a pandemic is a large outbreak.
b. An epidemic is caused by animal reservoirs, while a pandemic is caused by human carriers.
c. An epidemic is a large outbreak in a specific area, whereas a pandemic is a widespread epidemic throughout a large region, country, or the entire globe.
d. An epidemic only affects the respiratory system, while a pandemic affects all organ systems.

2. Why is the common cold classified as an endemic disease rather than an epidemic?
a. Because it is highly infectious and kills millions of people worldwide annually.
b. Because small numbers of incidents are continually found within the population.
c. Because it is a large outbreak that afflicts many people in a specific town.
d. Because it is a noninfectious disease caused by genetic factors.

3. Based on the historical examples provided in the text, which of the following diseases is correctly identified as a pandemic?
a. The SARS outbreak of 2003.
b. A localized cluster of strep throat in a school.
c. The Spanish flu of 1918.
d. Tetanus bacteria found in a soil reservoir.

4. According to the assessment resources, which of these scenarios could be a direct cause of a localized disease outbreak escalating into a pandemic?
a. A sick family returning from a foreign country and spreading the pathogen across multiple continents.
b. A single patient sneezing on a doctor in a local clinic.
c. A mosquito biting a person in a field next to their house.
d. A child attending school while infected with a cold.

5. In 2003, the outbreak of severe acute respiratory syndrome (SARS) was classified as an epidemic. what specific pattern did this outbreak follow?
a. It was continually found in small percentages within the population like an endemic disease.
b. It was widespread throughout the entire globe, infecting people in every country.
c. It was a large outbreak that occurred in a specific area and afflicted many people.
d. It was a degenerative disease resulting from the aging process.

6. Why do people experience symptoms like coughing and sneezing when they have a cold?
a. Because the virus is physically tickling the throat.
b. These symptoms are triggered by the body's immune system in response to the invasion.
c. Because the bacterial toxins have paralyzed the lungs.
d. Because the pathogens are trying to find a soil reservoir.

7. Which of the following is a direct result of viruses multiplying inside cells and causing them to burst?
a. Tissue damage and cell death.
b. The secretion of beneficial penicillin.
c. A decrease in the production of antibodies.
d. The immediate creation of a vaccine.

8. In the context of infection, aches and pains are often indicators that:
a. The body has too many beneficial bacteria in the hair follicles.
b. Pathogens have invaded body cells and damaged tissues.
c. The person is currently in the lag phase of an epidemic.
d. The person has developed permanent passive immunity.

9. Some symptoms of disease are not caused directly by the pathogen's toxins but by:
a. The use of synthetic antibiotics.
b. The presence of artificial media in the blood.
c. The response of the host's own immune system.
d. The movement of the pathogen into an animal reservoir.

10. Which statement best summarizes the cause of disease symptoms?
a. Symptoms are exclusively caused by the physical shape of rodlike bacteria.
b. Symptoms are caused by the invasion of the pathogen and the response of the host's immune system.
c. Symptoms only occur when a pathogen is resistant to all known antibiotics.
d. Symptoms are triggered only when a disease reaches the pandemic stage.

11. Public health officials monitor how infectious diseases spread to classify them into different patterns. Which statement correctly describes the difference between an epidemic and a pandemic?
A. An epidemic is a disease found in only a few people in a town, while a pandemic is a disease that is always present in a population.
B. A pandemic is a disease caused by a bacterium, whereas an epidemic is a disease caused by a virus. C. An epidemic is the outbreak of a disease in a large area in which many people are afflicted. A pandemic is a global outbreak of a disease.
D. An epidemic refers to a noninfectious disease like asthma, while a pandemic refers to an infectious disease like the common cold.

17	BIO.3.1.01.087 Differentiate between bacterial sensitivity and resistance to antibiotics	Information from text	10
28	BIO.3.1.01.087 Analyze the increase in the occurrence of antibiotic-resistant bacteria	Information from text Figure 7	10-11

Treating and Fighting Diseases

A medical professional may prescribe a drug to help the body fight a disease. One type of prescription drug is an **antibiotic** (an ti bi AH tihk), which is a substance that can kill or inhibit the growth of microorganisms. Penicillin is secreted by the fungus *Penicillium*, which is shown in **Figure 6**. This fungus secretes the chemical penicillin to kill competing bacteria that grow on the fungal food source. Penicillin was isolated, purified, and first used in humans during World War II. Many other fungal secretions are used as antibiotics, such as erythromycin, neomycin, and gentamicin. Synthetic antibiotics also have been developed by pharmaceutical companies.

