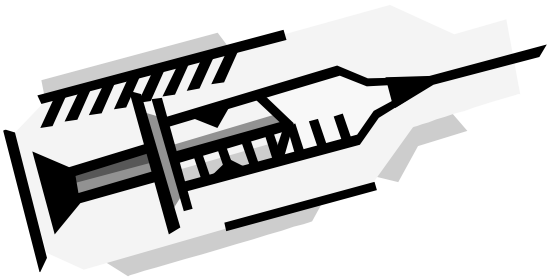
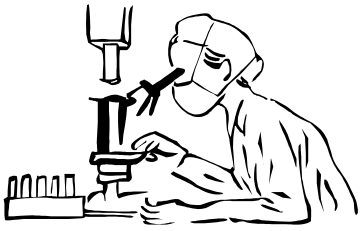


Disease



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Eradicating smallpox Internet assignment

Smallpox is a highly contagious, potentially deadly disease. A particularly nasty use of smallpox occurred in the 1700s when the French were attempting to take the lands belonging to the American Indians. Jeffory Amherst deliberately introduced the disease to the Indians, who had no resistance to it.

Go to http://www.ualberta.ca/~nativest/pim/ClashofWorlds.html and scroll down to the section 'A Dark Knight'.

1 How was smallpox introduced to the Indians? What were its symptoms? (You'll find these in one of the paragraphs in *italics*.)

Now, navigate to http://www.library.ucla.edu/libraries/biomed/smallpox/. Click on **Disease Effects**
To see photographs of smallpox victims, then on **1st Description** for some historical information. To answer the next question, click on the underlined link in the description.

2 When was this article written and which other disease was often confused with smallpox? Why was this?

Go to http://www.sc.edu/library/spcoll/nathist/jenner.html.

3 Who was Edward Jenner?

4 What did Jenner discover about cowpox? Click on the heading Island 2. What did Jenner do to James Phipps in 1796?

Although Jenner's discovery led to the birth of the branch of science called immunology, scientists still argue about whether he was morally correct in trying out his theories on a human patient. Go to http://www.abc.net.au/rn/science/ockham/stories/s356.htm. The article is long, but it is easy to read.

5 Explain why you think Jenner's experimentation on humans was morally right or wrong.

6 Although Jenner's treatment of Phipps is regarded as the birth of immunisation, was it really the first such treatment? To find out, go to http://www.thedorsetpage.com/History/Smallpox/smallpox.htm.
Briefly report on the first documented case of smallpox vaccination.

7 Go to http://www.bbc.co.uk/education/medicine/nonint/indust/dt/indtbi2.shtml. What is the significance of the dates 1840, 1853 and 1980?

Go to http://www.science.org.au/nova/012/012box02.htm and read the article. The world's supplies of the smallpox virus are presently held in two laboratories in Atlanta and Moscow. Some scientists recommend totally destroying the virus, while others have reasons for wanting to keep it in storage.

8 What are the arguments in favour of keeping the virus? What are the arguments for destroying it? What do you think? Information at http://www.abc.net.au/catalyst/stories/s404989.htm may be helpful. Reference to smallpox also appears in the media from time to time.

Health is a state of physical and mental well-being. This state is achieved when all cells, tissues and organs are functioning normally. Often this state of well-being is taken for granted until we experience ill health or disease.

Disease can be defined as any condition in which the body or parts of the body do not function properly. There are many causes of disease. Some diseases are caused by **micro-organisms** such as **bacteria, viruses, fungi** and **protozoa.** The micro-organisms that damage or kill body cells are called **pathogens.** Pathogens can spread from one individual or host to another; hence, these diseases are described as **infectious.** Infectious diseases include influenza, diphtheria, thrush and malaria.

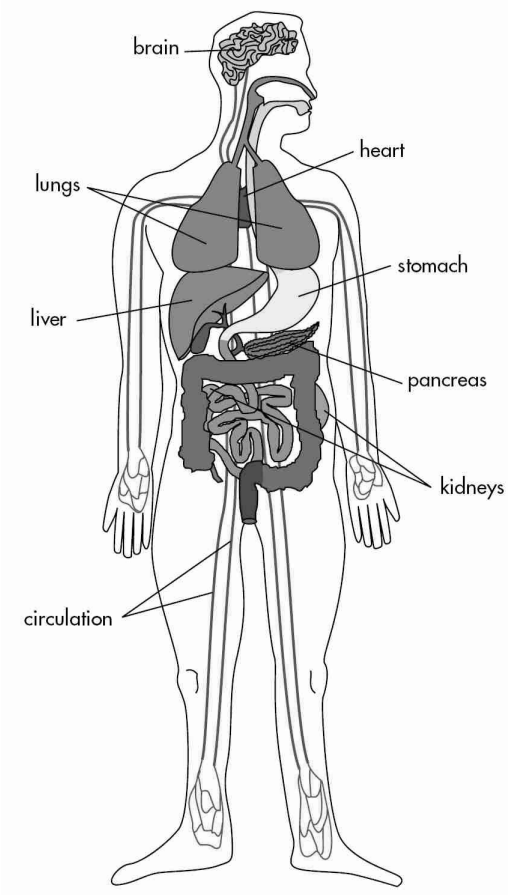
Many diseases are not transmitted from one person to another. A wide range of factors causes these non-infectious diseases. Causes of non-infectious diseases can be grouped in the following way:

- Genetic or congenital—these occur when abnormal genes are inherited from parents
- Age—as people get older some organs function less well
- Environmental factors—exposure to various forms of radiation, poisons and pollutants
- Lifestyle—poor diet, stress, drugs.

Unfortunately there are some illnesses that we do not know the exact cause of. Athat we do not know the exact cause of. An example is multiple sclerosis (MS), which is a nerve disease. We know how it affects the body, but not how it begins.

