

the science of  
**MICROBES**

## Glossary

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# INTRODUCTION

# Microbial Challenges

**I**nfectious diseases have plagued humans throughout history. Sometimes, they even have shaped history. Ancient plagues, the Black Death of the Middle Ages, and the “Spanish flu” pandemic of 1918 are but a few examples.

Epidemics and pandemics always have had major social and economic impacts on affected populations, but in our current interconnected world, the outcomes can be truly global. Consider the SARS outbreak of early 2003. This epidemic demonstrated that new infectious diseases are just a plane trip away, as the disease was spread rapidly to Canada, the U.S. and Europe by air travelers. Even though the SARS outbreak was relatively short-lived and geographically contained, fear inspired by the epidemic led to travel restrictions and the closing of schools, stores, factories and airports. The economic loss to Asian countries was estimated at \$18 billion.

The HIV/AIDS viral epidemic, particularly in Africa, illustrates the economic

For an emerging disease to become established, at least two events must occur: 1) the infectious agent has to be introduced into a vulnerable population, and 2) the agent has to have the ability to spread readily from person to person and cause disease. The infection also must be able to sustain itself within the population and continue to infect more people.

and social effects of a prolonged and widespread infection. The disproportionate loss of the most economically productive individuals within the population has reduced workforces and economic growth in many countries, especially those with high infection rates.

This affects the health care, education, and political stability of these nations. In the southern regions of Africa, where the infection rate is highest, life

expectancy has plummeted in a single decade, from 62 years in 1990–95 to 48 years in 2000–05. By 2003, 12 million children under the age of 18 were orphaned by HIV/AIDS in this region.

Despite significant advances in infectious disease research and treatment, control and eradication of diseases are slowed by the following challenges.

- The emergence of new infectious diseases
- An increase in the incidence or geographical distribution of old infectious diseases
- The re-emergence of old infectious diseases
- The potential for intentional introduction of infectious agents by bioterrorists
- The increasing resistance of pathogens to current antimicrobial drugs
- Breakdowns in public health systems



Baylor College of Medicine, Department of Molecular Virology and Microbiology, [www.bcm.edu/molvir/](http://www.bcm.edu/molvir/).

## USING COOPERATIVE GROUPS IN THE CLASSROOM

**C**ooperative learning is a systematic way for students to work together in groups of two to four. It provides organized group interaction and enables students to share ideas and to learn from one another. Students in such an environment are more likely to take responsibility for their own learning. Cooperative groups enable the teacher to conduct hands-on investigations with fewer materials.

Organization is essential for cooperative learning to occur in a hands-on science classroom. Materials must be managed, investigations conducted, results recorded, and clean-up directed and carried out. Each student must have a specific role, or chaos may result.

The Teaming Up! model\* provides an efficient system for cooperative learning. Four “jobs” entail specific duties. Students wear job badges that

describe their duties. Tasks are rotated within each group for different activities so that each student has a chance to experience all roles. For groups with fewer than four students, job assignments can be combined.

Once a model for learning is established in the classroom, students are able to conduct science activities in an organized and effective manner. Suggested job titles and duties follow.

### Principal Investigator

- Reads the directions
- Asks the questions
- Checks the work

### Maintenance Director

- Follows the safety rules
- Directs the cleanup
- Asks others to help

### Reporter

- Records observations and results
- Explains the results
- Tells the teacher when the group is finished

### Materials Manager

- Picks up the materials
- Uses the equipment
- Returns the materials

\* Jones, R.M. 1990. *Teaming Up!* LaPorte, Texas: ITGROUP.

# Glossary

**Aerobic** - an organism or process that requires oxygen.

**AIDS** - acquired immunodeficiency syndrome; late stages of HIV infection in which numbers of T cells are reduced and other secondary infections may be present.

**Algae** (singular, alga) - a plant-like (photosynthetic) member of the protist group; can be single-celled or consist of clustered or multiple cells.

**Allergy** - abnormal reaction of the body's defense system (immune system) to a substance that is otherwise harmless.

**Anesthetic** - substance (drug or agent) that causes a temporary loss of sensation or consciousness.

**Antibiotic** - chemical or natural substance (drug) that kills or slows the growth of bacteria.

**Antibiotic resistance** - condition in which a bacterium no longer is affected or killed by an antibiotic.

**Antibody** - protein made by certain white blood cells that tags invaders for destruction by the immune system.

**Antigen** - any substance that triggers an immune system response; an antigen can be a microbe, part of a microbe or any other material foreign to the body.

**Antimicrobial** - refers to any substance that destroys or weakens one or more kinds of microbes.

**Autotroph** (adjective, autotrophic) - organism that is capable of making its own food, usually through photosynthesis.

**Bacteria** (singular, bacterium) - single-celled organism without an organized nucleus; often separated from other forms of simple organisms known as archaea.

**Carrier** - someone who is infected with a pathogen but does not show symptoms of a disease.

**Cell** - basic unit of living organisms.

**Cell membrane** (also called plasma membrane) - outer boundary that controls the movement of substances into and out of a cell, which it encloses.

