



Me Against the Superbugs

- A workshop by Sonal Katyal -

This workshop informs young people about antibiotic resistance, by helping them understand the science involved. The major tools used are dialogue, games, role-playing and dramatics.

Target Audience: Class 11-12th students/15-18 year-old people

Duration: 9-11 hours (divided between 3-4 days)

Ideal group strength: 30-32 people

Common Requirements:

- To be brought by the participants:
 - Glue/Stapler
 - Pencil/pens/coloured pencils - as per the participant's preference
 - Eraser and sharpener
 - Notebook/clipboard to put provided sheets on



1 - Letters from Planet Z

- **Summary:** This activity will introduce the topic and the educator/communicator (if needed), engage the emotion of the participants and will also serve as a warm-up session.
- **Prior knowledge required:**
 - Microbes can cause communicable diseases.
 - What is animal husbandry/animal rearing farms (although that can be cleared later as well)
- **Key vocabulary attendees will build:**
 - Infection
 - Diseases
 - Bacteria
 - Medicines
 - Antibiotics
 - Animal Husbandry
 - Superbugs
- **Duration:** 60-90 minutes
- **Requirements - Links to printables/useful resources:**
 - [Activity trail map \(The knowledge trail\)](#)
 - [Pre-workshop evaluation forms](#) (if evaluating the workshop)
 - [Picture of an honour badge I made](#)
 - [Ground rules](#)
 - [The narrative about Planet Z and agents](#)
 - [Letters](#)



- **Activities:**



- After the attendees settle down, share the **trail map** (which will have a unique agent code written on it if the workshop is being evaluated - you (the educator/communicator) will have to write them manually after printing them), an **honour badge** that will act as a name label and a badge, and the **pre-workshop evaluation forms** (if you are evaluating the workshop).
- Ask them to fill out the **evaluation forms**. To keep anonymity, they shouldn't mention their names in the forms. This can help ensure you receive honest responses. Instead of names, they will mention the unique agent code written on their trail maps.
- This workshop is nestled into a fictionalised story that a planet, Planet Z, is under a health threat. Read the **narrative** provided in the resources above, or else feel free to build your own narrative!

Combining storytelling with activities can help build focus and enhance participation. This session sets the context of the narrative. Hence, sticking with the story from the beginning will be great.



- Introduce yourself as the super-agent who will train the participants to fight against the enemy on planet Z.
- Tell the attendees about the **trail map**, which enlists all the levels they need to complete to become a superhero and earn honour symbols.
- This session will also cover the **ground rules**. Make sure everyone understands them clearly before the activities begin.
- Next, ask them to write their names on the **honour badge** and pin them. This badge can be a rectangular strip of card/thick paper of any colour that can be attached to a shirt by a safety pin. It should have enough space for the attendees to write their names in a big font (visible from a small distance) and pin honour symbols. Honour symbols can be ribbon bows, stars, stickers, or any other DIY badge you would like to create, which will be awarded after the completion of each session of the workshop. Make sure that whatever you use as the honour badge and symbols fits within the workshop's low-resource/low-cost requirement. Do not use sticky labels since they will wear off after one day. You need something the attendees can reuse for all days of the workshop.
- Next, start the letter reading and listening activity.
- Letters from Planet Z:
 - Take a look at the five letters provided in the resources above. Print them and enclose them in sealed envelopes. Or showcase them like an email on the screens. These letters are written by the fictionalised characters on Planet Z. The first is by a teenager, second by a researcher, third by a doctor, next by an animal husbandry owner and last, by a patient. Each letter covers a problem situation they are facing (similar to what we face in real life) due to antibiotic resistance/superbugs. The shared narratives in the letters are not very descriptive of antibiotic resistance but will just provide a hint to the listener, like a tease. For e.g., a letter from a doctor saying I have been prescribing this medicine for years, but it is somehow not working at all; I am helpless.
 - The letters engage the emotion of the attendees. They are supposed to listen to the letters carefully, analyse what they have heard and understand what threat is looming on planet Z and how they can help.



- Ask the attendees, who among them are good orators, or enjoy public speaking. Yes, this might give a chance to students who usually get public speaking opportunities. However, the activity requires understanding the letters with clarity and the correct tone. It's like performing a small piece of theatre in itself. The overall workshop design ensures that other attendees are given a chance to perform in all other activities and enhance their oral communication skills. In the skit activities, for example, everyone gets an equal opportunity to portray a character.
- Hand over the five letters to the selected attendees. These five attendees read the letters out loud to everyone in the following sequence:

1. Faby (the teenager)
2. Dr Khoj (the scientist)
3. Dr Roshini (the doctor)
4. Farmie (the animal husbandry owner)
5. Nori (the patient)

This sequence is essential as it reveals the issues on the Planet in an order that can be meaningful to the attendees' understanding. Feel free to change the order if you want to experiment with the narrative or even create your own letters!

- Give the attendees ample time to read the letters and rehearse them before they perform the reading to everyone.
- Another way to deliver this activity could be by giving letters to all the attendees in pairs.
- After each letter is read, ensure all the attendees understand it or if they would like a second reading. Sometimes an attendee's pronunciation and reading style might not be suitable for some attendees.
- After all the letters are read, ask the attendees what they inferred from the letters. What were the problems on planet Z? They should be able to pick the keywords and ideas like 'medicines not working', 'something called superbugs being the culprit', 'terms



superbugs and bacteria having some connection' and 'treatments becoming longer and expensive'. If they are unable to point out some crucial idea, guide them towards it (instead of directly telling them about it). For example, instead of saying, "...and the regular medicines used by the doctor are not working", ask them, "What did the doctor say about the problem with the medicine?".

- At the end of the activity, award the attendees with their first honour symbol.

THE FIRST MILESTONE IS COMPLETE!!

- **Expected learning outcomes:**
 - ➔ The context for the workshop is set
 - ➔ The stage for the narrative is made clear. The attendees will understand their role in the story.
 - ➔ The attendees are excited and curious about what lies ahead.

2 - Know Your Foe

- **Summary:** This activity focuses on recollecting what bacteria are, their structure and how some bacteria are economically important, some benefit our body functions, while some cause diseases.
- **Prior knowledge required:**
 - ➔ Bacteria are unicellular organisms, and their prevalence around us
 - ➔ The basic structure of bacteria, up to a level covered in class 9 - size range, cell membrane, cell wall, DNA (chromatin) material
 - ➔ Role of bacteria in medicine, agriculture, industry
 - ➔ Some bacteria can cause diseases like typhoid and TB

Please note that only basic knowledge is required. This activity aims to recollect the knowledge and build it as a piece of information collectively in the group. So even if some students are unaware of some of the points, they will learn about them by the end of this session. So the above knowledge is not a mandated prerequisite.



- **Key vocabulary attendees will build:**

- Bacteria/bacterium
- Cell wall
- Protoplasm
- Cell membrane/plasma membrane
- DNA
- Nucleoid
- Unicellular

Please note that the attendees might/might not remember these terms from class 9. Please discuss them briefly while drawing the final picture of the bacterium on the board.

- **Duration:** 45-60 minutes

- **Requirements:**

To be provided by the school/venue:

- Blackboard/whiteboard/green board
- Coloured chalk/markers
- Duster

To be provided by the educator (printable resource):

- [Activity sheets](#)

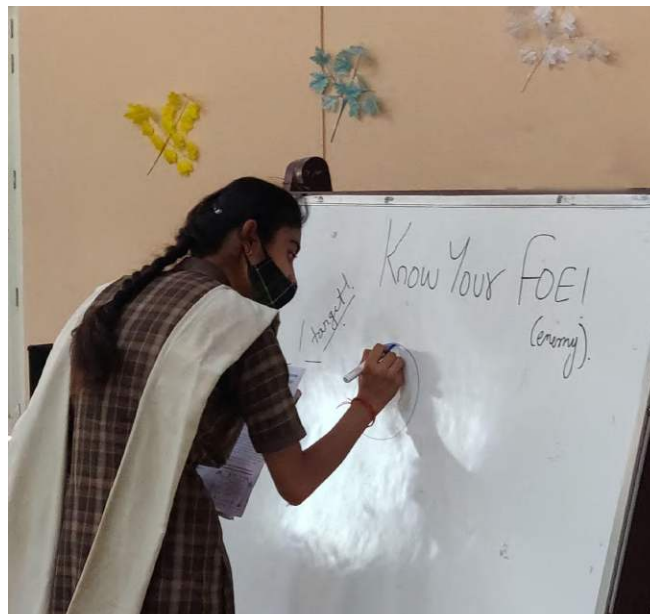
- **Guiding questions for the lesson plan:**

- What are bacteria?
- What is the basic structure of a bacterium?
- What are the economic benefits of bacteria?
- What are good bacteria?
- What are some diseases that bacteria cause in humans?