Figure 6 Penicillin, a widely used antibiotic, is secreted by the mold called *Penicillium*, shown growing on these oranges.

Determine *why many strengths and varieties of penicillin and other antibiotics are needed.*

Chemical agents also are used in the treatment of protozoan and fungal diseases. Some antiviral drugs are used to treat herpes infections, influenza in the elderly, and HIV infections. Most viral diseases are handled by the body's built-in defense system—the immune system.

Get It?
Explain the history of the use of penicillin as an antibiotic.

HEALTH Connection Over the last 60 years, the widespread use of antibiotics has caused many bacteria to become resistant to particular antibiotics. Natural selection occurs when organisms with favorable variations survive, reproduce, and pass their variations to the next generation. Bacteria in a population might have a trait that enables them to survive when a particular antibiotic is present. These bacteria can reproduce quickly and pass on the variation. Because reproduction can occur so rapidly in bacteria, the number of antibiotic-resistant bacteria in a population can increase quickly, too.

Problems resulting from antibiotic resistance

Antibiotic resistance of bacteria has presented the medical community with problems when treating certain diseases. For example, penicillin was used effectively for many years to treat gonorrhea (gah nuh REE uh), a sexually transmitted disease, but now most strains of gonorrhea bacteria are resistant to penicillin. As a result, new drug therapies are needed to treat gonorrhea. **Figure 7**, on the next page, shows the increase in gonorrhea resistance from 1980–1990.

Another treatment problem is with staphylococcal disease—it is acquired in high-density living conditions, which can result in skin infections, pneumonia (noo MOH nyuh), or meningitis. These staphylococci are often strains of bacteria that are resistant to many current antibiotics and can be difficult to treat.

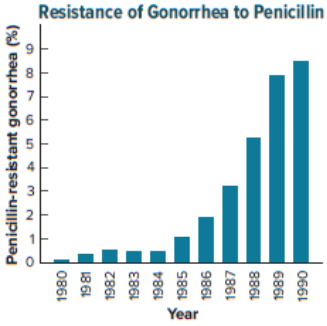


Figure 7 The graph shows the reported incidence of penicillin-resistant gonorrhea in the U.S. from 1980–1990.

For example, MSRA, or methicillin-resistant *Staphylococcus aureus*, is a type of bacteria that is a common cause of infections in hospitals and other healthcare facilities. It is spread by direct contact, usually from the contaminated hands of healthcare providers.

Streptococcus pneumonia is another bacterium that has become resistant to antibiotics. This bacterium causes pneumonia, sinus infections, and infections in the bloodstream. The bacterium that causes tuberculosis, a respiratory infection, can be resistant to the initial antibiotics used to treat the infection. In these cases, different medications are used to treat the infection, but it takes more time and can be more expensive. Scientists are continually researching solutions to treat antibiotic-resistant bacteria.

1.What is the scientific definition of an antibiotic?
a. A substance that strengthens the human immune system against viruses.
b. A substance that can kill or inhibit the growth of microorganisms.
c. A type of synthetic protein that acts as a vaccine.
d. A chemical produced by bacteria to help them survive in soil.

2.The fungus *Penicillium* naturally secretes penicillin for what primary purpose?
a. To provide a nutrient source for other fungi.
b. To assist the human body in maintaining homeostasis.
c. To kill competing bacteria that grow on the fungal food source.
d. To prevent viruses from entering the fungal cells.

3.Antibiotic resistance in a bacterial population is an example of which biological process?
a. Spontaneous generation
b. Natural selection
c. Artificial media growth
d. Passive immunity

4.Why does the number of antibiotic-resistant bacteria in a population increase so quickly once a trait for survival is present?
a. Because antibiotics make the bacteria stronger over time.
b. Because bacteria reproduce very rapidly, passing the survival trait to many offspring.
c. Because the bacteria learn to hide from the medicine.
d. Because the human immune system stops working when antibiotics are present.

