



SCIENCE

STUDENT BOOK

▶ **9th Grade | Unit 5**

SCIENCE 905

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Author:

Patsie Marineau, M.A.

Editor-In-Chief:

Richard W. Wheeler, M.A.Ed

Editors:

James R. Roten, M.A.

Lee H. Dunning, M.S.T., M.S.Ed.

Consulting Editor:

Harold Wengert, Ed.D

Revision Editor:

Alan Christopherson, M.S

Westover Studios Design Team:

Phillip Pettet, Creative Lead

Teresa Davis, DTP Lead

Nick Castro

Andi Graham

Jerry Wingo

Don Lechner



804 N. 2nd Ave. E.

Rock Rapids, IA 51246-1759

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Body Health 1

Introduction

In the beginning, God created all things. He created man perfect to live and have fellowship with Him. He created for him a perfect environment in the garden of Eden without illness, malnutrition, hunger, or climate problems. Man needed nothing.

Then, man fell when Eve gave in to the serpent's temptation, and God cast them out of the garden into a different environment. Read Genesis 3:1–6 and Genesis 3:22–23. Man's body was no longer perfect because sin had entered. He was no longer walking completely in God's Spirit, but in the flesh.

Man, therefore, became vulnerable to many things. His body could not live forever as his spirit could, so physical death became an experience for every man. He became vulnerable to many kinds of illnesses. Some were a result of environment; some, hard work; some, the lack of nutritious or sufficient food. The body was unable to protect itself against everything it had to face. Man became vulnerable to the many micro-organisms living in the soil, in plants, and in animals.

Many diseases are described in the Bible. Some of these diseases are abscesses, blindness, boils, consumption, deafness, dropsy, dysentery, emerods (tumors), epilepsy, fever, inflammation, leprosy, palsy, plague, and scabs (scabies). The Old

Testament describes healthful and cleansing procedures at great length. In Leviticus, chapter 13, various translations interpret the word *leprosy* as *plague* or *infection*. So we know that infectious disease has been present since the beginning of man's time outside the garden.

Disease is caused by the breakdown of the body's defenses, improper diet, unsanitary conditions, and so forth. Disease originated with the Fall and attacks man in his flesh.

We must work within the framework of life that we have now. Science aids in combating diseases that we contract. Not all men are susceptible to all diseases. Some tend to become ill from one source and others from another source. Most people, however, increase the chances of getting certain kinds of diseases if their bodies are not healthy or if their environment breeds disease-producing organisms.