- **Activity:** One letter from Planet Z, read out in the previous session, says that the superbugs attacking their planet seem like bacteria found in their atmosphere and those found on earth. To fight an enemy, one must understand how they look and function.



- Distribute the **activity sheets** to all the attendees. You can print the printable pdf in the resource list above.
- Ask the attendees (now addressed as agents by the educator) to draw a bacterium in as much detail as they remember. The activity sheet has guiding questions that can help them draw. These questions focus only on the points required to understand superbugs and comprehend other sessions of this workshop. For example, concepts like protoplasm, presence/absence of Golgi complex, and flagella are not in focus as that is a piece of information not required in the context of this workshop.
- The activity sheet also asks to enlist benefits from bacteria. In addition, it has a list of diseases, and the attendees are required to circle the ones they think are bacterial diseases.
- Give the attendees 15 minutes to fill in the activity sheet.
- After they are done, call one of the participants to draw a part of the bacteria structure on the board, which is the answer to the first question in the activity sheet.
- Next, ask if everyone agrees with the participant's drawing or if anyone has a different answer. If someone disagrees, let them come and draw what they think is the answer.
- Like this, let the students build a complete picture as a collaborative effort.





- After a final picture is drawn, correct the drawing if required (or add if anything is missing) and discuss the final drawing with them. Discuss the role of the cell wall, cell membrane and nucleoid.
- Next, discuss the benefits of bacteria.
- Lastly, discuss the diseases. A fun way to do so is to ask about each disease and let them raise their hands if they think it is a bacterial disease. Reveal the answer after that. You can also record the number of students who raised their hands for each disease. This can be helpful if you plan to evaluate the change in knowledge after the workshop.
- After discussing all the diseases, revise which ones are bacterial and what are the causative agents of others, once again, so that they remember it better.
- If you got the pre-workshop evaluation forms filled, it would be a good idea to look at the responses about harm and benefit from bacteria before you start this session. This can benefit the discussion during the session.
- After the completion of this session, award the second honour symbol.

THE SECOND MILESTONE IS COMPLETE!!

- **Reference video:**

<https://drive.google.com/file/d/19QOT0y3zRCp9THCOMkw8r1yQEsXELnT8/view?usp=sharing>

- **Expected learning outcomes:**

- ➔ Structure of a bacteria
- ➔ Nucleoid is a region where the genetic material of a bacterium is located
- ➔ A cell wall protects a bacterium from attack and harsh conditions
- ➔ DNA material's role in bacterial division
- ➔ Benefits from bacteria
- ➔ Pathogenic bacteria as disease-causing agents
- ➔ Collective knowledge building
- ➔ Analysing prior knowledge and improving it after gaining new information

- **References and additional resources:**

- Selina Concise Biology Class 9
- Srijan Biology For ISC School For Class-11 by Veer Bala Rastogi



3 - Attack and Defence!

- **Summary:** Through the help of 4 games and some dialogues, this session will help students understand that:
 - Antibiotics destroy bacteria - by either killing them or slowing their growth.
 - Defence mechanisms shown by bacteria (against antibiotics)
 - Antibiotics can work only on bacteria and not on viruses.
 - Superbugs are bacteria that have developed mechanisms to resist the attack of multiple antibiotics
- **Prior knowledge required:**
 - What are bacteria
 - The basic structure of a bacteria
 - Antibiotics are medicines/drugs we take when we get an infection/we are ill (the message that antibiotics are meant for and work only on bacterial infections/diseases will be covered in this session, so prior knowledge of this fact is not required)
 - Like some bacteria, certain types of viruses are also microorganisms in our environment that can cause diseases.
- **Key vocabulary attendees will build:**
 - Bacteria
 - Bacteriostatic antibiotics
 - Bactericidal antibiotics
 - Resistance
 - Defence mechanisms
 - UTI
 - Mutation
- **Duration:** 110 - 135 minutes
- **Requirements:**
 - Newspaper cuttings (1/4th of each page or A4). Number of papers - as required for the specific place provided by the school
 - Some pebbles (= to the number of papers)
 - Outdoor space/activity area in the school to play the games that involve running



- [Code cards](#) for Game 2 ('No more') (Print the linked code on card paper or any thick paper)
- Broad tape/chalk powder/chalk
- Printed [maze booklets](#) for Game 3 ('A-maze-ing')
- [Tippy tippy Top or stop props](#) (no. = half the number of participants)

- **Guiding questions for the lesson plan:**

- How does our immune system protect us from infection?
- Can antibiotics cure viral infections as well?
- What defence mechanisms do you think some bacteria have developed against antibiotics?

- **Activities:**

The attendees have revised what bacteria are, and they know that the threat on Planet Z is connected to bacteria, so now they know their enemy well. Also, Dr Khoj said that the superbugs on their planet are somewhat like the bacteria found on earth. However, they only know what bacteria look like and what is the function of their structural parts. To beat an enemy, one needs to know how one can attack it and what defence mechanisms the enemy can use. To do so, they need to understand how humans are destroying harmful bacteria on planet earth. They also need to understand what mechanisms some bacteria have adapted to defend themselves and hence become resistant. Let them know that this session will train them with this knowledge!

- First, discuss briefly what happens when any germ enters a human body - the role of our immune system as the first and a very important line of defence. This is to emphasise that not all infections need medicines.

If the school has resources like projectors or a TV screen, this video can be shown:

https://www.youtube.com/watch?v=IXfEK8G8CUI&ab_channel=Kurzgesagt%E2%80%93InaNutshell

If not, the educator can have a short discussion emphasising the following points:

- The skin is the first line of defence
- When any infectious agent, like bacteria, enters our body, say from a cut, our immune system fights with it



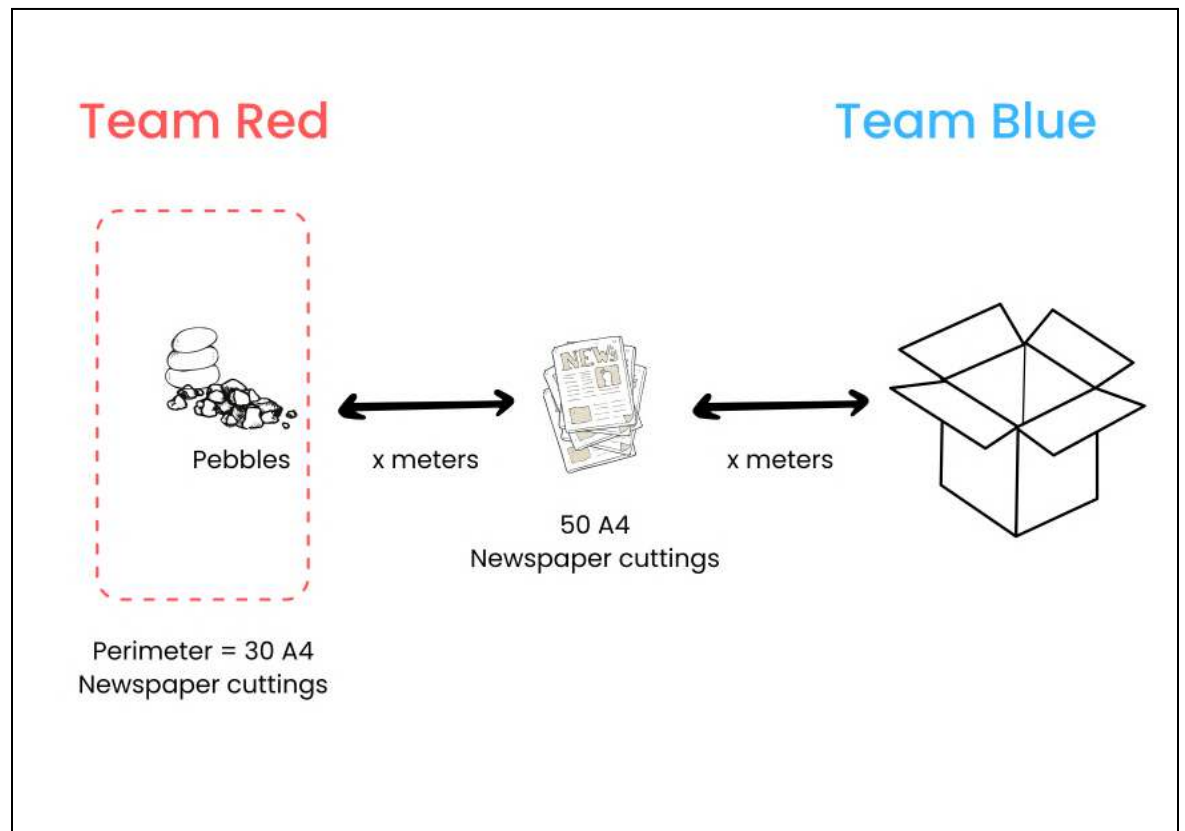
- Sometimes the immune system is enough to fight infections, and we do not need any medicine/drug to cure them. A discussion with your local physician or teacher can help you understand when one should go to a doctor or take medicine.
 - Different types of cells in the body fight the infection; some kill the germ, some store a memory about it, making you immune from the infection for a long time, and some help communicate about the infection/infection-causing agent between different cells.
 - There are times when the body is unable to fight infection. The symptoms do not go, the disease gets worse, or you have a deeper cut in the body that can be risky. In such cases, under a doctor's advice, medicines are required.
 - In the following games, we will learn more about the interaction between a specific type of medicine and bacteria.
 - The medicine/drug that is specifically taken to kill or neutralise bacteria is called an antibiotic.
- Then, the participants will play four games. Please note, do not reveal the analogy of the games with bacteria and antibiotics before the game is played. Explain each analogy in the discussion part after the games. Let the students play the game in their free spirits!