**Cell wall** - strong wall outside the cell membrane of some cells, such as those of plants.

**Chlorophyll** - any of a group of green pigments found in photosynthetic organisms, such as plants.

**Cilia** (singular, cilium) - hairlike projections from the surface of a cell, usually involved in movement.

**Compound microscope** - magnification tool that uses two magnifying lenses in series.

**Contagious disease** - illness that can be spread from one organism to another through direct or indirect contact.

**Culture** - in biology, a process by which cells or organisms are grown under laboratory conditions.

**Cytoplasm** - contents of the cell between the nucleus and the cell membrane.

**Decomposers** - organisms that break down waste materials and dead organisms.

**Digestion** - process by which food is broken down into molecules small enough to be absorbed and used by the body.

**Disease** - any change in the body that causes discomfort, loss of function, distress or death.

**DNA** - deoxyribonucleic acid; long spiral molecule built of smaller molecules (nucleotides); the order of nucleotides in DNA provides instructions for the development and function of living organisms and many viruses.

**Drug** - any substance that modifies the functions of the body; used in the treatment, cure or prevention of illness, or to enhance physical or mental wellbeing.

**Ecosystem** - community of living organisms and the environment in which they live.

**Epidemic** - widespread outbreak of a disease.

**Extremophile** - single-celled organism that lives in an extreme environment, such as very hot or salty conditions; usually considered part of the Domain Archaea or the Kingdom Monera (in the five kingdom system of classification).

**Fermentation** - process by which cells break down food in the absence of oxygen.

**Flagella** (singular, flagellum) - long, whip-like structures that enable some single-celled organisms to move.

**Fungi** (singular, fungus) - kingdom of organisms that absorb nutrients from other living things, dead or decaying organisms, or waste materials; can be single-celled or consist of multiple cells.

**Gene** - unit of inherited information; composed of DNA (or RNA in some viruses).

**Germ** - non-technical term for a disease-causing microbe.

**Heterotroph** (adjective, heterotrophic) - organism that obtains food by consuming other organisms or waste from other organisms.

**HIV** - human immunodeficiency virus; infects certain kinds of T cells in humans and causes the disease known as AIDS.

**Host** - organism that harbors a disease-causing organism or parasite, or that provides nutrition or shelter to another organism (for example, humans are hosts to the helpful bacteria in the intestines).

**Hyphae** (singular, hypha) - thread-like filaments that make up the body of a fungus.

**Immune system** - body's defense system; protects against infections and foreign substances.

**Immunity** - having biological protection or defenses against infection, disease or unwanted invasion of the body.

**Incubation period** - the time between being infected by a pathogen and showing symptoms of the disease.

**Lymph nodes** - organs that act as filters to collect and destroy bacteria and viruses.

**Macroscopic** - visible by the unaided human eye.

**Microbiology** - field that involves the study of microbes.

# Glossary

**Micron** - micrometer, one millionth of a meter; this term is no longer in frequent use.

**Microorganism, microbe** - any organism (usually single-celled) that must be magnified to be visible to the naked eye; sometimes also refers to viruses, which are not considered living by most definitions.

**Microscopic** - too small to be seen with the unaided human eye; requiring magnification to be visible.

**Mold** - member of the Fungus Kingdom that grows rapidly on a surface.

**Monera** - kingdom of unicellular organisms without an organized nucleus; when considered part of the five-kingdom system of classification, Monera contains both bacteria and archaeobacteria (which also are single-celled and lack an organized nucleus); other systems of classification separate bacteria and archaeobacteria (archaea) into distinct kingdoms or domains.

**Multicellular** - composed of more than one cell.

**Mutation** - change in the sequence of nucleotides in DNA.

**Nitrogen fixation** - process by which some kinds of bacteria convert nitrogen from air into forms usable by plants.

**Nucleus** - center of a cell containing hereditary material and bounded by a membrane; found in the cells of protists, plants, animals and fungi.

**Nutrient agar** - gelatinous substance derived from certain seaweeds that is

used as a thickener in foods and as a medium on which to grow microorganisms.

**Organelle** - part of a cell with a specific function, bounded by a membrane and located in the cytoplasm.

**Pandemic** - epidemic that has spread broadly throughout much or all of the world.

**Parasite** - organism that obtains nourishment or shelter by living on or within another organism, and causes harm to the host.

**Pathogen** - organism or virus that causes disease.

**Photosynthesis** - process by which energy from the sun is used to convert water and carbon dioxide into sugar molecules (food); carried out by plants, algae and some microbes.

**Population** - group of individuals of the same species living within the same geographic area at the same time.

**Protein** - large molecule made of amino acids; the sequence of amino acids in a protein is determined by the sequence of nucleotides in DNA; proteins are involved in a variety of functions in cells, including chemical reactions, signaling between cells, protection against disease, and as structural components.

**Protist** - member of the Kingdom Protista (in the five kingdom system); often used informally to classify any organism that has cells with organized nuclei, but is not a plant, animal or fungus.

**Protozoan** - single-celled protist often described as animal-like because it shows

characteristics (such as locomotion and ingestion of food) typical of animals.

**Red blood cell** - blood cell that transports oxygen and contains hemoglobin; also called an erythrocyte.

**RNA** - ribonucleic acid; several kinds of long molecules that act as messengers between DNA and the cellular mechanisms for manufacturing proteins; some viruses have RNA, rather than DNA, as their genetic material.

**T Cell** - class of white blood cells that recognize and attack cells of the body that contain multiplying bacteria or viruses; some T cells also release chemicals that communicate the presence of a pathogen.

**Vaccine** - harmless version of a pathogen that stimulates the development of a long-term immune response to the pathogen; used to prevent diseases such as measles and tetanus.

**Virus** - infectious particle that consists of genetic material (DNA or RNA) encased in a protein coat; viruses must invade a cell in order to make copies of themselves.

**White blood cell** - class of blood cells that defend the body against disease and infection; leukocytes and lymphocytes are types of white blood cells.

**Yeast** - single-celled fungus.