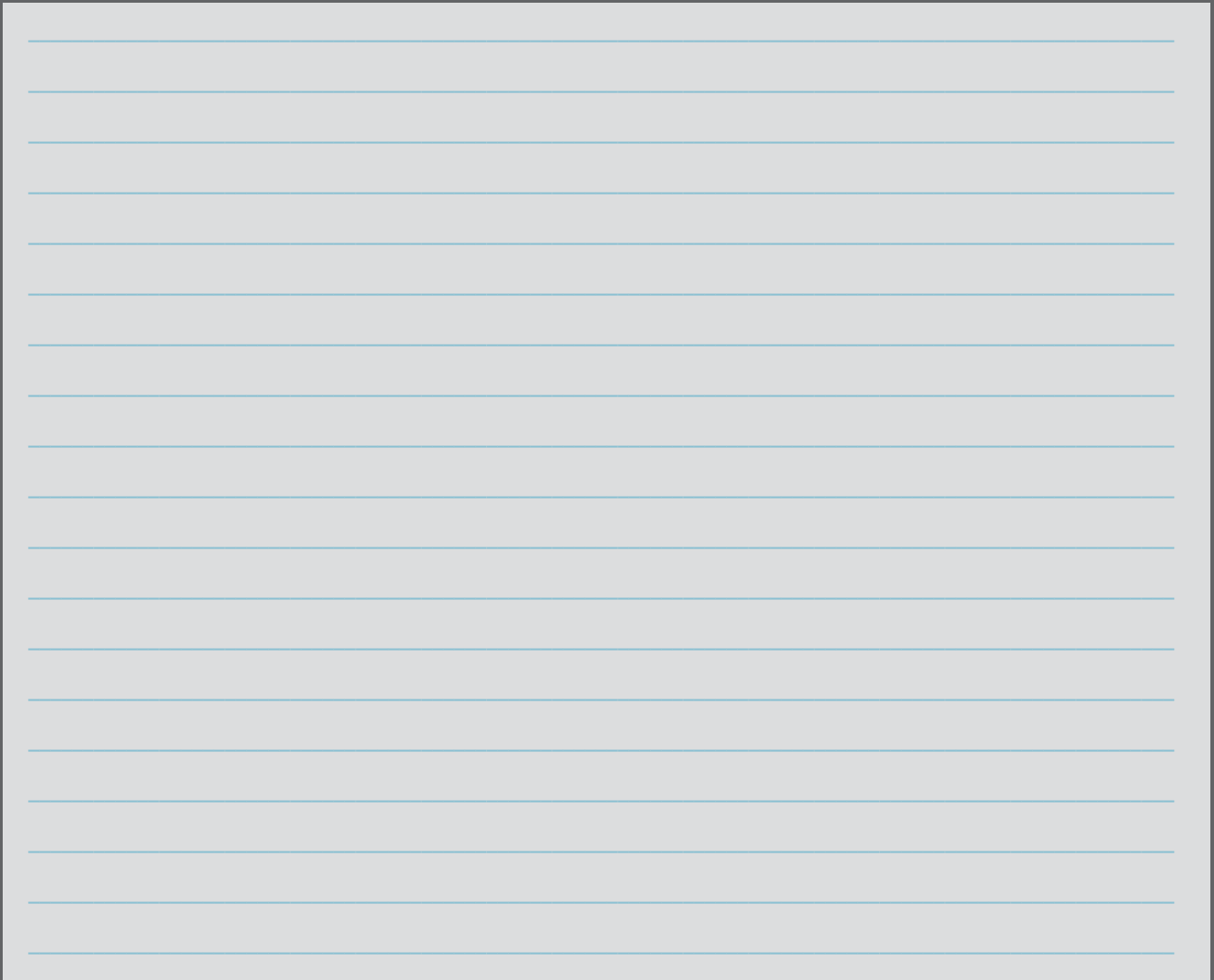
This LIFEPAC® will discuss many types of disease organisms that cause infections and common communicable diseases. The words *germs*, *microbes*, and *microorganisms* mean the same thing and will be used interchangeably throughout this LIFEPAC. We shall learn about many kinds of common diseases, what causes them, how they are relieved or cured, and how they may be prevented.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

1. Define and describe five infectious disease-causing microorganisms.
2. List the general symptoms of infectious disease.
3. Discuss the spread of infectious diseases through the media of air, food and water, and direct contact.
4. Discuss the major bacterial infections.
5. Discuss the major viral infections.
6. Discuss the major protozoan disease affecting man.
7. Discuss the forms of rickettsial infections.
8. Discuss the most common forms of fungal disease.

Survey the LIFEPAK. Ask yourself some questions about this study and write your questions here.

A large rectangular area with horizontal blue lines for writing. The lines are evenly spaced and extend across the width of the box, providing a template for handwritten notes or questions.

1. MICROORGANISMS

In this section, we will be discussing the five types of organisms which cause disease in man. We will also discuss how these diseases spread and the environment most likely to contain the

various disease-producing organisms. You will also learn the basic techniques used to control the spread of diseases.

SECTION OBJECTIVES

Review these objectives. When you have completed this section, you should be able to:

1. Define and describe five infectious disease-causing microorganisms.
2. List the general symptoms of infectious disease.
3. Discuss the spread of infectious diseases through the media of air, food and water, and direct contact.

VOCABULARY

Study these words to enhance your learning success in this section.

antibiotic (an' ti bī ot' ik.) A chemical produced by microorganisms that, when diluted, can destroy other bacteria and microorganisms.

infectious (in fek' shus). Spread by infection; causing infection; apt to spread.

jaundice (jôn' dis). A body condition characterized by yellowness of the skin.

microorganism (mī krō ô' gun iz um). An animal or vegetable organism too small to be seen except with a microscope.

mucus (myü' kus). A fluid secretion of the body membranes or linings.

pathogenic (path u jen' ik). Producing disease.

protoplasm (prō' tu plaz um). Living matter; the substance that is the physical basis of life; the living substance of all plant and animal cells.

symptom (simp' tum). Sign, indication.

toxins (tok' sunz). Poisonous products of animal or vegetable metabolism, especially those produced by bacteria.