5.If a bacterium is sensitive to an antibiotic, it means the drug will:
a. Inhibit its growth or kill it.
b. Encourage it to reproduce faster.
c. Have no effect on its survival.
d. Cause it to produce more toxins.

6.Analyze the data in Figure 7. What trend is evident regarding the resistance of gonorrhea to penicillin between 1980 and 1990?
a. Resistance decreased significantly as better antibiotics were developed.
b. Resistance remained steady at approximately 5% throughout the decade.
c. There was a significant and steady increase in the percentage of penicillin-resistant strains.
d. Penicillin became more effective at treating the disease over time.

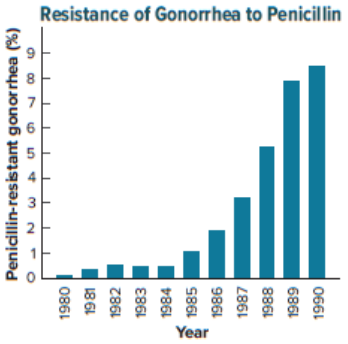


Figure 7 The graph shows the reported incidence of penicillin-resistant gonorrhea in the U.S. from 1980–1990.

7. Why is MRSA (methicillin-resistant *Staphylococcus aureus*) a major concern in hospitals?
a. It is resistant to many current antibiotics and spread by the hands of healthcare providers.
b. It is a virus that can only be treated with vaccines.
c. It only affects the skeletal system and cannot be treated with drugs.
d. It is a protozoan that contaminates the hospital water supply.

8. What is a major problem regarding the treatment of antibiotic-resistant tuberculosis?
a. It cannot be diagnosed by health organizations.
b. It requires the patient to stay in a soil reservoir for treatment.
c. Treatment takes more time and is often more expensive.
d. The disease becomes an endemic cold rather than a respiratory infection.

9. The rapid increase of resistant bacterial strains *Streptococcus pneumoniae*, is primarily driven by:
a. The slow reproduction rates of bacteria in high-density conditions.
b. The widespread use of antibiotics over the last 60 years and natural selection.
c. A lack of nutrient-rich artificial media in laboratory settings.
d. The transformation of bacteria into non-pathogenic organisms.

10. Why are many varieties and strengths of antibiotics needed by the medical community today?
a. To make antibiotics taste better for younger patients.
b. Because older antibiotics have turned into viruses.
c. To combat the increasing variety of resistant bacterial strains.
d. To ensure that every person can act as a carrier for the flu.

11. According to Figure 7, which statement best describes the trend in penicillin-resistant gonorrhea in the United States between 1980 and 1990?
A. The percentage of resistant cases remained constant throughout the decade.
B. Resistance increased gradually at first and then rose rapidly after 1986.
C. Resistance decreased steadily from 1980 to 1990.
D. Resistance fluctuated with no overall pattern.

12. Based on the data shown in Figure 7, approximately what percentage of gonorrhea cases were resistant to penicillin in 1990?
A. 3%
B. 5%
C. 8%
D. 10%

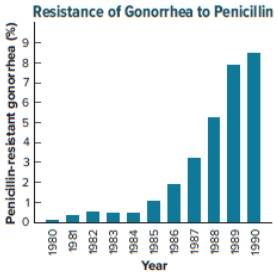


Figure 7 The graph shows the reported incidence of penicillin-resistant gonorrhea in the U.S. from 1980–1990.

13. Which conclusion is most strongly supported by Figure 7?
A. Penicillin became more effective against gonorrhea during the 1980s.
B. Gonorrhea bacteria developed increased resistance to penicillin over time.
C. Gonorrhea infections were completely eliminated by 1990.
D. Penicillin resistance only occurred after 1990.

14. In figure 7, which of the following is not consistent with what do the data show about the effectiveness of the drug penicillin in the treatment of the infectious disease gonorrhea?
a. Increase in the percentage of gonorrhea cases
b. Resistance of the pathogen to penicillin
C. The effectiveness of penicillin to kill this pathogen
d. The drug penicillin failed to cure the disease