Game 1 - Line align decline!!

Location: Outdoors

Agents (attendees) will be divided into two teams. Team **Red** and **Blue**. A stack of 50 A4-sized newspaper pieces will be kept in one place. (The number of papers in this activity is subjective to each school and area. 50 is chosen here just to explain the idea).



On one side of the pile, at some distance (say, x), will be an outline of a rectangle on the ground. This could be marked by chalk or tape. This is team **red's** station.

An empty box will be kept on the other side of the pile at a distance the same as that between the pile and team red's station (x). This is team **blue's** station.

The task of team **red** is to collect newspaper cuttings from the pile in the centre and line them one by one on the rectangular outline at their station to cover the perimeter. Some small pebbles can be kept near the rectangle. These can be used



to prevent newspapers from flying away. The number of newspapers that can cover the perimeter should be checked beforehand and fixed so the students know they cannot cheat and try covering with fewer numbers. Let's say, in our example, to cover the perimeter of the rectangle, 30 newspaper cuttings will be required.

Team **blue's** task is to stop team **red** from doing the above by collecting newspapers from the pile in the centre and putting them in the box kept at their station. They need to ensure that team **red** might not get enough papers needed for their task (30 in this case).

Before the game starts, each team will stand at their station in a line. At the blow of a whistle or any other signal, they will start running. The line has to be maintained throughout.

What's the catch?

From each team, at one point, only one player can run to the pile and come back to their station. The next person will start running only after the previous participant is back in their line. They will join at the back of the line. Also, the participants can pick and bring only one paper cutting at a time.

Analogy

This activity will denote how some antibiotics are bactericidal, i.e., kill the bacteria. One way is not to let bacteria form their cell walls (inhibit cell wall synthesis). Overall bactericidal antibiotics inhibit a function or enzyme that is essential for the bacterium's survival. Here team **red** is analogous to **bacteria** and **blue** to **antibiotics**.

How do we decide how many papers to keep in the pile? What if team red wins?

Before starting the activity and after drawing the perimeter line at the station of the red team, measure how many newspaper cuttings it will take to cover the rectangle. Let's say it is 30. The chance of team red winning means they get 30 papers before the pile runs out of them. If both teams run at the same speed, then for the blue team to win, we should have less than 60 papers in the pile. Hence, place 45-50 papers in the pile to be on the safe side. This almost ensures that the blue team will only win. So,

No. of papers in the pile = (No. papers required to cover the perimeter of the rectangle) - 10 (or 15)



You can even play this game twice, switching teams in the second round. Some audiences usually appreciate the game more if they play once as each team.

Reference videos:

<https://drive.google.com/drive/folders/1FYxK-7xjIXSz1TfWofueHlrtXgYHNmmQ?usp=sharing>

Game 2 - No more!

Location: Outdoors/Large hall

Divide the attendees into three groups.

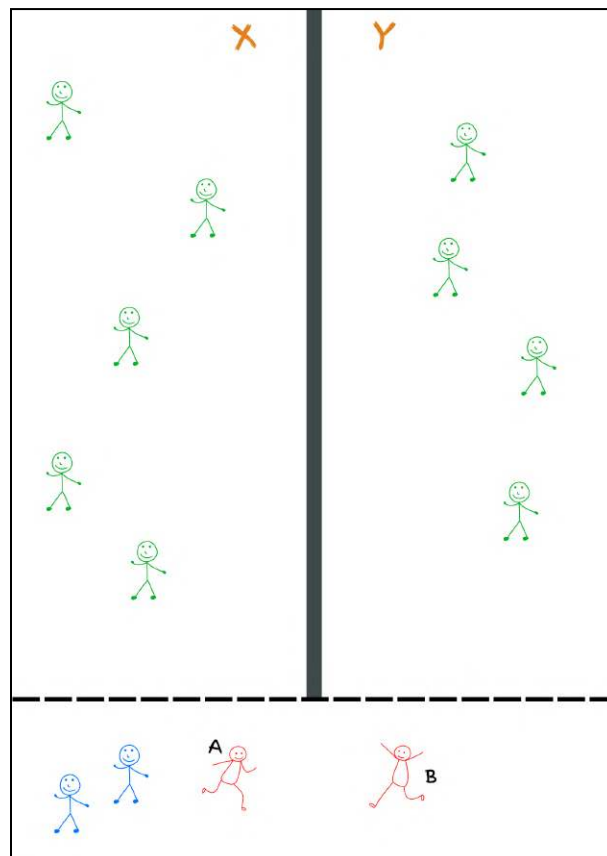
Group 1 - Team **Red** (You can choose any other name instead of red). This will have 2 members when the game starts.

Group 2 - Team **Blue** (You can choose any other name instead of blue). This will have 2 members throughout the game.

Group 3 - Team **Null** - All the remaining attendees will be in this group.

Starting positions

Make a line in the centre of the activity area, dividing it into two halves. You can use chalk or tape. Half of the people in team **null** will stand on the LEFT side of the line (area 'X') in a randomly dispersed manner (fairly distanced from each





other). The remaining half will stand on the RIGHT side of the line (area 'Y'). The 2 people from team **red** will stand on one side of the room, a little far from the team **null** members. One person will stand on the left side of the dividing line and the other on the right side. Team **blue** will stand on any side, somewhere behind the team **red** members. Team **red** members will have a card paper in their hand with a **code** (see link in the requirements list above) written on it.

Aim of the teams:

For a team to be stronger, it needs to build its army. This is the target of team **red**. Now how does their team grow? Existing members have a special 'team **code**' with them (written on the card paper). If they share the code with a new person (from team **null**), the person gets added to their army. The mission of team **blue** is to stop this growth in the army of team **red**.

Game starts!

Let's say there are 13 attendees. **2** will be in team **blue**, **2** in team **red** (**Person A** and **Person B**), and **9** in team **null**.

The first rule of the game is that anytime anyone moves or runs, they have to do that one-legged (aka langdi tang)!

A and **B** will be given one card each (with the secret code). When the game starts, **A** and **B** will run, one-legged, to catch someone from the team **null**. Team **blue** will start their game 5-6 seconds after team **red** starts running. They try to catch **A** and **B**. People from team **null** will be standing stationary in their positions.