Note: All vocabulary words in this LIFEPAC appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

Pronunciation Key: hat, āge, cāre, fār; let, ēqual, tērm; it, īce; hot, ōpen, ōrder; oil; out; cup, pūt, rüle; child; long; thin; /ʃh/ for then; /zh/ for measure; /u/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

DEVELOPMENT OF THE GERM THEORY

About a hundred years ago, scientists discovered that germs caused some diseases. This discovery started the *Germ Theory* era. Medical science no longer speaks of a germ *theory* because it is no longer a theory. Disease germs (**microorganisms**) do cause **infectious** disease.

In 1880 the microorganism associated with typhoid was isolated. Since that time, such critical diseases as tuberculosis, diphtheria, pneumonia, lockjaw, undulant fever, meningitis, dysentery, plague, syphilis, whooping cough, diarrhea, leprosy, and many others have definitely been related to specific bacteria, viruses, or other microorganisms.

The ability of most microorganisms (germs) to cause disease in man can be tested on animals. When germs are injected into the blood, skin, or muscle tissue of animals, they produce changes in the tissue that are *specific* for the type of germ concerned. For example, pneumococcus bacteria in the lungs produces pneumonia; a typhoid germ produces ulcers in the intestines. When meningococcus gets into the linings of the spinal cord or brain, it produces inflammation in the linings (called the *meninges*); and the person has *meningitis* (inflammation of the meninges). In each case, a specific germ produces a specific disease.

Robert Koch and Louis Pasteur were two founders of modern bacteriology. They developed tests that indicate the presence of particular microorganisms. These microorganisms are associated with particular diseases. If a germ is found in infected tissue, the germ can be grown artificially outside the human body. In this way tests can be performed. By injecting germs into animals, conditions can be observed, drugs tested, and **symptoms** defined. This procedure is the usual way diseases have been identified.

Even though the mother and the child have completely separate circulatory systems, an assortment of material passes between the mother and the child through the placenta. This material includes substances that promote life, such as nutrients and oxygen. But it also includes microscopic organisms. While in the mother's womb, the child receives a number of microbes from the mother. As long as the mother is in reasonably good health, this poses no danger to the child, and he will be unaware that he has them. When the child is born, he will be exposed to a host of others.

The body provides several favorable environments for microbes. The skin is not a place where microorganisms grow well because it is washed frequently. It is, however, never free from microbes and any break in the skin can be an entryway for them.

Microorganisms thrive in most parts of the digestive tract or alimentary canal (the mouth, stomach, and the intestines). The mouth has a large number of microbes: yeasts, bacteria, and protozoa, which feed on food particles. Microbes live in crevices of the teeth, the tonsils, and the folds of the lips. Most microbes do not thrive until they reach the intestines. Great numbers of microbes are killed by stomach acid, but those that reach the intestines live and multiply on the food we have eaten. The intestines become a nesting place for many types of organisms. Some microbes are helpful to us and are necessary for breaking down the food before it leaves the body.

Man also carries microorganisms in his lungs. Microorganisms are transferred from the mouth to the hands and from hands to whatever we touch. Although many microorganisms are not dangerous to us, some do cause diseases.



Write true or false.

- 1.1 _____ We have known about the existence of germs for several hundred years.
- 1.2 _____ A germ is also called a *microorganism* or a *microbe*.
- 1.3 _____ Specific germs cause specific diseases.
- 1.4 _____ If a microorganism causes a disease, then it can be identified with a microscope and artificially grown outside the body.
- 1.5 _____ A child is born with microbes present in his body.
- 1.6 _____ Clean skin is free of microorganisms.
- 1.7 _____ The alimentary canal is a good breeding place for microbes.
- 1.8 _____ The intestines breed helpful as well as harmful microorganisms.
- 1.9 _____ All microorganisms are harmful to man.
- 1.10 _____ Disease germs can be transferred from mouth to hands, then other things or people.

CATEGORIES OF PATHOGENIC ORGANISMS

Most **pathogenic** organisms are microscopic. Bacteria and fungi are plants, protozoans are animals, and viruses are neither plant nor animal. Rickettsiae have characteristics of both plants and viruses.

Bacteria. Bacteria are one-celled organisms classified as members of the plant world. They reproduce by fission, or splitting. Each bacteria cell splits to produce two identical organisms. If fission were to continue unchecked, with each bacteria splitting every one-half hour, 400

trillion (400,000,000,000,000) bacteria would result in twenty-four hours.