Staying healthy

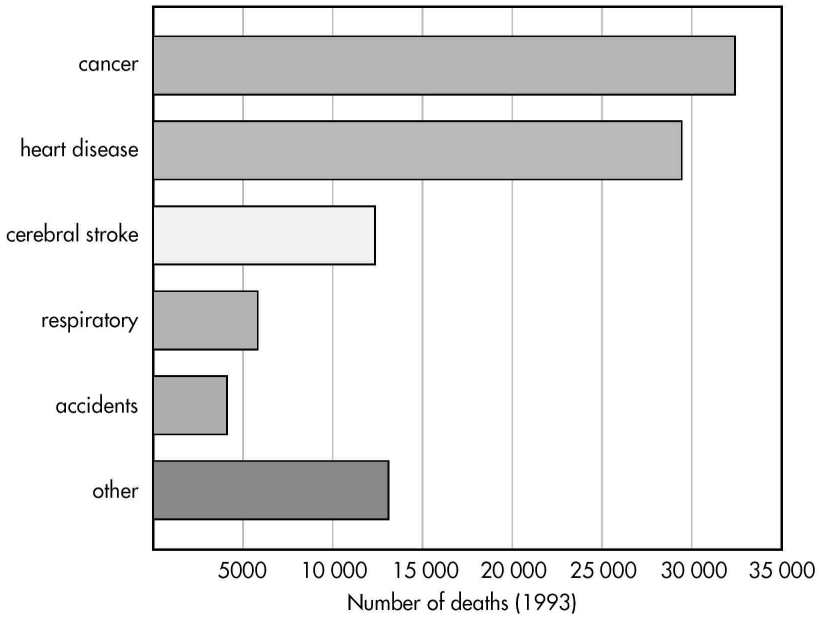
While we cannot select the genes we inherit from our parents or stop the ageing process, we can make a conscious effort to maintain good health. By eating a balanced diet, taking regular exercise, practising good personal hygiene and avoiding environmental hazards we can reduce the chances of disease. Maintaining a healthy lifestyle helps our body's defence system to fight off pathogenic organisms and avoid disease.



FACTORS THAT CAUSE ILLNESS

1 Rule up a table with the five main causes of illness as listed above.
2 Under each heading list as many examples as you can of illnesses that are associated with the organs and systems in the figure right
3 Draw an outline of a human body similar to Figure. Enter illnesses from your list on the diagram.
4 Compare your lists with others in the class.

5 Make a list of any diseases that you think of that there is not yet a cure for.



1 Explain how you could tell if someone was suffering from a disease.

2 List five factors that can cause disease.

3 Why do you think people are encouraged to:

a. Wash their hands before eating?

b. Not drink alcohol to excess?

c. Run cars on unleaded petrol?

d. Wear sunscreen?

_____

_____

_____

Infectious Diseases

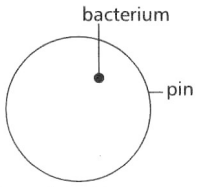
An animal's body is a biological battleground. Micro-organisms settle on it and try to break in, while the body retaliates and tries to fend them off.
An animal's body is usually kept in a stable condition by the control system called **homeostasis.** This stable state sometimes breaks down, and the body stops functioning normally. This breakdown is called a **disease.**
An infectious disease is one that is triggered by an infection, or by a growth of **pathogens.** A non-infectious disease is triggered by other factors such as inherited characteristics. Pathogens enter the body through the skin, through the mouth or by respiration (breathing them in).

What Is a Microbe?

A microbe is usually just a single cell and so cannot be seen without a microscope. Microbes are all around us. They are in the air, water, food and our bodies.
Some microbes make us sick but others are very useful. Microbes are used to make bread and cheese; others live in the digestive systems of some animals and help digest their food. Microbes break down dead animals and plants and some are used to process sewage. These are called saprophytic bacteria. Some diseases like malaria are caused by **parasites.** A parasitic organism depends on the **host** and the host is harmed.

Microbes that Cause Disease

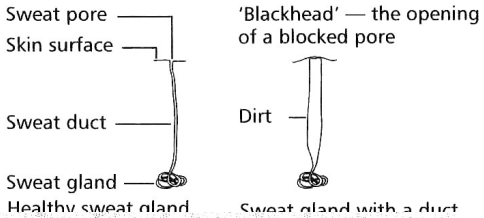
The most common microbes or pathogens causing disease are bacteria and viruses. However some fungi and unicellular organisms are also important.
How big are bacteria and viruses?

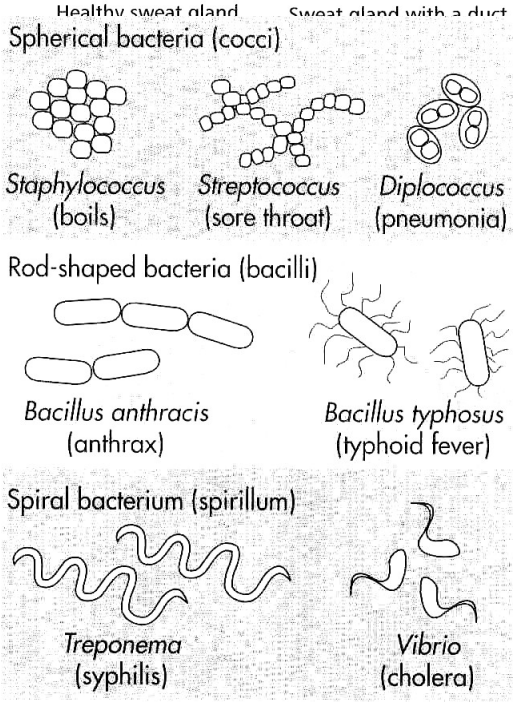


One of the biggest types of bacterium compared with the head of a pin.

