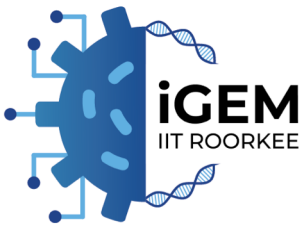
iGEM
IIT ROORKEE

Resource Booklet

This Resource Booklet has been created by the iGEM IIT Roorkee Team for the students of Standard 9th and 10th



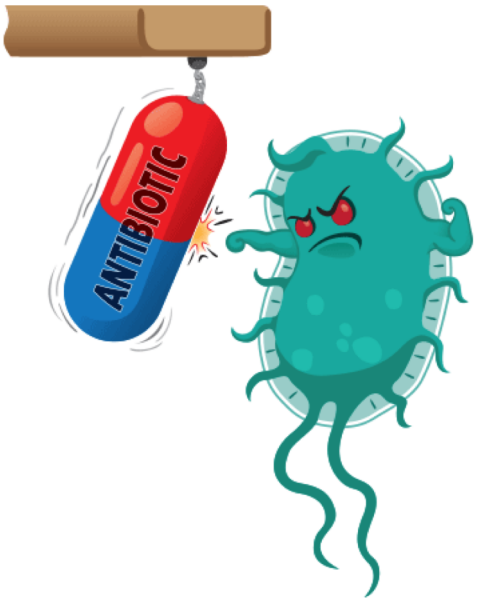
Contents

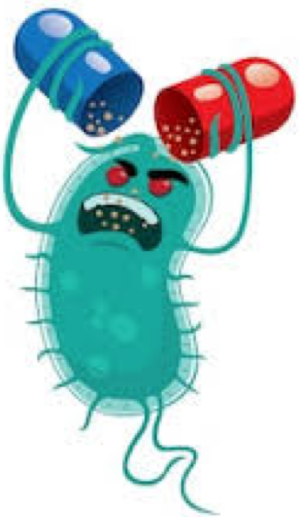
Getting to know AMR

What is Antimicrobial Resistance? Is it Different from Antibiotic Resistance?

Antimicrobial resistance (AMR) happens when a germ develops or acquires a way to prevent the antimicrobial drug from effectively killing or controlling growth. When germs do not respond to the drugs designed to kill them, infections that used to be treatable can become fatal.

The name, “antimicrobial resistance,” covers all types of germs, more scientifically called microbes, including bacteria, fungi, and viruses, that can cause infections. “Antibiotic resistance” specifically refers to bacteria and does not include other types of germs.





Bacteria cause most resistant infections, so the term, “antibiotic resistance” tends to be more common.

Antimicrobial resistance, and more specifically, antibiotic resistance, has become a major threat to our society. Resistance continues to grow because of improper antimicrobial dosage and use. Antibiotics are among the most commonly prescribed drugs used in human medicine and can be lifesaving drugs. But doctors prescribe antibiotics sub-optimally up to half the time, either when not needed or with incorrect dosing or duration.

Prediction by WHO and Impact

According to the World Health Organisation, even a small wound would become life threatening and about 10 million people would die because of the Antibiotic Resistance. Antibiotic resistance is one of the biggest threats to global health, food security, and development today.

The misuse of antibiotics in humans and animals is accelerating the process. A growing number of infections – such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis – are becoming harder to treat as the antibiotics used to treat them become less effective leading to longer hospital stays, higher medical costs and increased mortality. Antibiotic resistance is putting the achievements of modern medicine at risk. Organ transplantations, chemotherapy and surgeries such as caesarean sections become much more dangerous without effective antibiotics for the prevention and treatment of infections.