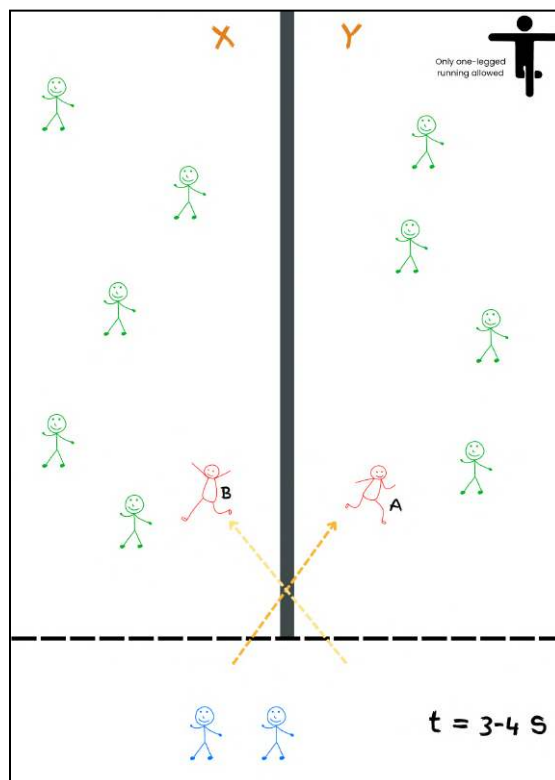
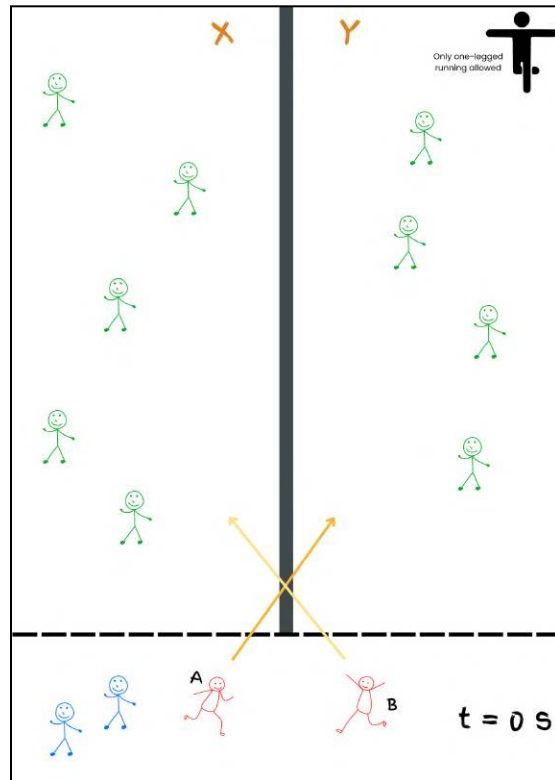
What's the catch? The criss-cross rule!

There is a special rule for team **red**. If a person (from team **red**) starts running from the left side of the dividing line, they can only run and catch someone from team **null** on the right side (area 'Y') of the dividing line. The person who starts running from the right side can only catch someone on the left side of the line (area 'X'). Team **blue** doesn't have to follow the criss-cross rule and can run, one-legged, in any direction.



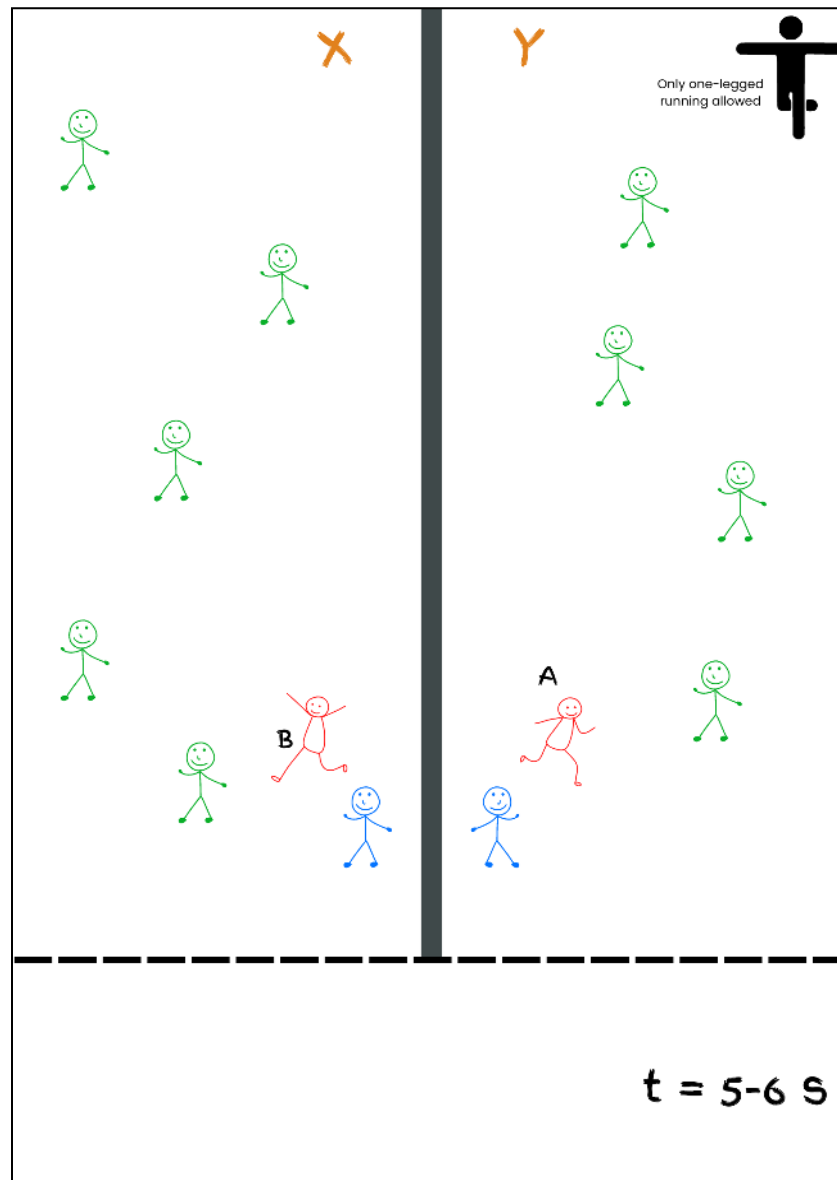
Gameplay

Let's say that **A** is standing on the left side of the line and **B** is on the right. When the game starts, **A** runs, one-legged, to the right side and tries to catch someone from team **null**. **B** does the same but on the left side of the line.

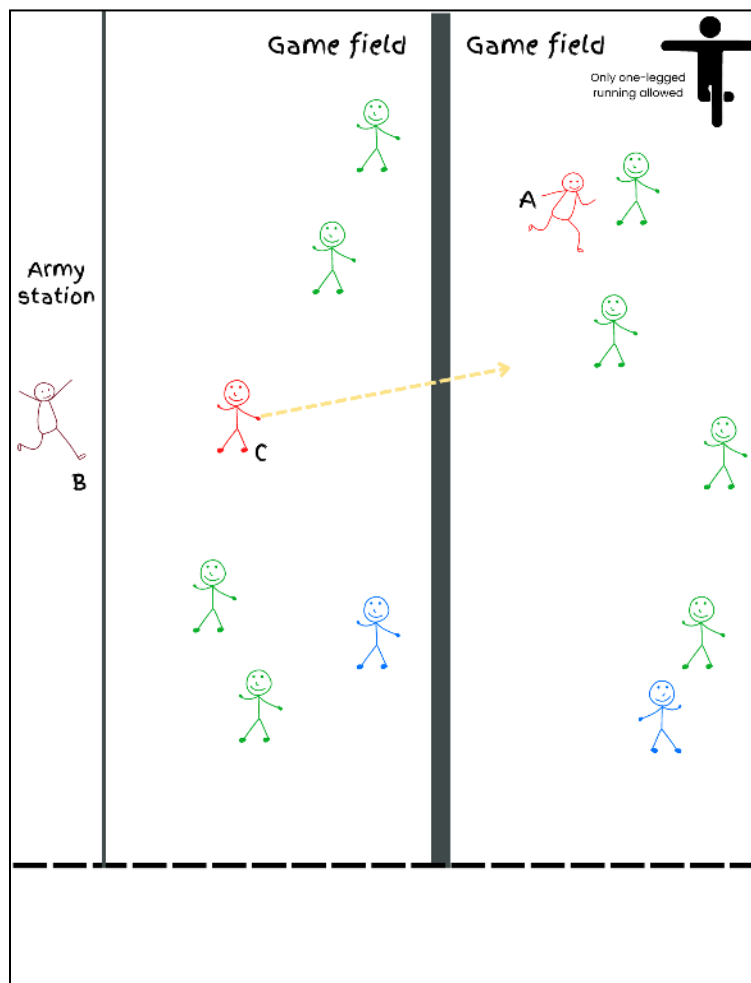
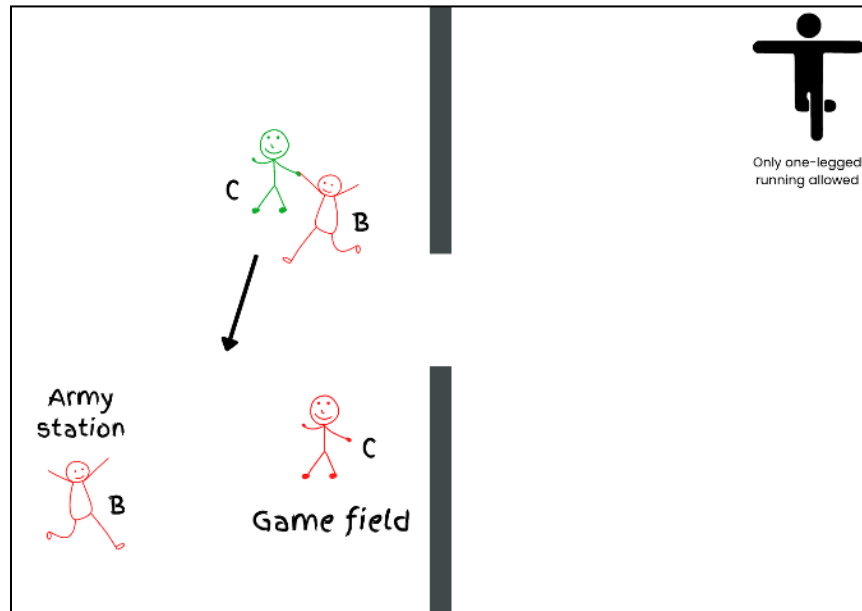