Pathogenic Bacteria

Pathogenic bacteria damage the cells of animals and plants causing disease. Sometimes they produce poisonous wastes or toxins. If bacteria get into your sweat glands a pimple may form.





What some bacteria look like.

Bacteria absorb nutrients and divide and multiply like all normal cells. Diseases caused by bacteria can spread to other organisms very quickly. Examples of diseases caused by bacteria are listed in the table below:

Disease	What it does	How it spreads
Tonsillitis	Headache, sore throat, raised temperature	Sneezing, coughing, spitting
Whooping cough	Bad cough, raised temperature	Sneezing, touching, spitting
Salmonella food poisoning	Diarrhoea, feeling sick	Eating infected food
Tuberculosis	Very ill, a bad cough	Water droplets in the air

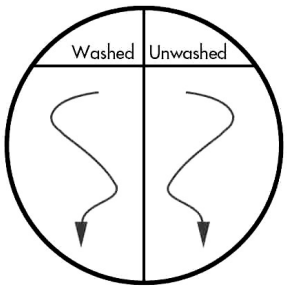
Growing Bacteria

When bacteria reproduce they form colonies. A colony may contain millions of bacteria. Different types of bacteria form colonies with different appearances—this helps microbiologists to identify the type of bacteria.

Warning: Treat all bacteria as potentially dangerous. Do not open the lids of the agar plates once you have grown the bacteria. Your teacher will dispose of the plates correctly.

AIM

To show that bacteria are common in our environment, including on our skin.



MATERIALS

Agar plates with nutrient agar
Permanent marking pen

METHOD

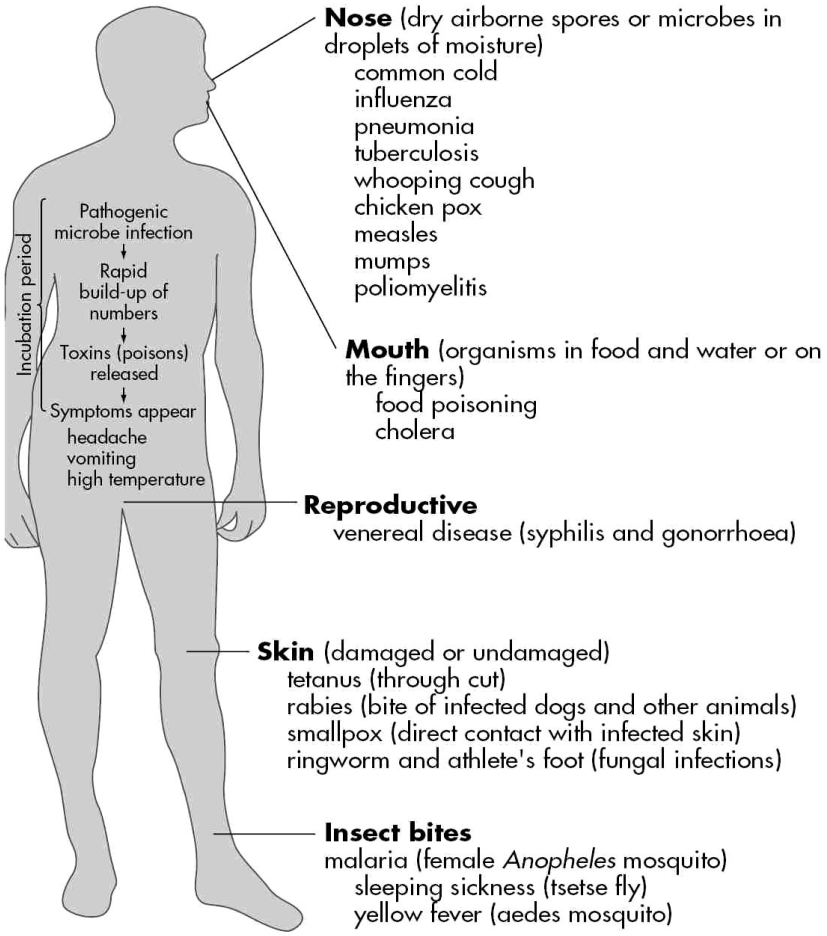
1. Take an agar plate, and mark the base as shown in figure.
2. Using an appropriate supply of material run it down the side of the agar marked 'unwashed. Be careful not to gouge into the agar.
3. Wash the surface with soap and water and repeat the process on the 'washed' side.
4. Seal the plates with sticky tape and put them in an incubator set at 25-30°C overnight.

RESULTS

1. Count the number of different types of colonies on each side, and the total number of colonies. Bacterial colonies tend to be smooth and round. You may also have some moulds: these tend to be fluffier in appearance.
2. Draw and describe the appearance of one or two of the colonies.

DISCUSSION

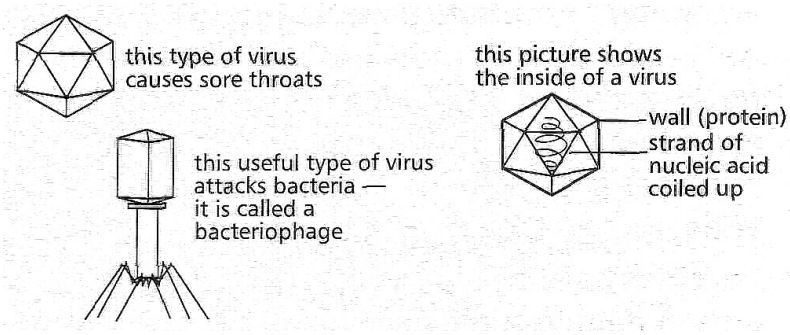
1. Explain your results.
2. Are there any bacteria on the 'washed' side? How could this have occurred?
3. Why is it important to wash your hands after going to the toilet and before eating?



