Lesson Plan 2: Understand the differences between various microorganisms and their interaction with humans

This section will focus on identifying differences among the microbial life forms in terms of their size, shape, structure, interactions with humans and effects they have on human life. There are 5 activities in this session.

Time: 2 hours and 30 minutes

Requirements:
Computer and an internet connection (for YouTube videos)
Screen and projector
Cue Cards for Activity 2
Glo Germ™ and UV lamp (available on amazon or www.glogerm.com) OR glitter for Activity 3
Activity sheets
Flipchart (if possible) or a blackboard

Activity 1:
Introduction to different microorganisms

Time: 15 minutes

Make a student read aloud the poem below and ask the class what they think the poem is about.

We are vast and small but we cover it all,

On stones, on walls, and even your skin we crawl,

Various places some thrive,

While the rest decline,

Now watch as our presence stand tall.

Source: biol342.community.uaf.edu

Image source: macrovector /Freepik

Watch the video and make a note of the different kinds of microbes around us- bacteria, viruses, fungi, algae and protozoa.

Activity 2: In this activity, students will learn about the different classes of microorganisms through a fun group activity.

Time: 45 minutes
Facilitator: Do you know the different kinds of microbes around us? Let's play a game.
Game: Cue card activity (Who am I?) (For the cue cards, click here)
Facilitator: Each of the cue cards describe a microbe belonging to different classes or its function. Each of you will get one of the cards randomly. You have to identify which of the 5 microbial families your cue card describes, and find your classmates who have cue cards describing the same group of microbes.

(The facilitators review whether the children have rightly identified the clues and take help of rest of the class to re-group the children that might have made mistakes.)

After this activity the students get the "**Know my Powers**" group activity sheets (click here for activity sheets). This activity is to reinforce the characteristics of each class of microbes that was covered in the Activity 2.

Facilitator: In this activity - Know my Powers, each group will get a sheet with a picture with the name of the class of microbes. You are expected to write its salient features. After that one student from each group will have to read out your answers for the entire class.

Activity 3: ***The following activity will help in understanding how easily microbes spread and most often without our knowledge.***

Time: 30 minutes

Preparation: If this activity follows the previous activity, then the cue cards (in the previous activity) will have Glo Germ™/glitter on them so that it spreads among students in the class while performing the previous activity.

If this is an independent activity, then Glo Germ™/glitter can be placed on the hands of the facilitator with the facilitator shaking hands with the children at the beginning of the session. It can also be placed on other material like notebooks/papers/pens etc. that will be distributed to the children.

Facilitator: Where do you find these microbes? Can you see them around you?

Expected outcome: We can't see them because they are too small. But they are around us in many different ways - in beneficial ways such as in yoghurt or in our gut, some like paramoecium that live neutrally and don't bother us in our daily lives or others that cause diseases.

Facilitator: What do you think is the most common way these microbes spread?
Expected outcome: air, water, soil, contact.

Image designed by Katemangostar / Freepik

Facilitator: Yes, contact! What is the most common form of contact, how do you mostly touch your friends or other objects?

Expected outcome: Through hands.

Facilitator: You have all taken a bath in the morning. Do you think your hands are clean right now?

With Glo Germ™:
Expected response 1: Yes, we think they are clean.

Facilitator: Are you sure? Let's see them under this machine? (Put their hands under the UV lamp and some of the students will have Glow Germ on their hands.)

Facilitator: So now do you think your hands are clean?

Expected outcome: No.

Facilitator: Well, this was a trick played on you with a special material that can be seen only under this UV lamp. We wanted to show you that we can have things on our hands that we can't necessarily see. Similarly, do you think we have microbes on our hands too that we can't see?

Expected outcome: Yes, we can't see them because they are too small. But if we had powerful microscopes we could see them clearly. (visit www.glogerm.com for other lesson ideas with glogerm)

Or
With glitter:
Students notice glitter on their hands.
Expected answer 2 : Yes.
Facilitator: How did you get these on your hands?
Expected outcome: By contact from the cue cards/shaking hands

Facilitator: Imagine that I was sick and sneezed on my hands, after which I shook hands with all of you. In such a scenario, what you see on your hands here is not glitter but harmful microbes from my sneeze. Since we cannot see microbes, we wanted to use this experiment to show you how easily microbes can spread. From just one person, can you see how quickly and easily the microbes can spread to all of you?