Three basic forms of bacteria are named on the basis of shape: the oval or spherical *coccus*, the rod-shaped *bacillus*, and those that have one or more curves such as the *spirillum* or *spirochete*

Pathogenic bacteria cause harm to the body by the poisons, or **toxins**, they produce. Many *toxins* are simply waste products the organism produces in the process of its growth and reproduction. Bacteria produce severe



Coccus



Bacillus



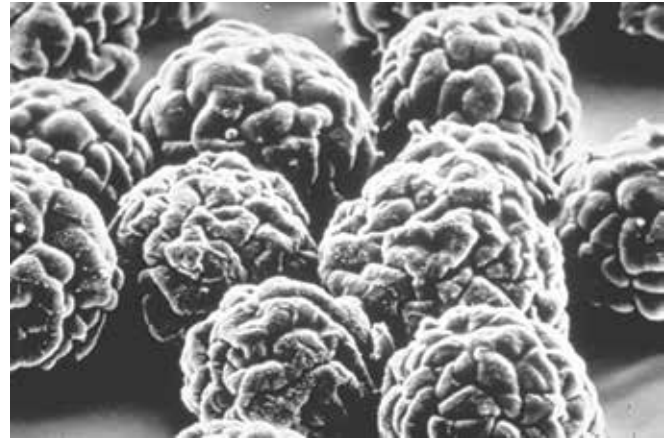
Spirillum

| Three Shapes of Bacteria

reactions in whatever part of the body they settle, such as tuberculosis, diphtheria, tetanus (lockjaw), typhoid fever, streptococcus (often called “strep throat”), pneumonia, and localized infections.

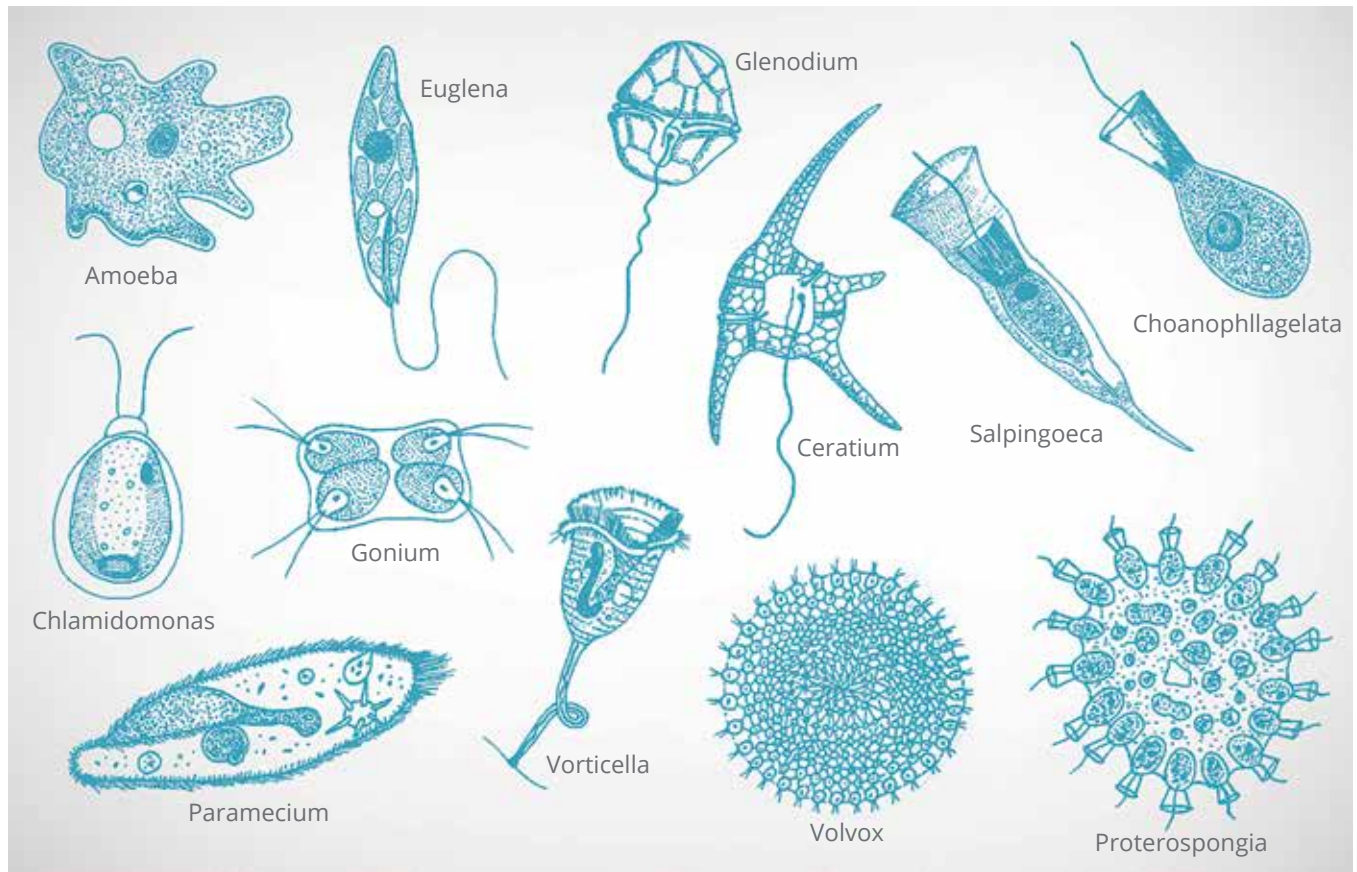
Protozoans. Protozoa is the general name for several species of single-celled animals. Protozoans that cause disease in man are usually parasites. Some of them also live in other organisms. They can also be found free living in fluids, primarily in water. Protozoan diseases include amoebic dysentery, malaria, Chagas disease, sleeping sickness, and trichomoniasis. Protozoans are the largest and most complex of the microorganisms. Since they are animals, most protozoans move about in reaction to stimuli.