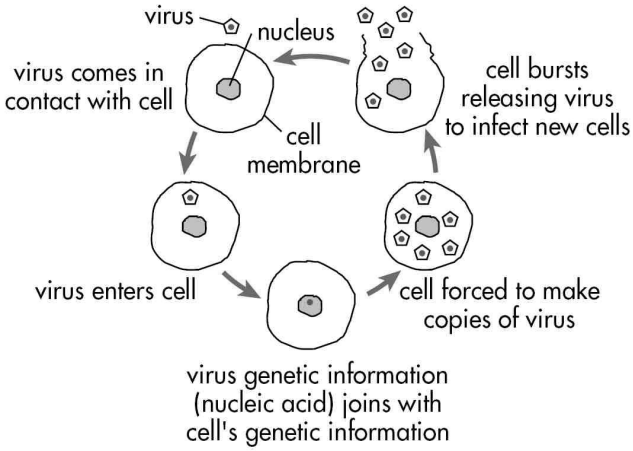
Entry points on the body for some disease-causing microorganisms.

Viruses

Viruses are bundles of genetic material that attack cells and take chemicals from them. Viruses are extremely small. Their size ranges from 0.01 to 0.3 µm across. They cannot exist on their own. Each type of virus causes a different disease. Some are easier to catch than others and sometimes you don't catch them again after you have had them once. Viruses are not living organisms in the true sense of the word—they do not eat, drink, produce wastes, or do any of the other things living organisms do. Their structure is non-cellular (i.e. they are not made up of cells). They are simply a piece of nucleic acid (DNA or RNA) wrapped in a protein coat.
Viruses cannot even reproduce on their own! They can enter the body in the same ways as bacteria. When a virus enters a cell, it reproduces by forcing the cell to make more viruses. The cell then bursts, releasing the viruses to infect other cells.



What Viruses Look Like



Examples of viruses follow:

Disease	What it does	How it spreads
Influenza	Aches, pains, runny nose, high temperature	Water droplets in the air
Measles	Small red spots and a skin rash	Close contact
Chicken pox	Raised itchy spots on skin	Close contact
Mumps	Swollen cheeks and neck	Close contact
AIDS	Destroys some of the cells of the immune system	Sexual contact or blood
Ross River fever	Fatigue and high temperature	Blood-sucking insects

Questions

1. What is a pathogen?

2. For each way that pathogens can enter the body; suggest at least one way this could be prevented.

3. How do bacteria reproduce? What could be an advantage of this method?

4. Why are viruses not considered to be living?

5. Describe the structure of a virus.

6. On average, how much bigger is a bacterium than a virus? How much bigger is a human cell than a virus?

7. How do pathogens cause the symptoms of a disease?

Stopping super staph

A baby boy recently underwent open-heart surgery in Japan to correct a congenital heart condition. After the operation he contracted a bacterial infection, commonly acquired in hospitals, called *Staphylococcus aureus*, or golden staph. There was nothing unusual about this. The boy was treated with methicillin—an antibiotic often used to combat staphylococcus infections—but the infection did not respond. The boy was diagnosed as having an infection of MRSA—methicillin-resistant *Staphylococcus aureus*. MRSA has been an unwelcome invader in hospitals since 1961; it is resistant to all available antibiotics except one, vancomycin. The boy was immediately treated with vancomycin. Again there was no response.

The long held fears of medical science were being realised by the arrival of a 'superbug'—vancomycin-resistant *Staphylococcus aureus*. The boy eventually recovered but only after an artillery of drugs, including the experimental antibiotic arbekacin, was deployed.
Staphylococcus aureus is a very contagious bacterial infection. It is easily passed from person to person through skin contact and it is commonly passed from one patient to another in hospitals. Symptoms include skin rash, aches and pains, fever associated with rigor (shaking) as well as festering boils and ulcers. It is serious because, if untreated, it can cause debilitation, sometimes resulting in the amputation of limbs or even death. Until recently, antibiotics have been effective in eliminating even the most serious bacterial infections, including golden staph.

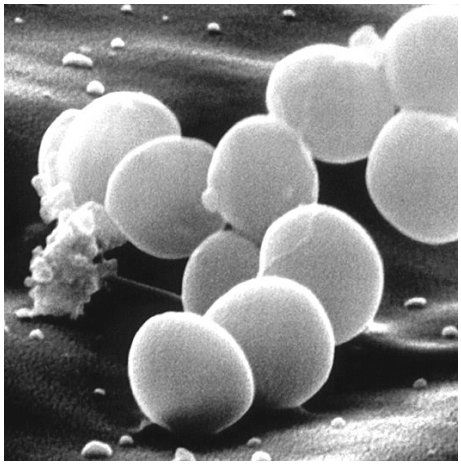


Figure 1 *Staphlococcus aureus* has cocci arranged in clusters.

Antibiotics are prescribed to eliminate bacterial infections. Bacterial cells can be killed off in different ways depending on the kind of bacteria and the type of antibiotic. Sometimes a mutation occurs in a bacterial cell rendering it resistant to the effect of a particular antibiotic. Such a cell will pass on the resistant gene to its offspring; the non-resistant cells will succumb to the antibiotic, the resistant cells will flourish. Then more potent antibiotics are required to keep infections in check.
Various factors are responsible for the current crisis involving multi-drug resistance to antibiotics. Many medical researchers and general practitioners believe that overprescribing of antibiotics has played a key role. It is known that the rate of antibiotic resistance of different bacterial species increases proportionally with the rate of antibiotic use. Another key factor is that patients often stop taking antibiotics before they are fully recovered. This practice prolongs infections, giving bacteria a longer time to reproduce and increasing the chance of resistant mutations arising. When this occurs a repeat prescription of the original antibiotic is ineffective. Furthermore, some antibiotics have undesirable side affects so that a patient's compliance is often low; once again this allows bacteria the opportunity to mutate to a resistant strain.
What happens when our most potent antibiotic is powerless against a pathogen as serious as *Staphylococcus aureus*?