After a few seconds, the educator signals team **blue** to start their game. The two members of the team **blue** run one-legged and try to catch **A** and **B**.

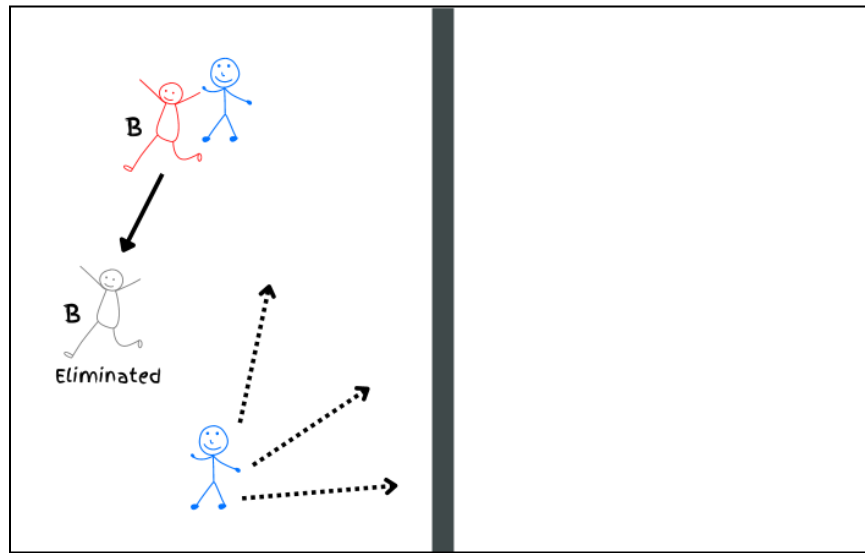


If **B** catches person **C** from team **null**, they will have to give the code card to **C**. Then **B** will go and stand in the **army station**. They will still be part of the team **red** army but won't be a part of the gameplay anymore. Now **C** has become a part of team **red** and continues the work of growing their army. **C** will now run, one-legged, to catch another person from team **null**. Since **C** started from the left side of the dividing line, they will run and catch on the right side of the line.





At the same time, team **blue** needs to stop this growth in team **red's** army. If a team **red** member is caught by anyone from team **blue**, they are out of the game, i.e. eliminated. Team **blue** will then go on to catch the remaining (one) member of team **red**. Team **blue** needs to catch only those team **red** members running in the field, not those in the army station. Also, remember that even team **blue** needs to run one-legged.



The game ends when either 1) team **blue** catches both the running members of team **red**, and thus no one from team **red** is left in the field, or 2) all members of team **null** are caught (have been shared the code) and team **red** has completed the task of growing its army.

Analogy

This game will denote that some antibiotics are bacteriostatic and stop the growth of bacteria by affecting their replication or metabolism. Team **red** member catching team **null** member is equivalent to a bacterium dividing and making a copy, i.e. growth in a bacteria colony. Team **blue** catching a team **red** member is equivalent to antibiotic stopping or slowing the growth of bacteria. The game rules have nothing to do with the analogy. They are just meant to make the game fun and challenging.

Reference video:

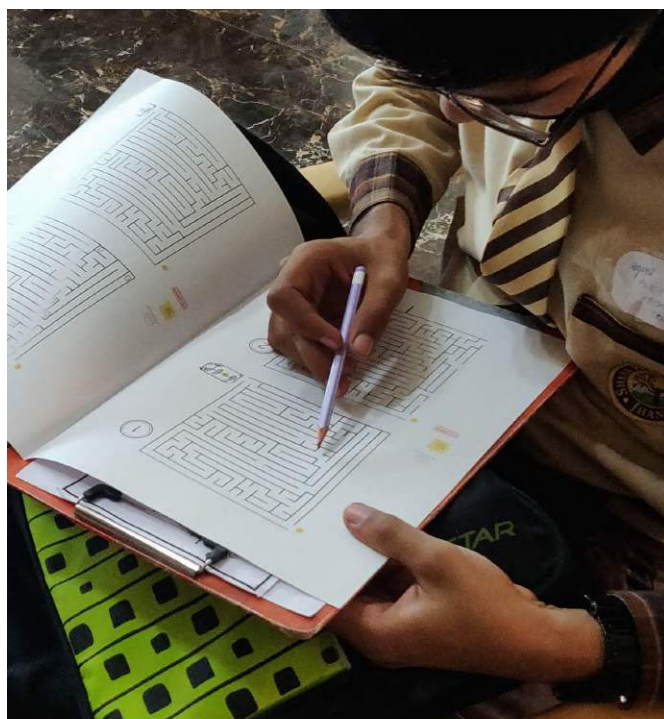
https://drive.google.com/file/d/19Rr68432CU-cQY1JCm4z5BZdq_Jsh2wH/view?usp=sharing



Discussion round 1

After the first two games, bring everyone together and discuss the analogies of the first two games. Help the attendees understand what the terms bacteriostatic and bactericidal mean. Next, play Game 3.

Game 3 - A-maze-ing!



Location: Indoors

Print the [booklets](#) given in the resources and give one to each attendee. The booklet has 5 maze puzzles that the attendees need to solve in 5-7 minutes. The rules of the maze are given in the booklet itself. The goal of each maze involves reaching the treasure box at one end of the puzzle and opening it with a circular key.

The first maze will be a success. In the second maze, no matter which path the participants choose, they will end up back to the outside of the maze. In the third maze, all paths will lead to different red monsters (that they cannot cross or else they lose). In the fourth maze, there will be no entry point. In the last maze, the participant will reach the box, but unlike in the other maze puzzles, the shape of



the keyhole in the treasure box will be a triangle, while their key to the box is a circle, so they cannot open the box.

Analogy

Reveal the analogies only after playing the game.

These puzzles denote the defence mechanisms shown by resistant bacteria.

- The first maze denotes that antibiotics kill/stop the growth of bacteria. Reaching the treasure box and opening it is analogous to antibiotic defeating/destroying bacteria.
- The second puzzle denotes efflux pumps that bacteria develop to throw the antibiotic out.
- The third puzzle denotes the bacterium using enzymes to destroy the bacteria.
- The fourth puzzle is analogous to the cell wall of bacteria being impermeable to an antibiotic.
- The fifth puzzle refers to mutations in the target site in the bacteria where a particular antibiotic typically attacks.
- Refer to the resource links below to read more about the defence mechanisms.

Reference video:

https://drive.google.com/file/d/19JTPbQ_GXHUt-KThANyW97x3OScuWbzc/view?usp=sharing

Discussion round 2

Bring everyone together. Till now, they learnt how antibiotics attack bacteria. Now discuss how bacteria defend by adopting certain defence mechanisms. Reveal the analogies and explain them. Steer the discussion through questions like - “Was anyone able to solve puzzle 2? Why not?” Let them analyse the puzzle critically. This will help them understand the defence mechanisms clearly. After discussing the analogies of all 5 puzzles, revise the defence mechanisms once again to help them remember better. Discuss mutation in detail, as it will reoccur prominently in the next session, and proper understanding will be required. Proceed to Game 4.