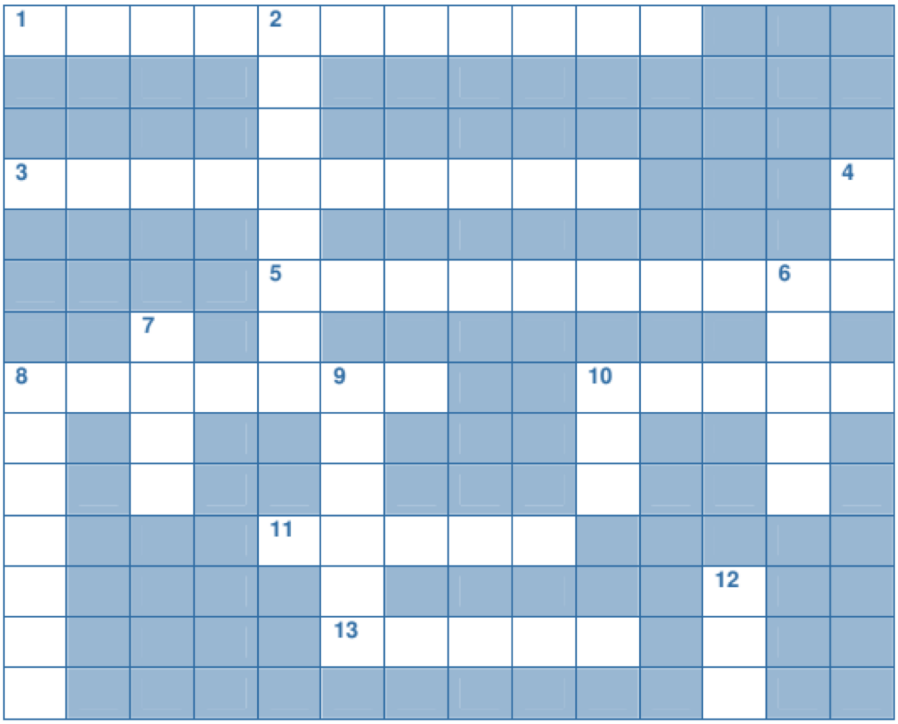
WHO Response

Tackling antibiotic resistance is a high priority for WHO. A global action plan on antimicrobial resistance, including antibiotic resistance, was endorsed at the World Health Assembly in May 2015. The global action plan aims to ensure prevention and treatment of infectious diseases with safe and effective medicines.

The “Global action plan on antimicrobial resistance” has 5 strategic objectives:

- To improve awareness and understanding of antimicrobial resistance.
- To strengthen surveillance and research.
- To reduce the incidence of infection.
- To optimize the use of antimicrobial medicines.
- To ensure sustainable investment in countering antimicrobial resistance.

Crossword



ACROSS

1. Something you might take to fight infections from bacteria (11 letters)
3. A mild infection you might get, but antibiotics won't help cure it (2 words, 4 then 6 letters)
5. Taking antibiotics when you don't need them helps bacteria to develop '…' (10 letters)
8. Antibiotics are often given to this group by farmers unnecessarily (7 letters)
10. This can cause an infection, but it's not a bacteria and antibiotics won't kill it (5 letters)
11. If your doctor prescribes antibiotics, they will usually be in the form of '…' (5 letters)
13. Another common word that is often used to describe bacteria or viruses (5 letters)

DOWN

2. These can cause infection but they are not viruses (8 letters)
4. Bacteria are so small you can't see them with your naked '…' (3 letters)
6. This is usually caused by a virus so antibiotics won't help (5 letters)
7. '42' is the answer to the meaning of this, the universe and everything (4 letters)
8. What does 'anti' mean in the word antibiotic? (7 letters)
9. What does 'biotic' mean in the word antibiotic? (6 letters)
10. Someone who treats sick animals (3 letters)
12. Another name for a germ (3 letters)

DIY Experiments

How To Extract Your Own DNA?

Every one of your cells contains DNA, the molecular blueprint that makes you - You. Accessing that blueprint may seem like a job for scientists. But extracting DNA from your cells is actually surprisingly simple.

Mac Cowell, an advocate for open-source biotechnology, created a set of simple instructions that lets anyone isolate her own DNA in mere minutes. The rough-and-ready procedure uses basic kitchen supplies, including the best possible container: a shot glass. This DIY process won't create the cleanest sample, but avid biohackers can purify the DNA after it's extracted. Once you have a pure sample, you can try sorting the DNA fragments by size or building a DIY DNA-copying machine.