Source: Resisting Resistance*, The Economist,* 31 May 1997.

1. 'Golden staph' is the common name for a common hospital-acquired infectious disease.
   a. Give the full scientific name for this organism.

_____

   b. What kind of organism is golden staph?

_____

2. Golden staph is a very contagious disease.
   a. How is it passed from one person to another?

_____

   b. Describe the symptoms and potential effects of golden staph on a patient.

_____

_____

_____

3. What are antibiotics and what do they do?

_____

_____

4. Scientific names are often abbreviated for ease of use.
   a. What do the abbreviations MRSA and VRSA stand for?

_____

_____

   b. Explain why VRSA is called a 'superbug'.

_____

_____

The following questions do not have answers in the text. You might want to base a class discussion on these questions.

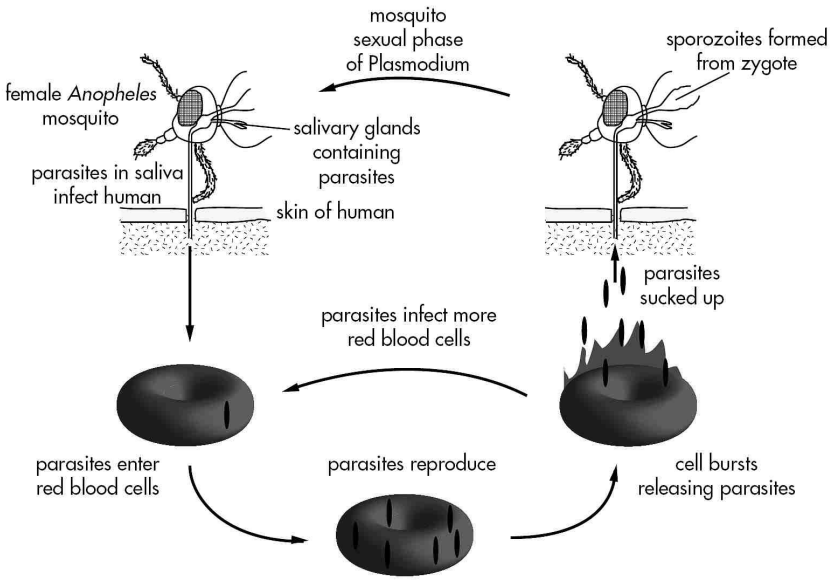
5. Sick people generally congregate in hospitals in order to get well. Unfortunately many contract golden staph during their stay. Explain this irony.
6. About 33% of the population are believed to be carriers of golden staph with spores typically present on the skin and in the nose. Why don't these people get sick?
7. Arbekacin is an experimental antibiotic not yet licensed for use in Western countries.
   a. Why are experimental drugs not licensed for use?
   b. In what circumstances might an experimental drug be used?
8. Vancomycin is a much more potent antibiotic than penicillin. Why don't doctors just prescribe vancomycin whenever antibiotics are required to halt an infection?
9. Suggest some strategies that could be put in place to manage an outbreak of VRSA in a hospital ward.

Fungi

Fungal infections usually attack the skin and do not invade deeper layers. Athlete's foot is a disease that causes itching between the toes. It is spread by bare feet coming into contact with infected areas. Ringworm is a fungus present in dogs and cats and is transmitted by contact with damaged or infected skin

Parasites

A parasite lives in or on another organism. **Vectors** carry parasites and pathogens from one host to another; for example, the malaria mosquito carries plasmodium (singled cell animal like organisms are called protozoans) from one person to another.



Examples of Parasites pathogens:

Parasite	Condition caused	Source of infection
Amoeba	Amoebic dysentery	Contaminated food and drink
Malarial parasite	Malaria	Bite from infested mosquito
Tapeworm	Tapeworm	Raw or poorly cooked meats
Blood fluke	Schistosomiasis	Contaminated water
Tick	Skin infestation	Tick-infested areas
Louse (nit)	Pediculosis	Contact with human carrier, bedding, clothing
Flea	Skin irritation	Animal and human carriers
Typhus	Fever, muscle pain, rash	Lice, mites, ticks, fleas
Bilharzia	Rash, cough, diarrhoea	Water snail

1. Write the names of 12 diseases from the box in alphabetical order in the table below. Tick the most likely cause(s) of each disease and say which major organ is affected.

Heart disease measles ringworm influenza herpes cancer
AIDS tetanus alcoholism hepatitis A/B tinea glaucoma Pneumonia smallpox athlete's foot

Disease	Infection	Genetic	Environmental factors	Age	Lifestyle	Major organ affected

2. Look at the names of the 11 diseases listed below. Decide which type of infection causes each disease, and complete the table that follows.

Sleeping sickness	smallpox	AIDS	ringworm	hepatitis A/B
Athlete's foot	malaria	influenza	tinea	amoebic dysentery
polio				

Viral infection	Fungal infection	Protozoan infection

Killing Pathogens

- **Bacteria** and **fungi** in food can be prevented by using heat (sterilising), cold (freezer), sugar (jams), salt (bacon), weak acid like vinegar (pickled onions), or drying (dried fruit).
- **Antiseptics** and **disinfectants** are chemicals applied to the skin surface that kill bacteria.
- **Antibiotics** should kill bacteria if taken according to the directions, but not viruses. Antibiotics destroy or halt the growth of micro-organisms. They do not harm body cells and can be used inside the body. However, microbes are becoming immune to many antibiotics so they don't work as well.
- **Vaccines** have been produced to prevent a person getting some bacterial and viral diseases.
- **Viruses** can be prevented by avoiding close contact with infected individuals.
- **Parasites** can be prevented by avoiding eating them or being bitten by their vectors. This often involves physical barriers like mosquito nets, washing hands or chemicals like insecticides.