Game 4 - Tippy Tippy Top or Stop?



Location: Indoors

The aim of this game is to understand what diseases/infections antibiotics work on. That is, antibiotics can only be taken for bacterial infections and that too after a doctor's advice. They do not work on viral and other infections. Also, fever and stomach ache are just symptoms. They could be due to an infection by any pathogen or other reasons. Antibiotics should only be taken when a doctor identifies that one's symptoms are due to a bacterial infection and the patient requires the antibiotic.

Before the workshop, print the 'tippy-tippy top or stop' sheets and make the game [prop](#) out of them. If there are 30 attendees, you need 15 props (half the number).

During the workshop, divide the attendees into pairs of two. Give one prop to each pair.

In this pair, one person will be an antibiotic (person A), and the second person (person B) will be asking questions to the antibiotic (person B) by playing the



game. This is like the typical tippy-tippy top-top game you might have played in your childhood.

The first inner whorl of the prop has some diseases and symptoms written on it. Person B starts playing the game and sings:

“Tippy tippy Top or stop, what disease or symptom do you want?”

Or

“Tippy tippy Top or stop, choose a disease or symptom to cure!”

Four options will be available to person A to choose from. Let’s say they choose ‘UTI’. Then B asks them,

“Do you think you can cure this?”

At this point, person A, the antibiotic, has to think and answer if an antibiotic can cure or work on a UTI infection. After they say yes/no, person B will open the leaflet of that infection. B reads the answer out loud to person A, and they find out if their guess or understanding is correct. The game will continue till they have discussed all the diseases and symptoms (8 in total).

This game builds the understanding of when and on which infection antibiotics work through team discussion, critical thinking and by asking questions.

After the game, bring everyone together and discuss what they learnt. Go through each disease and symptom and share more about it. Answer any questions/confusions they have. In the end, award an honour symbol to everyone.

THE THIRD MILESTONE IS COMPLETE!

Reference videos:

<https://drive.google.com/drive/folders/1HPAYE469p5ITKcynf-LvW7wzIUmsel8j?usp=sharing>

- **Expected learning outcomes:**

- Antibiotics can be bacteriostatic or bactericidal, i.e. they either destroy bacteria or slow down their growth
- Defence mechanisms of bacteria
- Antibiotics only work on bacterial infections
- Antibiotics do not work on the common cold and other viral infections
- Doctor’s advice and prescription are essential before taking antibiotics



- Teamwork
- How to understand concepts using critical thinking skills

- **References and additional resources:**

- Antibiotics: <https://www.cdc.gov/antibiotic-use/q-a.html>
- Bactericidal & bacteriostatic antibiotics:
 - [https://bio.libretexts.org/Courses/Northwest_University/MKBN211%3A_Introductory_Microbiology_\(Bezuidenhout\)/07%3A_Antimicrobial_Drugs/7.01%3A_Overview_of_Antimicrobial_Therapy/7.1.05%3A_Antibiotic_Classifications](https://bio.libretexts.org/Courses/Northwest_University/MKBN211%3A_Introductory_Microbiology_(Bezuidenhout)/07%3A_Antimicrobial_Drugs/7.01%3A_Overview_of_Antimicrobial_Therapy/7.1.05%3A_Antibiotic_Classifications)
- Immunity system:
https://www.youtube.com/watch?v=IXfEK8G8CUI&ab_channel=Kurzgesagt%E2%80%93InaNutshell
- Defence mechanisms in resistant bacteria:
 - <https://www.fda.gov/animal-veterinary/antimicrobial-resistance/animation-antimicrobial-resistance-video>
 - <https://www.indiascience.in/videos/surviving-the-superbugs-e>
- Diseases and symptoms mentioned in the tippy-tippy top or stop activity:
 - <https://www.mayoclinic.org/diseases-conditions/urinary-tract-infection/symptoms-causes/syc-20353447>
 - <https://www.mayoclinic.org/diseases-conditions/common-cold/symptoms-causes/syc-20351605>
 - <https://www.mayoclinic.org/diseases-conditions/strep-throat/symptoms-causes/syc-20350338>
 - <https://www.mayoclinic.org/diseases-conditions/sore-throat/symptoms-causes/syc-20351635>
 - <https://www.mayoclinic.org/first-aid/first-aid-insect-bites/basics/art-20056593>
 - <https://www.mayoclinic.org/diseases-conditions/fever/symptoms-causes/syc-20352759>



- <https://www.nhs.uk/conditions/stomach-ache/>
- <https://my.clevelandclinic.org/health/symptoms/4167-abdominal-pain>
- <https://www.mayoclinic.org/diseases-conditions/gastritis/symptoms-causes/syc-20355807>
- <https://www.mayoclinic.org/diseases-conditions/viral-gastroenteritis/symptoms-causes/syc-20378847>

4 - Play it out





- **Summary:** Using dramatics as a learning tool, this session talks about resistant bacteria and the misuse of antibiotics by humans.
- **Prior knowledge required:**
 - What are bacteria
 - The basic structure of a bacterium
 - What are antibiotics
 - Defence mechanisms in bacteria, including mutation
- **Key vocabulary attendees will build:**
 - Resistance in bacteria
 - Resistant bacteria
 - Drug-resistant TB
 - Prescription
 - Dose
 - Course of medicine
 - Mutation
 - Gene transfer
 - Superbugs
 - Natural Selection
 - Evolution
 - Resistant gene
 - Growth-promoter
- **Duration:** 210-240 minutes
- **Requirements & links to printables/useful resources:**
 - Script for play - Rear-ity - [Link](#)
 - Script for play - Survival of the Fittest - [Link](#)
 - Script for play - The plan - [Link](#)
 - Script for play - 'Dose' it matter? - [Link](#)
 - Question sheet - [Link](#)
 - 4-5 large-sized chart papers
 - Space or board to stick the chart papers
 - Blue tack/pins/tape to stick/pin the chart papers
 - 4 bold markers (of different colours if possible)
 - A whistle



- **Activities:**

It's theatre time! The attendees now know about bacteria on earth and how antibiotics can kill them. They also understand what type of defence mechanisms resistant bacteria develop. Next, they must explore how bacteria become resistant to antibiotics and what is accelerating the process. Continuing with our narrative, the educator will inform the attendees that the aliens from Planet Z have shared glimpses of the current situations on their planet in the form of short plays. The attendees must enact and analyse those plays to better understand the situation on Planet Z.

Part 1 - The performances

- While preparing for this session, the educator/communicator should ensure they have gone through all the reading resources provided below. Also, they should be clear with all the concepts discussed in the plays.
- Divide the attendees into four groups.
- There are 4 scripts provided in the links under the requirements section above. Assign one play to each group. They will practice and perform this piece in front of everyone. If possible, give one copy of the script to each person.
- The number of people in a group is decided by which play they will be enacting. In total, the scripts can cover 36 people. If you have more participants, then:
 - Some people can play characters that help set the scene and have no dialogues, or,
 - You can increase the number of characters in the play 'The Plan'.

If you have fewer participants, you can do the following:

- Decrease the number of characters in the play, 'The plan.'
 - Remove the cow and chicken characters in the play, 'The rear-ity'
 - Some people can play two characters in the plays 'Survival of the Fittest' and 'Dose it matter' as it has different scenes.
- Give each group 90-120 minutes to prepare the plays.
- Next, each group will perform their play in front of everyone. The attendees need not remember the dialogues. They can look at the sheets

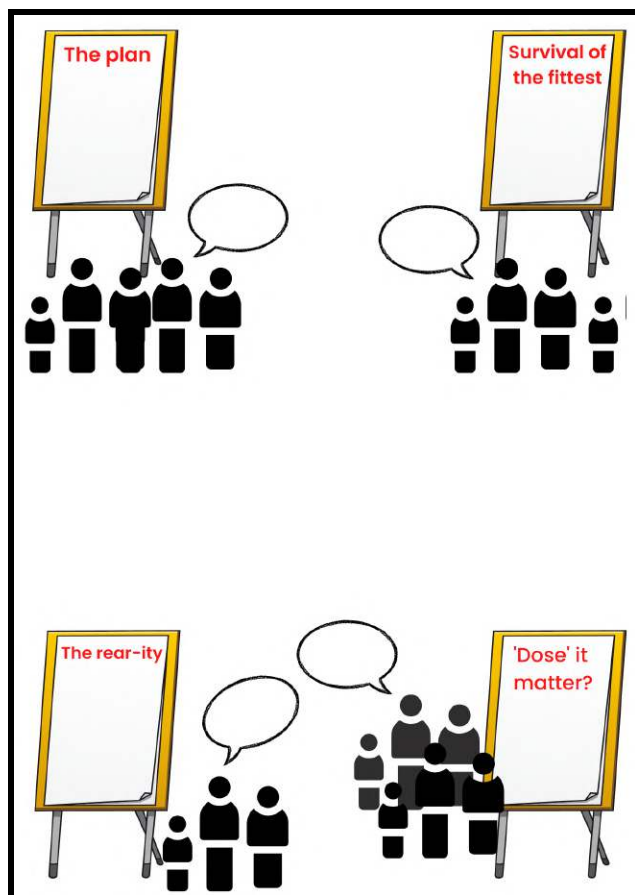


and read them out. However, encourage them to show the emotions and expressions that convey the meaning of the dialogue.