Instructions:

- Spit into the shot glass until it's a quarter full of your saliva. (If you're having trouble salivating, imagine you're sucking a lemon-flavored candy.) The saliva is laden with cells, shed from your cheeks and mouth lining, which are full of DNA
- Add a few drops of dish soap. This will break open the cells, a process called "lysing"
- Add a tiny splash of pineapple juice. This will clean up some of the proteins that have spilled out of your cells alongside your DNA
- Add a pinch of salt. This causes the DNA to start clumping together.
- Swirl the shot glass to mix the ingredients
- Gently fill the rest of the shot glass with the high-proof alcohol, which should sit in a layer on top of the mixture

(**Note** - To prevent it from mixing too much, you can add the alcohol gradually with a drinking straw: Put the straw into the alcohol, cap it with your finger, hold the straw right over the liquid in the shot glass, and release)

- Use a toothpick to spool up the cloudy, snot-like material that has formed in the glass. This is your DNA—a gross result of some cool science

Agar Plates

Make your own agar Petri dishes and grow bacterial colonies. You will be amazed at the diversity of bacteria around us all the time.

CAUTION - This science activity involves the use of boiling water. Hot water must only be handled by an adult.

You Need:

- 1 teaspoon of beef stock powder
- A cup of water
- 1 teaspoon of sugar
- 1 teaspoon of gelatin
- Saucepan for boiling mixture
- 2 Petri dishes
- Spoon
- Sticky tape
- Felt-tip pen to label petri dishes
- Cotton swab (optional)
- 35 to 37 °C incubator oven (optional), warm spot behind fridge, near a heater, box with a desk lamp inside or on top

What to do:

- Pour the water into the saucepan and bring to the boil
- Add beef stock powder, sugar and gelatin to the boiling water and stir for a minute until all the ingredients have dissolved
- Cool your new agar mixture slightly for 10 minutes. The mixture needs to be still hot to avoid the gelatin setting in the saucepan and to prevent contamination from bacteria in the air

(**Note** - The conditions are far from sterile, but you want to avoid as much contamination as possible)

- Take the lid off the Petri dishes and have an adult half-fill the petri dish with the hot mixture. Only take the lid off the petri dish when you are ready to pour your agar, or they will become contaminated with the bacteria in the air
- Immediately put the lid back on the Petri dish and put it in the fridge for about 4 hours until the agar has set. Do not touch the agar or you will contaminate it with bacteria on your fingers
- Now it's time to collect and grow your bacteria (or fungi) on the agar Petri dishes. Note: the Petri dishes can be stored in the fridge for 1-2 days before use
- Bacteria is not hard to collect because it is everywhere. Try exposing one plate to the air in your house or classroom, and the other to the air in your backyard or playground. Touch one with your thumb and the other with a piece of hair. Add the scrapings from your finger nail, or touch with a piece of grass or dirty tissue. If you have some cotton swabs - using a clean one each time - run it along things like the inside of your mouth, your hands, the door handle, mobile phone, computer keyboard, and then rub it lightly across the agar in a zig-zag pattern
- Put the lids back on the Petri dishes, label them, tape them closed and place them upside down in your make-do incubator (if you have one) for 1 to 2 days. If you don't have an incubator, leave the plates at room temperature for 3-5 days
- Although your grown bacteria colonies and fungi is likely to be harmless, just as a precaution, do not open your sealed Petri dishes. Dispose of the entire sealed plate in the bin

Why is it so?

Bacteria are so tiny they can't be seen with the naked eye, and often millions of bacteria are condensed in a small spot. Growing bacteria in a nutrient agar plate is a great way to see bacteria because each one becomes a colony of thousands of bacteria. The agar serves as food for the bacteria. Growing bacteria can be tricky so don't give up if your first couple of attempts fail. Once you have them growing, count the number of colonies and note the differences in colour, shape and other properties. Did you find more bacteria on the bathroom sink or on the computer keyboard? Try adding a drop of hand sanitizer or the like to the middle of your growing plate. Does this make a difference to the number of colonies and type of growth in this area of the plate? Do washed hands have less bacteria than unwashed hands?

Safety Tips

Know Your Risk, Ask Questions, and Take Care

Ask your healthcare provider about risks for certain infections and sepsis. Speak up with questions or concerns. Keep cuts clean and covered until healed, and take good care of chronic conditions, like diabetes or heart disease.

Clean Your Hands

Keeping your hands clean is one of the best ways to prevent infections, avoid getting sick, and prevent spreading germs. This video explains how washing your hands can fight germs that get on our hands every day.

Get Vaccinated

Vaccines are an important step to prevent infections, including resistant infections. Talk to your child's healthcare provider about recommended vaccines, and learn more about vaccines recommended for all ages.