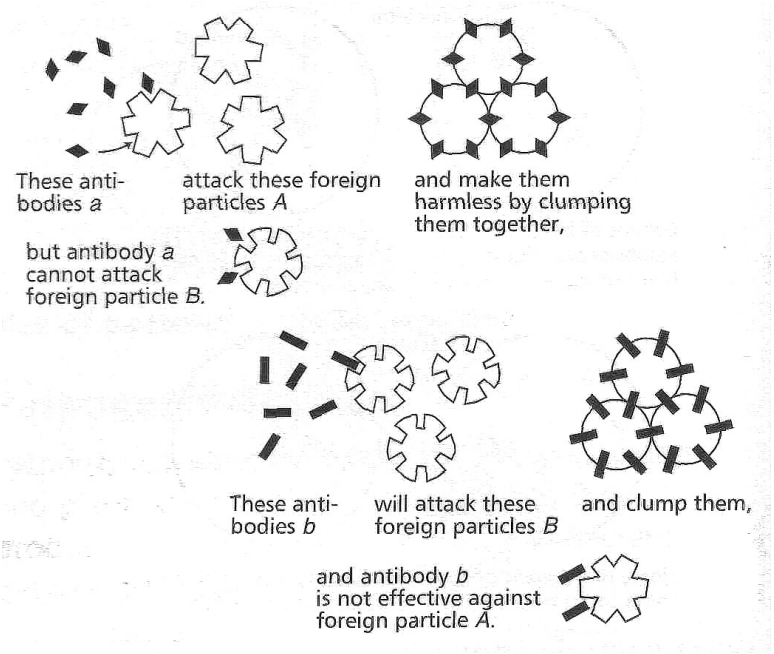
Fighting Disease

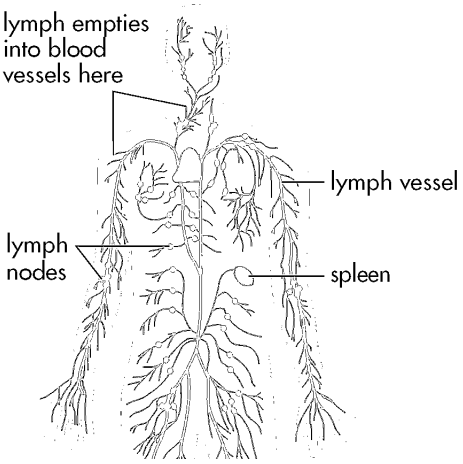
Using an assortment of special defences, the body normally manages to keep invading pathogens in check.

- **Non-specific resistance** are defence systems that respond in the same way to all invading organisms. They provide a variety of physical and chemical barriers against infection. Sweat, tears and saliva wash pathogens away and they also contain an enzyme that attacks them. The body also produces special white cells that engulf invading foreign cells.

- **The immune system** produces substances that are specifically selected to attack a particular invading pathogen. The immune system recognises specific foreign cells when they enter the body, and produces special chemicals called antibodies to fight them. The immune system also 'remembers' invading pathogens and responds even faster if they reappear.

- **Antibodies** are special proteins that are produced by cells of the immune system and circulate in the blood. When the pathogen enters the body, antibodies lock onto the foreign substances, or antigens on the pathogen's surface. This immune response makes the invader harmless. Antibodies are specific — an antibody will react only with the antigen that triggered its formation. Antibodies are produced by special white blood cells called lymphocytes. Lymphocytes can make antibodies against millions of potential pathogens. Some white blood cells (T cells) digest the microbes. This is called phagocytosis.

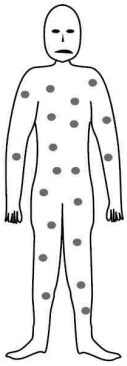




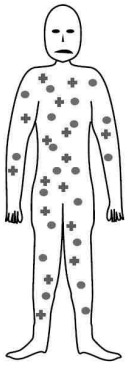
- The **lymphatic system** drains fluid from the body's tissues into the blood. It also houses lymphocytes that fight infection. Lymph nodes occur at intervals along lymph vessels. They filter out bacteria and other foreign material. They often swell up if the body is fighting infection.

- **Immunisation** is the injection into the body of some dead or weakened pathogens that trigger the body's immune system to produce the appropriate antibodies. The person does not then get these diseases. However, some people do not agree with immunisation, as it can cause some side effects.

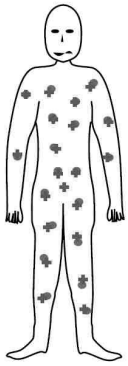
1. Bacteria or viruses invade body causing disease.



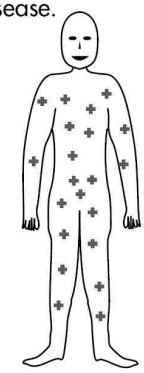
2. Lymphocytes form antibodies against pathogen.



3. Antibodies destroy invading pathogen.



4. The ability to produce antibodies remains in body, resulting in immunity to that disease.



Complete the following:

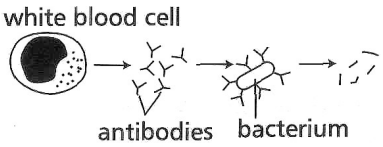
1Some white blood cells make

_____ to

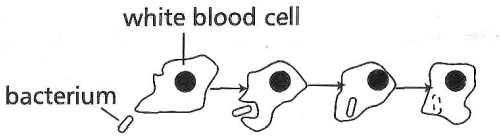
destroy microbes; others _____ them, which is called phagocytosis. In response to a new disease,_____ blood cells make new kinds of antibodies, or antibodies can be provided through _____. _____are chemicals that kill _____ in your body.

2Which diagram below explains?

A



B



Phagocytosis (A/B)	**The destruction of invaders via antibody production? (A/B)**

3Match the following words with the correct explanation.