- While one group is performing, everyone else needs to observe and find answers to certain questions provided to them in an [activity question sheet](#).
- They needn't write answers on these sheets. The questions are meant to guide them to observe & analyse the play critically and build their focus.

Part 2 - Carousel Activity

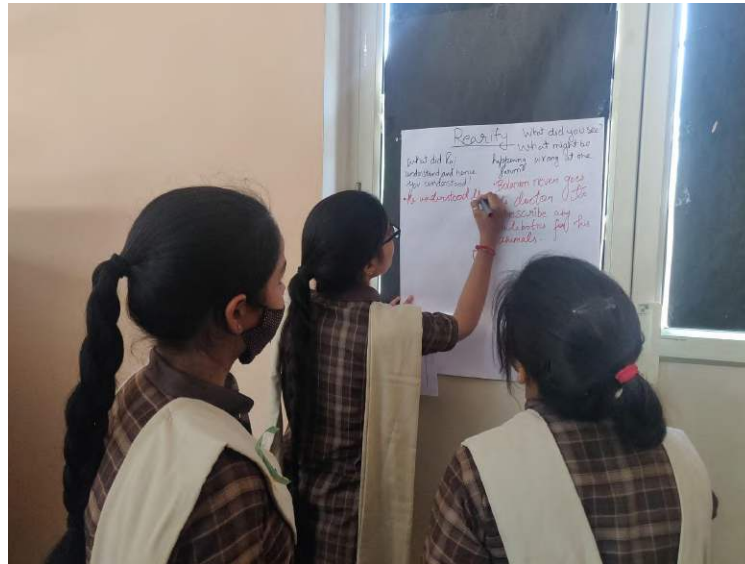
- Position 4 big chart papers in four different corners of the activity area. Make sure there is enough space to stand near the chart papers. Position them at a height the attendees can easily reach and write on.
- Write the name of the four plays, one on each chart. You can do this preparation while the attendees are practicing their plays.
- The attendees are already divided into 4 groups - the ones for the theatre exercise. Let them stay in the same groups for this part of the session.
- Give a bold marker to each group. It will be useful if each group gets a different colour. However, this is optional.
- When the activity starts, there is one group on each station (where the charts are positioned). Make sure they are NOT at a station where the chart reads the name of the play they enacted.





- Give the attendees **10 minutes** at this station. They must discuss and write down what they observed in this play. Ask them to consider the question sheets they received earlier to guide their thoughts.
- After 10 minutes, blow a whistle indicating they need to switch stations. In the second round as well, they shouldn't go to the chart where their own play is mentioned. (They will go to their own play's station in the last rotation, i.e., 4th round).
- This time, give the attendees **8 minutes**. They should discuss their ideas, read & reflect on those already written on the chart and then add their thoughts.
- After 8 minutes, blow the whistle, and ask everyone to rotate again and reach a new station. Give them **5 minutes** this time to reflect and add to the answers of the previous groups.
- After 5 minutes, blow the whistle again and ask everyone to rotate. This time everyone should have reached the chart with their own play's name written on it. Give everyone **4 minutes** on this station to reflect and write.
- After 4 minutes, ask everyone to gather together.
- This exercise is a fun way to pool cumulative understanding and ideas from everyone. Here each group builds on the understanding of the previous one in addressing the questions about one play.
- This way, feedback from group to group is built into the activity, providing a time-efficient and better-organised way to do so.





Part 3 - Discussion

- Once everyone is together, bring all the chart papers as well.
- Pick one of the chart papers and first revise the mentioned play's story with everyone.
- Then, read out the points written by the attendees and discuss them.
- This will be an excellent opportunity to identify all the misconceptions and confusion everyone has.
- Repeat the same for all charts.
- Once all the charts have been discussed, reveal that Planet Z under threat is just fiction. Whatever they have learnt so far is meant for them to understand antibiotic resistance on earth. The narratives in the plays are actual realities happening presently on their own planet.
- The attendees would already know that the Planet Z narrative is fictional, but please ensure everyone is on the same page at this point.
- Sensitise them about the fact that antibiotic resistance is a major global health threat. Their awareness of the same and the zeal to make others aware is the need of the hour.
- You can share some facts from WHO reports like:
<https://www.who.int/news/item/29-04-2019-new-report-calls-for-urgent-action-to-avert-antimicrobial-resistance-crisis>



- Lastly, make sure that at this point, everyone is clear with the terms antibiotic, antibiotic resistance, resistant bacteria, resistance, susceptibility and superbugs.
- In the end, award an honour symbol to everyone.

THE FOURTH MILESTONE IS COMPLETE!

- Reference video:

<https://drive.google.com/file/d/1ODOKdUWqTEs3LLuvBOQ6dw85n1V3x03x/view?usp=sharing>

- Expected learning outcomes:

- ➔ Antibiotics should only be taken for bacterial infections
- ➔ Antibiotics should only be taken if a doctor prescribes them
- ➔ One should complete the course of antibiotics as prescribed by the doctor
- ➔ Personal and family healthcare should be taken seriously
- ➔ Waste treatment, especially at hospitals and pharma factories, is crucial
- ➔ Challenges in developing new antibiotics
- ➔ Different ways bacteria can gain resistance against antibiotics
- ➔ A mutation is random and cannot be controlled by bacteria
- ➔ Antibiotics are over and misused in animal husbandry farms
- ➔ Researchers are looking at different ways resistant bacteria enter our environment and if that is of any concern to us
- ➔ Antibiotics can kill good bacteria as well
- ➔ Antibiotics should not be overused and misused
- ➔ Teamwork
- ➔ Group learning
- ➔ Critical analysis
- ➔ Careful listening

- Reading resources:

- ➔ Play - The rear-ity:
 - <https://theconversation.com/antibiotic-resistance-how-drug-misuse-in-livestock-farming-is-a-problem-for-human-health-141911>
 - <https://www.who.int/news/item/07-11-2017-stop-using-antibiotics-in-healthy-animals-to-prevent-the-spread-of-antibiotic-resistance>
 - <https://www.cdc.gov/drugresistance/food.html>
 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3234384/>



- https://academic.oup.com/cid/article/34/Supplement_3/S93/293306?login=false
- https://microbewiki.kenyon.edu/index.php/Growth_promoting_antibiotics_for_animals#:~:text=The%20exact%20mechanisms%20by%20which,energy%20investment%20in%20maintaining%20immune
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5485445/>
- <https://www.cdc.gov/drugresistance/food.html>
- <https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/antimicrobial-resistance-global-threat#:~:text=The%20environmental%20dimension%20of%20antimicrobial,water%2C%20soil%20and%20air>

→ Play - 'Dose' it matter?:

- <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>
- <https://www.reactgroup.org/toolbox/understand/how-did-we-end-up-here/use-and-inappropriate-use/in-human-medicine/>
- <https://www.mayoclinic.org/healthy-lifestyle/consumer-health/in-depth/antibiotics/art-2004572>
- <https://www.mayoclinic.org/diseases-conditions/tuberculosis/symptoms-causes/syc-20351250>

→ Play - Survival of the fittest:

- https://www.youtube.com/watch?v=7VM9YxmULuo&ab_channel=AmoebaSisters
- <https://www.bbc.co.uk/bitesize/guides/z6trd2p/revision/2#:~:text=Over%20time%2C%20bacteria%20can%20become,not%20affected%20by%20the%20antibiotic>
- <https://www.reactgroup.org/toolbox/understand/antibiotic-resistance/mutation-and-selection/>
- <https://pubmed.ncbi.nlm.nih.gov/21120720/>
- <https://www.science.org.au/curious/space-time/origins-life-earth>