Facilitator: Even if I did not shake hands with you, we could have touched the same objects such as door knobs, cue cards etc., which could also be a means for the microbes to spread.

Facilitator: Now look at each other's faces. Do you see the microbes on your friend's face? Where? Expected answer: cheeks, around the mouth, nose etc.

Facilitator: From your hands, they can easily spread to your face, mouth, nose etc. since we are often touching these. From there, they can easily get into our bodies as well.

Facilitator: Now wash your hands and check if you have gotten rid of the glitter from your hands.

Facilitator: Check again using UV lamp. Good hand washing practice can be taught here by showing them where all the Glo Germ™/glitter remained on their hands - Palms, fingers, between fingers, back of the hand, thumb, under the nails. Washing hands for 20 seconds (singing happy birthday twice!) using regular soap and clean water is generally considered a good practice to get rid of most of the microbes.

Dettol – 6 Steps to proper hand washing

Optional video that illustrates how microbes spread through contact

Activity 4: ***The following discussion will touch upon the relationship between humans and different types of microbes.***

Time: 20 minutes

Facilitator: How do we interact with all the different microbes around us and inside us? Do we happily share our space and food with them? Or are we always competing against each other? Are all of the microbes inside or on our bodies harmful for us? Or are some of them our friends too? How?

Facilitator: You will get an activity sheet (Know thy Smaller Neighbours) which has the three options of microbes' relation with us - neutral, friendly, harmful. You will choose the correct option, according to you.

The group activity sheet will look like this:

Microbes are (put a tick in the correct option)		
Our friends	Annoying	Don't do anything to us
Examples	Examples	Examples

After they fill in the sheets, go through the following discussion:

Facilitator: Microbes as friends - how many of you think so? Why?
Expected outcome/ points to be discussed here: There are very many microbes that are extremely useful to us. For example, we harbour about 100 trillion bacteria in our bodies, which have a huge impact on our health and well-being. These microbes in our body are called microbiome and they are present all over our body like skin, gut, eyes etc.. Microbes in our gut help us digest our food and maintain our body physiology well.

Why do some microbes want to be friends with us - to get readymade food and shelter from us. Why do we want to stay friends with them? Because without them we won't be able to do a lot of important functions like digestion well enough. There are also microbes in soil that help the plants to grow well by nitrogen fixation. They also help decompose waste material, treat sewage and recycle important nutrients in nature. In fact, they are so important that we will not be able to survive without them! Video explaining good microbes.

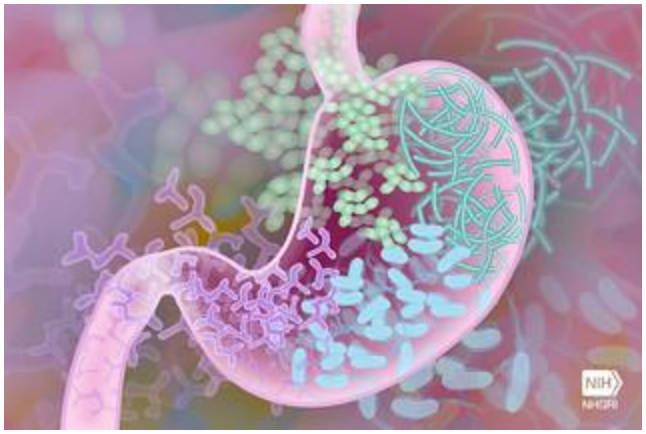

Image Credit: Darryl Leja, NHGRI, NIH/Flickr

Facilitator: Microbes as annoyance - How many of you think so? Why?
Expected outcome/points to be discussed: Some microbes cause diseases.

Facilitator: Do we like to get diseases? Obviously, not! These disease-causing microbes are also called germs or pathogens. But we call these as bugs. So, whenever I say bugs, it means ____? (Fill in the blank: Disease causing microbe/germ) Do you know which of the microbes that we just discussed cause most

of the diseases? Most of the diseases are caused by bacteria and viruses, while some are due to protozoa and fungi.

Image: pxhere.com

Facilitator: Why do they cause discomfort to us? Because once they are inside our bodies they grow. And to grow they need food, just like we do. Where do they get this food from? From our bodies. They take our food, and make us weak. Some of them also release toxins making us sick.