Protozoan disease rarely occurs in the United States because of sanitation advances. In much



| Poliovirus

of the rest of the world, particularly “third-world” countries, people live in overcrowded areas where there is little or no safe drinking water, no pollution-free bathing, few or no sanitary facilities, and an abundance of insects.



| Diagram Illustrating Protozoa

Intestinal parasites commonly determine the people's condition.

Viruses. Viruses are the smallest known organisms. They grow only in living cells and are not complete in themselves. They must use **protoplasm** of other cells to multiply and live. Viruses become a part of the cell they invade, but they cannot reproduce themselves. Viruses change the individual cells they invade so that the cells reproduce the viruses. When a cell is full of new viruses, it bursts and infects other cells. Viral diseases include influenza, mumps, polio, infectious **jaundice**, and measles.

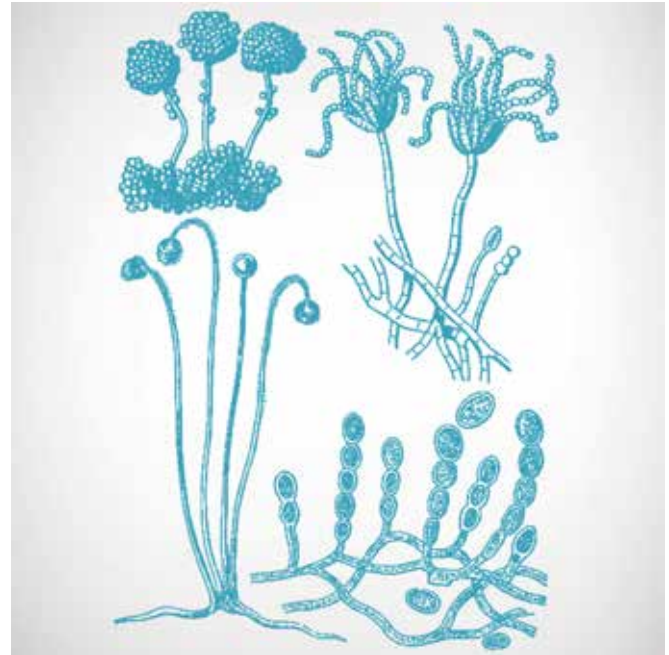
Fungi. Fungi is a group of simple plants whose common forms are mushrooms, molds, and yeasts. Fungi do not have any chlorophyll.

They depend on other organisms for food. Fungi that invade other living organisms and obtain their food at the expense of those organisms are called *parasites*. Fungi flourish in soil and in warm, damp places

Some fungi are many-celled and reproduce by forming spores. Each spore is capable of forming a new growth similar to the parent plant. Other fungi, like yeasts, are one-celled and reproduce by budding. The buds break off and form new plants.

Thousands of varieties of molds have been isolated and identified. Most are harmless to man and some are beneficial. Varieties are even used as **antibiotics**. Many fungi, however, are a constant and serious threat to mankind.