- <https://micro.cornell.edu/research/epulopiscium/binary-fission-and-other-forms-reproduction-bacteria/>
- <https://doi.org/10.3389/fmicb.2016.01763>
- <https://www.fda.gov/animal-veterinary/antimicrobial-resistance/animation-antimicrobial-resistance-video>

→ Play - The Plan

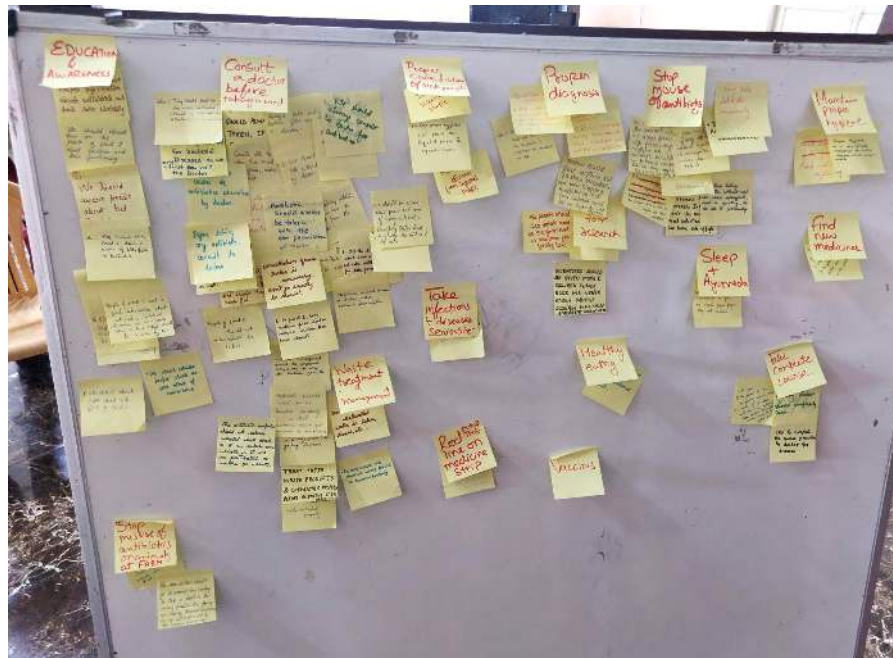
- <https://www.indiascience.in/videos/surviving-the-superbugs-e>
- https://www.youtube.com/watch?v=ZvhFeGEDFC8&ab_channel=TED-Ed
- <https://www.nature.com/articles/d41586-020-02884-3>
- https://www.youtube.com/watch?v=AnSBYWQI07A&ab_channel=CentersforDiseaseControlandPrevention%28CDC%29
- <https://www.sciencedirect.com/science/article/abs/pii/S0304389407009909?via%3Dihub>
- <https://www.reactgroup.org/toolbox/understand/how-did-we-end-up-here/antibiotics-in-the-environment/>
- <https://www.cdc.gov/drugresistance/environment.html>
- https://www.youtube.com/watch?v=1wNFcullF8Q&ab_channel=Peew

5 - Time for action

- **Summary:** This activity marks the end of the fictional narrative and talks about the Antibiotic Resistance (AR) situation on our planet. This session provides a platform for the attendees to suggest solutions they think can combat antibiotic resistance in the present times.
- **Prior knowledge required:**
 - What are bacteria
 - What are antibiotics
 - What is antibiotic resistance
 - How are bacteria becoming antibiotic resistant
 - What role are humans playing in accelerating the resistant bacteria load



- **Requirements:**
 - Square-shaped sticky notes/post-it - 3 X no. of attendees + some extra
 - Big rectangle-shaped sticky notes (if not available, then regular square-shaped sticky notes) - 20-22
 - Pens/pencils (to be brought by the attendees if possible)
 - One black bold marker
- **Duration:** 30 minutes
- **Guiding questions:**
 - How can individuals contribute to combating antibiotic resistance?
 - What can we as a society do to tackle the rise in resistant bacteria?



- **Activities:**
 - Hand out three sticky notes to each attendee
 - Make them sit far from each other by spreading them out in the room if possible
 - Ask them to write three ways (each one on a separate sticky note) in which they think people as individuals or as a society can combat antibiotic resistance



- It is important that they write in bold and clear writing so everyone can read and understand
 - Tell them to write on the non-sticky side of the note paper. Sometimes people tend to write on the opposite side
 - They should not mention their names on the sticky notes
 - Give them 10 minutes for this exercise
 - After one is done writing, they can come and place the note randomly on a designated flat wall
 - Once everyone is done, gather all attendees near the wall space, in a semicircle, close enough that they can read out the notes. Then ask the participants what similar points they see in the solutions and move the similar notes together in a cluster accordingly.
 - If the writing in the notes is small, you can read the notes aloud to everyone.
 - As clusters with a common theme begin to emerge, ask for a heading the attendees feel is appropriate for each cluster. For example - 'consult a doctor before taking an antibiotic'. Write that heading on the larger-sized sticky note, in big and bold letters, and paste it on top of the cluster
 - The attendees should be happy with the cluster headings. It is important that you ask for 'their' suggestion. Change or edit it only if it is scientifically wrong or misleading
 - The outcome will be a map of solutions or a meta plan the attendees created together as a group!
- **Expected learning outcomes:**
 - How can one combat antibiotic resistance at a personal level
 - How a community can combat antibiotic resistance
 - How can we make more people aware of antibiotic resistance
 - Why understanding and finding solutions for antibiotic resistance is crucial
 - Group work
 - Respecting and understanding the views of others

6 - Write, Act, Repeat



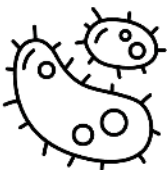
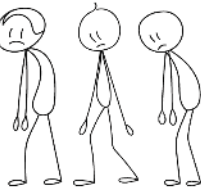




- **Summary:** This session supports the attendees in creating plays about antibiotic resistance, which they can perform for their peers and communities.
- **Requirements:**
 - Notebook/Paper
 - Pen/pencil
 - A space where the attendees can sit in small groups and discuss
 - Post-workshop [evaluation forms](#) (if this workshop is being evaluated)
- **Duration:** 90-120 minutes (and then one week)



● **Activity:**

- Ask the attendees to divide themselves into groups of 5-6 people.
- Give the groups 10-15 minutes to discuss and select one concept or learning they gained from the workshop and would like to share with others through a play. Each group will produce one play.
- Next, give them 30 minutes to storyboard their play. To storyboard, ask them to divide their notebook page into six equal parts. The first box represents the story's beginning, and the last box the ending. In the six boxes, they write short notes and make rough drawings representing the flow of the narrative. Storyboarding will help the attendees jot down their ideas clearly and also remember them later.

<p>THE BEGINNING</p>  <p>The description comes here, the description comes here, the description comes here, the description comes here</p>	 <p>The description comes here, the description comes here, the description comes here, the description comes here</p>	 <p>The description comes here, the description comes here, the description comes here, the description comes here</p>
 <p>The description comes here, the description comes here, the description comes here, the description comes here</p>	 <p>The description comes here, the description comes here, the description comes here, the description comes here</p>	<p>THE END</p>  <p>The description comes here, the description comes here, the description comes here, the description comes here</p>

- After 30 minutes, ask each group to share their story with everyone. You can suggest changes, especially if they have incorporated some wrong concepts. This time is also good to do away with any remaining



misconceptions anyone has. Discussing in everyone's presence will allow the group to learn from each other's creativity and mistakes (if any).

- Award them the final honour badge and congratulate them for becoming superheroes and heroines, ready to fight antibiotic resistance!
 - Here, we complete the FINAL MILESTONE! If you have planned to evaluate the workshop, share the [forms](#) now.
 - Allow the attendees a week to draft the play and submit it to you.
 - Check the play's script and suggest edits, if any. Please make sure the edits pertain to science and grammar only. Or ones required in a case when something is offensive to any community. Other than that, the creative sense should remain what the attendees have decided. They should be encouraged to spread awareness through a play representing their own style.
 - Organise the performances of their plays in their school or local community.
- Expected learning outcomes:
 - Creative writing
 - Playwriting
 - Teamwork
 - Oral communication skills
 - Theatre skills