

UNIT 1

Life processes are performed at the cellular level

TOPIC 1.6

What medicines help protect us from microbes that make us sick?



TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Topic 1.6: What medicines help protect us from microbes that make us sick?

- Kisameet clay from Kisameet Bay, B.C.:
 - Able to kill bacteria that have become resistant to antibiotics
 - Heilsuk First Nation has been using the clay for hundreds of years to treat ulcers, arthritis, burns, and skin disorders



UBC researchers have found that Kisameet clay can kill pathogens that are resistant to modern medicines

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Concept 1: Traditional First Peoples medicines and treatments come from resources in nature.

Medicinal plants used by First Peoples of B.C.:

- Indian hellebore
 - Found in open forests
 - Used by Nuxalk Nation to treat skin and scalp conditions
 - Smoke from a burned plant can be used as a decongestant



Figure 1.23: Indian hellebore (*Veratrum viride*)

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Concept 1: Traditional First Peoples medicines and treatments come from resources in nature.

- Devil's club
 - Grows along the coast and in the B.C. interior
 - Treats breathing and digestive disorders, arthritis, and diabetes



Figure 1.23: Devil's club (*Opolopanax horridus*)

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Concept 1: Traditional First Peoples medicines and treatments come from resources in nature.

- Pacific yew tree
 - Grows along the coast
 - Tea from the needles and bark treats pain and internal injuries
 - Bark contains a cancer-fighting chemical that is the basis of the drug Taxol (used to treat breast and ovarian cancers)



Figure 1.23: Pacific yew (*Taxus brevifolia*)

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Discussion Questions

- How can nature be used to heal?
- Why might it be important to identify and preserve plants used for medicinal purposes?



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Concept 2: Vaccines can help us prevent infections.

- **Vaccine:**
 - A substance that causes a response in the body that protects it against a specific disease
 - Can be injected or taken orally

Vaccines are usually given to babies and children based on a schedule.



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

How Do Vaccines Work?

- Vaccines contain small amounts or pieces of a live or killed pathogen that causes disease
 - Vaccines cause an immune response from the body
 - Immune system “remembers” the exposure to the pathogen and can defend the body against it
 - A vaccinated person has immunity against the disease



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Types of Vaccines: Live, Attenuated Vaccines

- Live, attenuated vaccines:
 - Contains living microbes that have been weakened
 - Results in a strong immune response (only one or two doses needed)
 - Examples: measles, mumps, chickenpox



Chickenpox rash

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Types of Vaccines: Inactivated Vaccines

- Inactivated vaccines:
 - Contains microbes that have been killed with heat, chemicals or radiation
 - Results in a weaker response from immune system (booster shots are needed)
 - Examples: hepatitis A, rabies, whooping cough



Infants in B.C. are given a vaccine for whooping cough at 2, 4, and 6 months.

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Types of Vaccines: Subunit Vaccines

- Subunit vaccines:
 - Contains only specific pieces of microbes
 - Results in a weaker immune response (several doses needed)
 - Examples: hepatitis B, Hib disease



Haemophilus influenzae type b (Hib) is the bacterium that causes Hib disease.

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Types of Vaccines: Toxoid Vaccines

- Toxoid vaccines:
 - Contains inactivated toxins from certain types of bacteria
 - Results in a weaker immune system response (booster shots are needed)
 - Examples: diphtheria, tetanus



The bacterium that causes diphtheria produces toxins which harm the respiratory system.

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Immunization Schedule for B.C. Babies

Vaccine	2 Months	4 Months	6 Months	12 Months	18 Months	Starting at 4 Years of Age (Kindergarten Entry)
Chickenpox (Varicella) Vaccine				<input checked="" type="checkbox"/>		
Diphtheria, Tetanus, Pertussis, Hepatitis B, Polio, and Haemophilus influenzae type b (DTaP-HB-IPV-Hib) Vaccine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Diphtheria, Tetanus, Pertussis, Polio (DTaP-IPV) Vaccine						<input checked="" type="checkbox"/>
Diphtheria, Tetanus, Pertussis, Polio, Haemophilus influenzae Type b (DTaP-IPV-Hib) Vaccine					<input checked="" type="checkbox"/>	
Hepatitis A Vaccine <i>Aboriginal children only</i>			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Immunization Schedule for B.C. Babies (continued)

Vaccine	2 Months	4 Months	6 Months	12 Months	18 Months	Starting at 4 Years of Age (Kindergarten Entry)
Inactivated Influenza (Flu) Vaccine					<input checked="" type="checkbox"/>	
Live Attenuated Influenza (Flu) Vaccine				Children 6 months to 4 years of age		
Measles, Mumps, Rubella (MMR) Vaccine				<input checked="" type="checkbox"/>		
Measles, Mumps, Rubella and Varicella (MMRV) Vaccine						<input checked="" type="checkbox"/>
Meningococcal C Conjugate (Men-C) Vaccine	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Pneumococcal Conjugate (PCV 13) Vaccine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Rotavirus Vaccine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Immunization Schedule for B.C. School Age Children

Vaccine	Grade 6	Grade 9
Chickenpox (Varicella) Vaccine	<input checked="" type="checkbox"/>	
Hepatitis B Vaccine	<input checked="" type="checkbox"/>	
Human Papillomavirus (HPV) Vaccine	<input checked="" type="checkbox"/>	
Meningococcal Quadrivalent Conjugate Vaccine		<input checked="" type="checkbox"/>
Tetanus, Diphtheria, Pertussis (Tdap) Vaccine		<input checked="" type="checkbox"/>

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Vaccines and Public Health

- Benefits of vaccination:
 - Help protect people against deadly diseases and those that cause permanent damage
 - Help stop the spread of disease
 - Help stop an outbreak from turning into an epidemic or pandemic
 - Example: Smallpox was eradicated in 1980

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Table 1.6: Effectiveness of Certain Vaccines

Disease	Number of Reported Cases, 1980	Number of Reported Cases, 2014	Percent Decrease in Cases
Diphtheria	97 774	7321	92.5
Measles	4 211 431	267 582	93.6
Polio	57 795	371	99.4
Tetanus	114 248	11 392	90.0
Whooping cough	1 982 384	220 504	88.9

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Discussion Questions

- In your own words, explain what a vaccine is.
- Make a graphic organizer of your choice to explain how vaccines help protect people against disease.