Disease-bearing molds are most prevalent in the soil, but they have been found also in unpasteurized milk, cellars, animal excrement, and occasionally in community water supplies. Dangerous or undesirable fungi infest crops raised for food, causing potato blight and wheat rust. Some fungi cause superficial infections in humans, affecting the skin, hair, or teeth, as in ringworm of the scalp, feet, or nails.



| Some Types of Molds

Forms of fungi that invade the human body and produce serious infections of the mucous membranes, lungs, or other organs, include *coccidioidomycosis*, *histoplasmosis*, and *moniliasis*. Fungal infections in humans are often difficult to treat.

Rickettsiae. Rickettsiae grow only in living cells. They are, however, a complete cell unit and carry out all life functions. They are usually transmitted through the bite of insects. Diseases caused by rickettsiae are typhus, Rocky Mountain fever, and Q-fever.

Rickettsiae are classified somewhere between bacteria and viruses. They were named after Dr. H. T. Ricketts who first isolated them while studying Rocky Mountain spotted fever and typhus fever. In the course of his experiments, he contracted typhus and died. Rickettsiae are injected into the bloodstream by the bite of ticks, lice, or fleas. Treatment, prevention, and control of these diseases have become more effective with the development of mass pesticides, vaccines, and antibiotics.



Write true or false.

- 1.11 _____ Viruses are unable to reproduce outside a living cell.
- 1.12 _____ Fungi flourish in hot, dry environments.
- 1.13 _____ Pathogenic molds are found in soil.
- 1.14 _____ Bacteria are smaller than rickettsiae.
- 1.15 _____ Fungi reproduce by spore formation or budding.

Write the letter of the correct choice.

- 1.16 In twenty-four hours, one bacterium can produce four hundred _____ organisms.
a. thousand b. million c. billion d. trillion
- 1.17 The largest and most complex of microorganisms are _____.
a. bacteria b. protozoans c. rickettsiae d. viruses
- 1.18 The smallest organisms are _____.
a. bacteria b. protozoans c. rickettsiae d. viruses
- 1.19 Rickettsial infection is usually transmitted through _____.
a. the air b. contaminated food
c. vapor from sneezes and coughs d. insect bites

Complete these sentences.

- 1.20 All organisms that cause disease are called _____.
- 1.21 Bacteria are classified as _____ (plants, animals).
- 1.22 Protozoans are classified as _____ (plants, animals).
- 1.23 Bacteria cause diseases by producing poisonous substances called _____.
- 1.24 A substance which cells contain is _____.
- 1.25 The division of simple plants that includes molds and yeast is the _____.
- 1.26 Yeasts reproduce by _____.
- 1.27 Organisms that cause typhus and Rocky Mountain spotted fever were named for _____.



Complete these activities.

1.28 Name the three forms of bacteria.

a. _____, b. _____, and c. _____

1.29 List five conditions that encourage the growth of protozoans.

a. _____

b. _____

c. _____

d. _____

e. _____

1.30 Name five viral diseases.

a. _____

b. _____

c. _____

d. _____

e. _____

CHARACTERISTICS OF INFECTIOUS DISEASES

Each disease is spread in its own particular manner. The way the disease spreads depends upon the environment in which that organism lives.

1. Bacterial infections are spread in droplets from breathing and coughing, by direct contact, through water and food, human or insect excrement, and insect bites.
2. Protozoans can be contracted through food and water or the bite of insects that carry the organism.
3. Viruses may live within insects for a considerable length of time and be passed down to later generations through insect eggs. Viruses are also spread through contact with contaminated food and water or by droplets in a cough or sneeze.
4. Fungi can be spread through direct contact, in food, and occasionally from fungi spores in the air.

5. Rickettsial infections are spread only by insects such as lice, ticks, or fleas. Rickettsiae live only in these insects. This type of disease can be acquired through the bite of the insect, through a cut or scratch that has picked up some remains or excrement of an insect, and sometimes by breathing the excrement of insects.

An infection usually follows a predictable course of development. An organ, tissue, or area of the body is invaded by an organism and the body responds with reactions called symptoms. Symptoms vary with the type and severity of the infection.

Infections may be of two types: *localized*, meaning in one area; or *systemic*, meaning *general body distress*.

A *local* infection is isolated by an encirclement of protective cells. Blood plasma tends to push bacteria together and antibodies are produced in the blood to combat the invading organisms.