Sterile, Disinfectant, Antiseptic, Antibiotic

Definition	Explanation
	A substance that stops the growth of disease-causing organisms in wounds.
	A substance that stops certain bacteria from reproducing.
	Something that has no viruses, bacteria or other organisms on it.
	Something that kills disease- forming organisms, eg heat and sunlight.

4Match the following words with the correct explanation.

Immune system, Immunisation, Immunity,

Definition	Explanation
	Injection of dead or weakened pathogens so the person does not get the disease.
	Once the body has been infected it 'remembers.
	Produces substances specifically for attacking invading organisms.

5The _____ _____drains fluid from the body's tissues into the blood. It also houses _____ that fight infection. _____ occur at

intervals along lymph vessels. They filter out bacteria and other foreign material. They often swell up if the body is fighting infection.

The flu virus changes its 'spots'

There have been three influenza (flu) pandemics (worldwide epidemics) in the 20th century. The worst of these occurred in 1918 when it is estimated that 20 million people died from the flu or complications arising from it. Different subtypes of the flu virus caused other pandemics in 1957 and 1968. In each case the virus was altered, so immunity to one subtype would not protect individuals against a new subtype.

A virus has a coat of protein that has certain regions or 'spots' which can be altered by mutation. Whenever these 'spots' change, a new strain of the virus is produced. At present, when a vaccine is developed it is specific to a particular strain of a virus. The antibodies it causes the body to produce will only inactivate a virus with matching 'spots'.

The flu virus can mutate so rapidly that it is not possible to produce a vaccine for every strain; by the time a vaccine has been developed for one strain, the virus may have changed its 'spots' and the vaccine may no longer work.

Recently, scientists in Australia have isolated a protein (sialidase) from the outer coating of the flu virus. This protein helps new particles of flu virus to escape from the cell where they have been produced, so the disease can spread. This is a part of the virus coating which does not alter: it is the same in different virus strains. Scientists felt that if they could somehow block the action of this protein, they could reduce the spread of the virus. By isolating sialidase, researchers were able to look carefully at its structure and then identify its position on the actual virus. This has enabled them to design a drug to block the action of the protein.

1 What is a pandemic?

_____

_____

2 Why would a person who had suffered a bout of the flu in the pandemic of 1957 not have been immune to the flu virus that caused the 1968 pandemic?

_____

_____

_____

_____

3 What part of the virus changes (mutates) to alter the subtype or strain of the flu virus?

_____

_____

4 How do current vaccines protect the body against the flu virus?

_____

_____

5 Explain how the recently developed flu drug acts to prevent the spread of the flu virus and how this is different from a flu vaccine.

_____

6 Why would the recently developed drug be more effective than a flu vaccine in preventing a flu epidemic in a human population?

Food poisoning

The incidence of food poisoning is on the increase. There are about 2 million cases in Australia each year. Pathogenic bacteria and viruses contaminate food and cause nausea, vomiting, diarrhoea and upset stomachs. In severe cases death may result, particularly in children, the elderly or people with other illnesses.

Causes of food poisoning

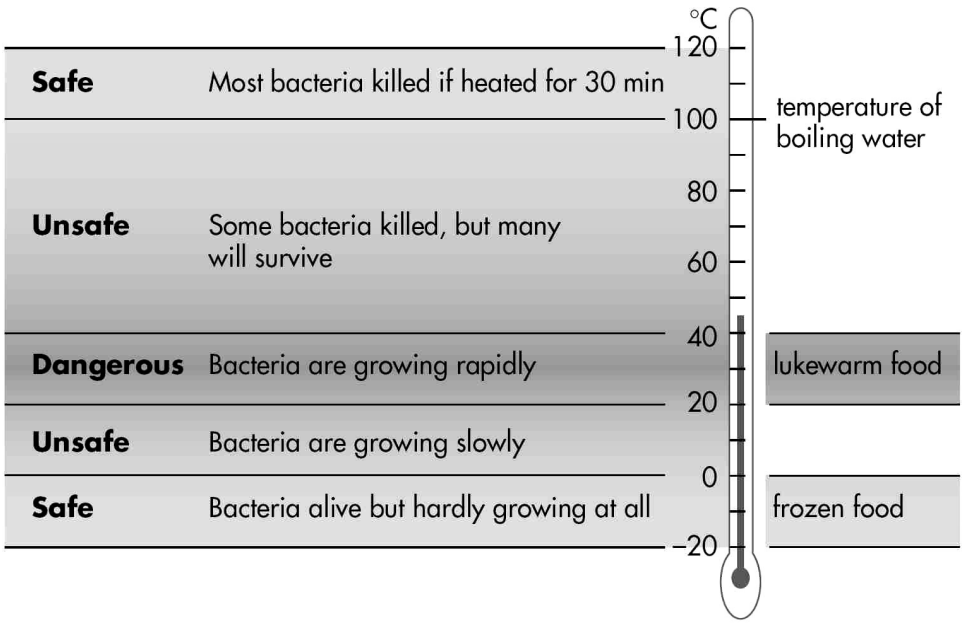
From 1980 to 1995, 128 food-poisoning outbreaks were reported. This resulted in 5952 individual cases and six deaths.

The causes of these food poisonings included:

- Inadequate cooking (food should be heated to a high temperature until thoroughly cooked)
- Inappropriate storage (food should be frozen or refrigerated at very low temperatures)
- Contamination from infected water, soil and animal wastes (via unclean utensils, surfaces and storage containers)
- Poor personal hygiene by food handlers (failure to wash hands, cover hair, cuts and coughs).

Some causes and effects of food poisoning.