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Concept 3: Antibiotics can treat bacterial infections.

- **Antibiotics:**
 - A substance that fights infections by interfering with the life processes of bacteria
 - Kill bacteria or prevent them from growing or reproducing
 - Not effective against viruses or other microbes

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Penicillin – The First Antibiotic Available on a Global Scale

- **Discovery of penicillin:**
 - 1928: Alexander Fleming grew *Staphylococcus* bacteria on a Petri dish
 - The dish had a large patch of mould, but no bacteria growing around the mould
 - Penicillin was derived from this mould
 - Penicillin-based antibiotics: erythromycin, tetracycline



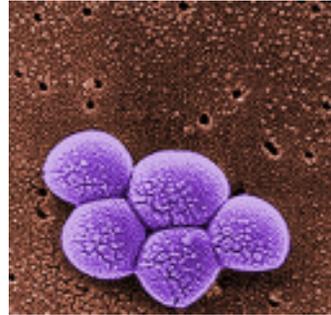
Figure 1.24: The area near the mould does not have bacteria growing around it.

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

The Development of Antibiotic-Resistant Bacteria

- Overuse of antibiotics has led to antibiotic-resistant bacteria.
 - Some diseases (pneumonia, tuberculosis) are now more difficult to treat
 - “Superbugs”: bacteria that are resistant to several types of antibiotics
 - Example: methicillin-resistant *S. aureus* (MRSA)



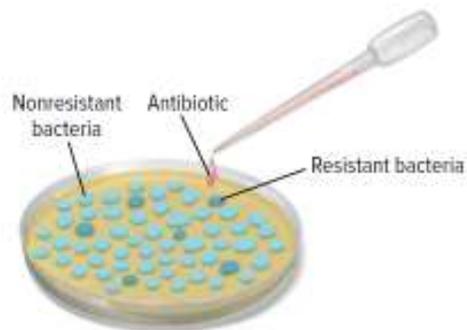
Methicillin-resistant *Staphylococcus aureus* (MRSA)

BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Figure 1.25: How a population of bacteria develop resistance to antibiotics (A)

- An antibiotic is added to a colony of bacteria.
- A few bacteria have mutations that enable them to resist the antibiotic.

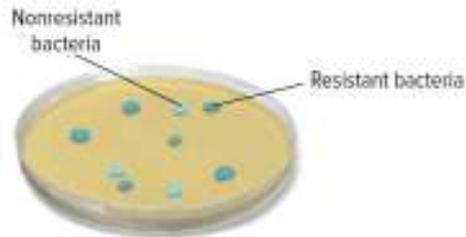


BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Figure 1.25: How a population of bacteria develop resistance to antibiotics (B)

- The antibiotic kills the nonresistant bacteria.
- The resistant bacteria survive and reproduce.

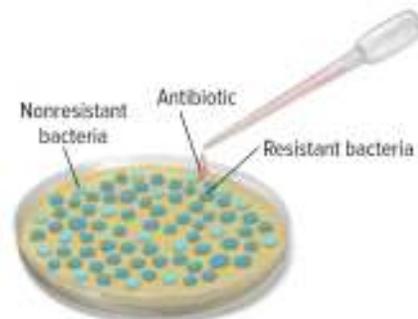


BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Figure 1.25: How a population of bacteria develop resistance to antibiotics (C)

- Surviving bacteria are added to another plate containing more of the same antibiotic.

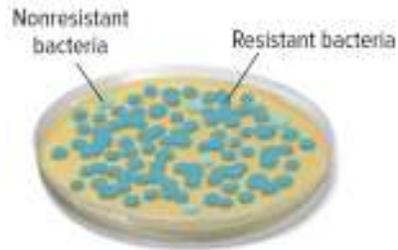


BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Figure 1.25: How a population of bacteria develop resistance to antibiotics (D)

- The antibiotic now affects only a small percentage of the bacteria.
- The surviving bacteria continue to reproduce.
- Most of the bacteria are resistant to the antibiotic.



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Discussion Questions

- What are antibiotics? How are they used?
- How would you describe antibiotic-resistant bacteria to a grade 3 class?

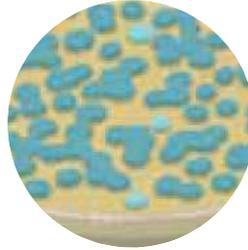


BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Discussion Questions

- Why do you think the medical community is concerned about antibiotic-resistant bacteria?



BC Science Connections 8, Copyright © McGraw-Hill Education

TOPIC 1.6 What medicines help protect us from microbes that make us sick?

Summary: What medicines help protect us from microbes that make us sick?

- Traditional First Peoples medicines and treatments come from resources in nature.
- Vaccines can help us prevent infections.
- Antibiotics can treat bacteria infections.



BC Science Connections 8, Copyright © McGraw-Hill Education