Air	Food & Water	Contact		Animal or Insect Bite
		Excrement	Touching	
bacteria (droplets) →	bacteria ←	bacteria (human/insect)	bacteria localized	bacteria
virus (droplets) →	virus ←	virus (human/insect)		virus
	protozoa ←	protozoa (human)		protozoa
fungi spore			fungi	
		rickettsiae (insect)		rickettsiae

Figure 1 | How Communicable Diseases Are Spread

In localized infections, pus pockets tend to form. These are observable by the whitish **mucus**. A boil is a localized infection involving skin cells. The body quickly walls off the area so that the bacteria are prevented from invading the bloodstream and the infection remains localized.

Symptoms of a *systemic* infection throughout the body are fever, weakness, and digestive disturbances, including loss of appetite. Because fever is considered one of the body's defense mechanisms against an attack of germs, a physician does not always attempt to suddenly reduce a fever. Fever that is not high nor prolonged is not especially harmful to the body, particularly if enough fluid is taken. Fever tends to destroy microorganisms or inhibit their growth. It may also stop some of the effects of bacterial toxins.

In any contagious disease, a certain amount of time elapses between infection and first symptoms. This time is known as the *incubation* period. It varies with the disease.

In most common children's diseases, for example, an eruption or rash appears on the body. Each rash has a characteristic distribution over the skin, and a physician can tell the probable disease by where and when the rash occurs. The eruptions differ in appearance from tiny blisters to large red patches. Most of these

bodily infections begin with a mild cold, sometimes accompanied by a sore throat.

Resistance to any disease is decreased when the body is tired, exposed to sudden or severe changes in temperature, or is insufficiently nourished; therefore, body mechanisms vary with the situation. Even in an epidemic, some people escape infection although conditions are such that almost everyone else is unable to resist.

The best defense against disease is a healthy body. The skin, nostril hairs, and mucous membranes at body openings protect the internal structure of the body from germs; however, if organisms enter, the body immediately counterattacks. White cells in the blood rapidly increase in number and attempt to envelope and destroy the invaders. They literally consume the invaders. Toxins produced by the bacteria stimulate the body to produce anti-toxins to counteract them. Exposure to air and sunlight may prevent bacteria from multiplying and may cause the organism to lose its ability to reproduce.

A germ's worst enemy is cleanliness. In any type of illness, clothing, bedding, and the body should be kept clean. Disinfectants and anti-septics reduce microorganisms so the body will have only one type of infection to combat. Disposal of clothing and medical supplies in

a sanitary manner is vital to protect others. Sanitizing eating and drinking utensils with hot water and soap is also necessary. Bed rest is recommended during a bodily infection to direct the body's energies toward defense activities. If energy is spent in other activities,

the body may not be able to cope with invading organisms. In some cases, the first infection may leave the body so weakened that a new organism can attack before the first condition is overcome, producing a *secondary infection*.



Write true or false.

- 1.31 _____ The body's best defense against disease is antibiotics.
- 1.32 _____ Bed rest is recommended for bodily infections.
- 1.33 _____ Prevention and treatment require the use of hot water and soap.
- 1.34 _____ Most diseases of children are marked by swollen glands.
- 1.35 _____ Fever is the most important symptom to be treated.

Complete these sentences.

- 1.36 A localized infection is characterized by _____ .
- 1.37 Attack by another organism when the body is already weakened is called _____ .
- 1.38 A germ's worst enemy is _____ .
- 1.39 An aid to reducing microorganisms in the patient's environment is the use of _____ .
- 1.40 The time between infection and the appearance of symptoms is the _____ period.
- 1.41 Most children's diseases begin with a mild _____ .
- 1.42 Exposure to air and sunlight may prevent microbes from _____ .
- 1.43 As protection against localized infection, organisms are surrounded and consumed by _____ .



Research and report.

- 1.46** The remainder of this LIFE PAC deals with specific diseases caused by bacteria, protozoa, viruses, fungi, and rickettsiae. All preventive medicine, cures and procedures, vaccines, inoculations, and even the discovery of the “germ” itself were due to the efforts of scientists such as Louis Pasteur, Robert Koch, Madame Curie, and Jonas Salk. These famous people contributed greatly to the advancement of medicine. Technological discoveries like the optical and electron microscopes, surgical instruments, and chemical synthesis were necessary to advance knowledge and treatment to the point where they are today.