Facilitator: Can we fight these bugs? We will discuss this in our next activity.

Activity 5: ***This section will discuss the different ways humans (can) fight microbes for a healthier life.***

Time: 40 minutes

Facilitator: We will now discuss another interesting part to this story - different microbes have different ways of growing in our bodies. Why do you think it is important to know this? Because then the solutions to stop their growth in our bodies are also going to be different. Facilitators to become microbes themselves and show us what these microbes talk about with each other.

The following role play also touches upon how microbes spread easily from one place to another, and how different microbes follow different modes of infection.
Role play developed by Dr Ponnari Gottipati, Consultant - Research Management, Science Education and Public Engagement, Hyderabad

The instructor to do a role play on how bacteria infects us and viruses can infect bacteria and us.

Facilitator: Would we want to stop their spread?
Expected answer: Yes, specially the disease-causing ones.

Facilitator: How?
Expected answer: Through sanitation and hygiene - washing hands before eating, after going to the bathroom, maintaining cleanliness, etc.

(iii) The following discussion is on the different ways humans are able to fight disease-causing microbes, with and without external help.

Facilitator: But once they are inside our body what can we do about it?
Expected answer: We would like to either stop their growth or kill them.

Facilitator: How are our bodies able to kill the bugs once they enter it? What abilities do they need to acquire?

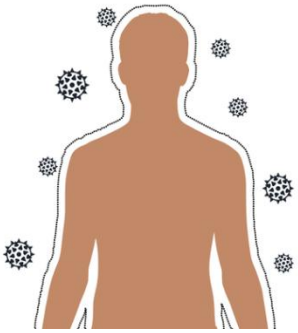

Image: Immunity_ graphic.png

Expected outcome/ points to be discussed: By identifying the bugs that enter our body. And then learning to remember what these bugs look like, so that the next time they enter our body, they are killed even more quickly. The ability to identify and remember any foreign particle in our body is called immunity.

Facilitator: (Put up a slide to show) what is immunity, in simple terms. Humans, dogs, cats, horses can all do this and thus have immunity. It is part of our competition against the bugs. And when we are fighting against the bugs, we need to rest so that our bodies are not over stressed.

This video explains how our body defends itself against microbes

But sometimes microbes can overcome our defense mechanisms and start growing in large numbers in our body. That is when they make us sick.

Facilitator: Are there other ways of killing microbes? Maybe there are also other living organisms that can also kill them? Any guesses? Who else can also kill microbes? Who else might want to kill microbes? Who are the other angry neighbours of these microbes?

Expected answer: Other microbes. One group of microbes would not like other kinds of microbes to grow in the same space - as probably they don't like to share their food and space.

Facilitator: But how would one microbe kill the other? Let's take a look at this video -
(Take the first 1.16 min of the video)

Facilitator: So, what else can kill microbes?
Expected answer: Antibiotics such as Penicillin.

Facilitator: And who makes these antibiotics?
Expected answer - Fungus.

Facilitator: And what is killed by it?
Expected answer: Bacteria.

Image: pxhere.com

Facilitator: Thus, humans found out these miracle drugs called antibiotics that are made by fungi against bacteria. Moreover, some bacteria also kill other bacteria *via* chemicals that can also be used as antibiotics. For example, streptomycin and tertracycline are made from soil bacteria. We now know many different kinds of antibiotics. Some stop the bacteria from growing, some kill the bacteria right away by making a hole in their cell walls or by causing other damaging things to the bacteria. And once we, humans, got to know about the structure of antibiotics, we also learnt to modify those structures and started making them in large quantities in industries.

Facilitator: In India alone in the year 2010, we used 12.9 billion antibiotic pills all over the country, and on an average every Indian takes about 11 antibiotic pills in one year. In the USA, each person takes about 22 antibiotic pills each year.

Closure

Facilitator: Remember that antibiotics are chemicals made by other microbes to kill bacteria. So, when you eat them they can also kill the friendly bacteria in your gut that help you digest your food. It is also very important to remember that antibiotics can act only on bacteria, and not on any other types of microbes. So, before you pop in an antibiotic pill, you must know whether you are feeling sick due to bacteria or other microbes like viruses, fungi or protozoa.

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