Cause	**Usual food contaminated**	**Symptoms**	**Incubation period**
(ampylobacter jejuni	Raw chicken, raw milk, untreated water	Diarrhoea, fever, stomach pains	2-7 days
Staphlylocoaus aureus	Meat and meat products, eggs, milk and dairy products	Nausea, vomiting, diarrhoea, cramping	1-6 h
Salmonella species	Poultry, fish, milk, cream, peanut butter, chocolate	Stomach pains, nausea, watery diarrhoea	8-72 h
Listeria monocytogenes	Milk, cheese, raw vegetables, smoked mussels	Fever, chills, backache, headache, diarrhoea, vomiting	Average 30 days
(Lostridium botulinum	Home preserves, canned food, soft cheeses	Dizziness, blurred vision, difficulty swallowing and breathing, death	18-36h



1 Examine the figure above and use it to explain why inadequate cooking and storage can lead to food poisoning.

_____

_____

_____

2 People eat more processed foods and take-away meals now than in the past. How could this lead to more cases of food poisoning?

_____

_____

_____

Complete the following:

Bacteria and_____ are microorganisms which can cause disease. Any organism, which causes disease, is called a_____. Further examples of these are fungi and are chemicals which can be swallowed or injected to combat bacteria. They are not effective against viruses_____ can help prevent disease by stimulating the body to make antibodies against disease-causing microorganisms. This results in_____ to that particular disease.

Relating cause and effect

In science you are often asked to give the reasons for one thing leading to another. In other words, you have to relate the *cause* (the reason) to the *effect* (what occurs).
To relate the cause to the effect, you usually have to analyse data carefully and remember not to jump to conclusions.

Case study

A farmer bought three new chickens and put them in with fifteen others in a large pen. The next day he noticed that the three new chickens looked sick. In the following week, many of the other chickens became sick.

He called a vet who inspected his chickens and their pen. The farmer told the vet that he had changed to a new type of poultry food two or three days before he noticed the sick chickens. What should the vet do to find the cause of the sickness?

Step 1 Suggest inferences

An inference will help in the design of tests and in the collection of data.

In this case, two inferences could be made:

1 The new type of food caused the sickness.

2 The new chickens may have an infectious disease which is spreading to the other chickens.

The vet decided to investigate inference 1 first.

Step 2 Make and test predictions

Using the inference, the vet made a prediction that was then used to design a test.

Prediction: If the new food causes the disease, then the chickens will recover if they are fed the original food.

The vet divided a pen into two and put some of the sick chickens into one side and an equal number of healthy chickens into the other. She fed both lots of chickens on the original type of food. Each group of chickens had the same shelter and water.

Step 3 Collect and evaluate data

After a week, the vet observed that none of the sick chickens feeding on the original food had improved, and that some of the healthy ones had become sick.

Prediction: If the disease is caused by an infectious agent, it may show up in the faeces.

The vet took samples of the faeces of a sick chicken and a healthy chicken. In the laboratory, she found a bacterium in the sick chicken's faeces that was not present in the healthy chicken's faeces.

The vet then returned to the farm and took faeces samples from all the sick and healthy chickens. She found the same bacterium in all the samples from sick chickens and in none from healthy chickens.

She treated all the chickens with antibiotics, and after a week the sick chickens recovered.

Don't jump to conclusions

Without adequate tests, the farmer may have 'jumped to conclusions' and blamed the new food for the sickness in his chickens. Well designed predictions and tests help to relate the cause to the effect.

EXERCISES

1 Describe what 'jumping to conclusions' means so that a 10-year old person would understand.

_____

_____

2In testing her first prediction, why did the vet divide the chickens into two equal groups of well and sick chickens?

_____

_____

3In testing her second inference, why did the vet return to the farm and test the faeces of the other chickens?

_____

_____

4In this example what was the 'effect' of the disease? What was the 'cause'?

_____

_____

Find each of the following words.

DISEASE	ANTIGEN	ALLERGY	PARASITE
VECTOR	PANDEMIC	IMMUNITY	STERILE
BACTERIA	LYMPHATIC SYSTEM	PATHOGEN	HOST
VIRUS	HOMEOSTASIS	ANTIBODIES	DISINFECTANT

E T T E I E L Y M P H A T I C S Y S T E M I
R T U T T T A Y H I C A N T I B O D I E S E R
N I S E V I R U S I A V I M M U N I T Y A E H
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S G Y O U S D B A P A R A S I T E T I D O S S
I R T E H N S T I F H H D T E A Y S S M E S E
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F L A P Y A A E A S V M I E N D P O O T I E N
E L C E S R S P S B I L G T H U S G A H S M N
C A C E H O N I I Y E P I M T T T A R T B I N
T A N E A T T G T E G V T A S E O E N S I A
A U T L A C R O O E E A A S Y I M T T E S Y A
N H I R A E I A E N S R I E P L R H R E F E E
T S V Y U V B H A H R S E V A L L T N G N A D
R I H M N S E S E H I I N L T I T T T A T A T

Glossary

Allergy
An excessive immune response to an antigen.
Antibodies
A protein that locks onto a specific foreign substance.
Antigen
Foreign substances on the surface of a pathogen.
Bacteria
Organisms made of one cell, they are neither animals nor plants.
Disease
A breakdown in the body's stable state.
Homeostasis
The maintenance of stable conditions in a cell or a living thing.
Host
An organism that provides food for a parasite.
Immune system
Specific defences against disease-causing organisms.
Immunity
Resistance to a pathogen or a foreign substance.
Lymphatic system
A system of channels that drain fluid and fight infections.
Lymph nodes
Glands in the lymphatic system that swell when infected.
Lymphocyte
Special white blood cells that produce antibodies.
Non-specific resistance
Defence systems that attack a wide range of pathogens.
Parasite
An organism that benefits at the expense of the host.
Pathogen
A disease-producing organism.
Vector
A living thing that carries a parasite or pathogen from one host to another.
Virus
Disease-causing organisms smaller than bacteria, that can only grow inside a