While you are studying this LIFE PAC, research a part of the field of medicine. Select a general area of study from the following suggested topics. Then select a specific topic for detailed research. Write for information to medical associations such as the Arthritis Foundation, National Tuberculosis Association, or National Kidney Foundation. Your teacher has lists of places where information is available. Your librarian should also be able to help you in selecting a topic and resource information. The public library has periodicals, journals, books, as well as Internet information on most subjects.

The product of your research will be a report. Your report should contain a:

1. Title page.
2. Table of contents.
3. Introduction (stating your reason for choosing this particular topic) and some questions you expect to answer during your research.
4. Body of information—including pictures, drawings, and charts, if applicable.
5. Summary—list ten major facts you learn, including answers to questions you had asked and conclusions you reach.
6. Bibliography.

Topics for selection

Ancient medicine

- Biblical
- Egyptian
- Chinese
- Indian
- Hippocrates
- Aristotle
- Galen
- Leprosy

A.D. 1 to the fourteenth century

- Roger Bacon
- Order of the Holy Ghost
- plagues and epidemics of the Middle Ages

Renaissance medicine

- the microscope
- Leonardo da Vinci
- William Harvey
- Vesalius

- Fernel

- Ambroise Paré
- public hygiene

Through the nineteenth century

- Leeuwenhoek
- Sir Francis Bacon
- Priestley and Scheele
- Lavoisier
- Philippe Pinel
- Edward Jenner

- Johann Peter Frank
- Matthias Jakob Schleiden
- Theodor Schwann
- Pasteur
- Lister
- antiseptis
- Ignaz Phillipp Semmelweis
- nitrous oxide
- Hermann Helmholtz
- Rudolf Virchow

- Emil Behring
 - Robert Koch
 - Paul Ehrlich
- Twentieth-century medicine**
- Roentgen
 - Christiaan Eijkman
 - vitamins
 - hormone research
 - insulin
 - sulfonamides

- penicillin
- cortisone
- antibiotics
- medical technology
- transplant surgery
- kidney dialysis
- computer applications
- genetic engineering

Skim through a few of the areas of study. You will find they are grouped around a certain period of years. Looking up one person or topic for study will refer to other people or topics. Do not select your topic before skimming several areas. Some of your information may overlap another area. Look up cross-references given by the book or periodical you read—you may discover more interesting information. By learning about the people who have contributed to the information presented in this LIFE PAC, you will get a new perspective on our present knowledge. Your friends and classmates may find your information interesting and want to share theirs with you.

When you have selected your topic, enter the information below.

Topic selected _____

Hand in your report before going on to Section Two.

TEACHER CHECK

_____ initials

_____ date



Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1

Define these terms (each answer, 3 points).

1.01 pathogenic _____

1.02 microorganism _____

1.03 bacteria _____

1.04 protozoans _____

1.05 virus _____

1.06 fungi _____

1.07 rickettsiae _____

List six symptoms of systemic infection (each answer, 3 points).

1.08 _____

1.09 _____

1.010 _____

1.011 _____

1.012 _____

1.013 _____

Write true or false (each answer, 1 point).

- 1.014 _____ When dealing with infectious disease, clean all sickroom areas with hot water and soap.
- 1.015 _____ Antiseptics should be used on articles used by an infected patient.
- 1.016 _____ Patients should be bathed daily.
- 1.017 _____ Pus or mucus is no cause for concern.
- 1.018 _____ Complete bed rest is recommended.
- 1.019 _____ Secondary infections are possible.
- 1.020 _____ A rash can indicate the type of disease present.
- 1.021 _____ If cold symptoms are present, no other disease will occur.
- 1.022 _____ Incubation period is the time between pathogenic invasion and appearance of symptoms.

Complete this activity (this answer, 5 points).

- 1.023 Explain why fever is beneficial. _____

Write the letter of the correct choice (each answer, 2 points).

- 1.024 The bite of an insect or a higher animal is not the means by which a _____ infection is spread.
 a. fungal b. viral c. bacterial d. protozoan
- 1.025 Protozoan infection is not likely to be transmitted by _____.
 a. dog bite b. direct contact c. breathing d. eating
- 1.026 The organism possessing most characteristics of animals is the _____.
 a. bacteria b. virus c. rickettsia d. protozoan

<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 48 <hr style="width: 50%; margin: 0;"/> 59 </div>	SCORE _____	TEACHER _____ <small>initials date</small>
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SCI0905 – May '14 Printing

ISBN 978-0-86717-785-5



9 780867 177855



804 N. 2nd Ave. E.
Rock Rapids, IA 51246-1759

800-622-3070
www.aop.com