Be Aware of Changes in Your Health

Talk to your healthcare provider about how to recognize signs and symptoms of infections, or if you think you have an infection. If an infection isn't stopped, it can lead to additional complications like sepsis, a life-threatening medical emergency. Symptoms of a *C. difficile* infection include severe diarrhea, loss of appetite, abdominal pain/tenderness, and nausea. Often these symptoms come with a fever.

Protect Yourself and Your Family

Infections caused by antibiotic-resistant germs are difficult, and sometimes impossible, to treat—but we can help stop the spread of these germs. Antibiotic resistance happens when germs like bacteria and fungi develop the ability to defeat the drugs designed to kill them. No one can completely avoid getting an infection, but there are steps you can take to reduce your risk.

Use Antibiotics Appropriately

Talk with your healthcare provider or veterinarian about the best treatment when you, your family, or your animal is sick. Antibiotics save lives, but any time they are used they can cause sides effects and lead to antibiotic resistance. Learn more about using antibiotics, including when they are needed and when they are not.

Practice Healthy Habits Around Animals

Always clean your hands after touching, feeding, or caring for animals, and keep your animals healthy.

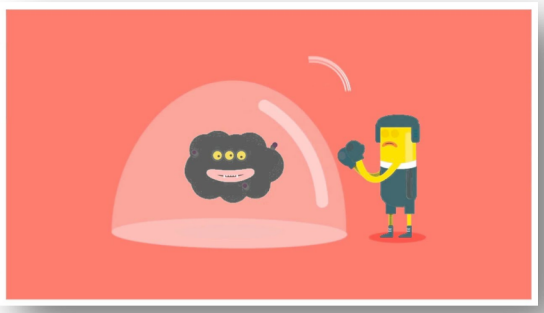
Learn more about pets and antibiotic resistance.

Prepare Food Safely

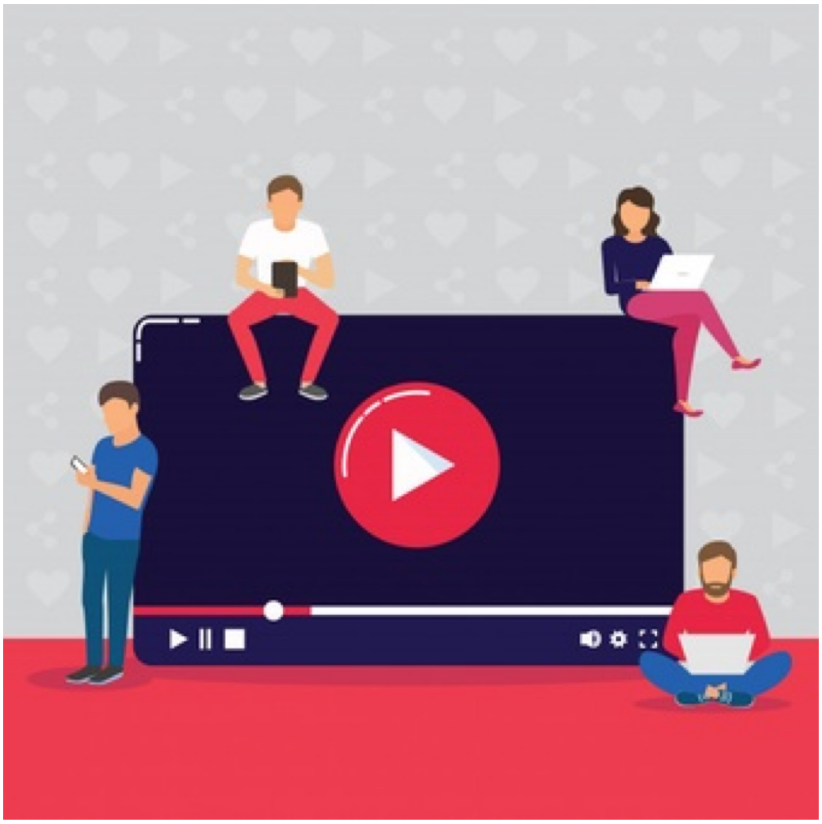
Follow four simple steps to avoid foodborne infections. Clean your hands, cooking utensils, and surfaces. Separate raw meat from other foods. Cook foods to safe temperatures. Chill leftovers and other foods promptly.

Watch it on YouTube

https://youtu.be/6368Y-OfU9U



https://youtu.be/mngVeKX8plk



About iGEM

- **World's Largest Synthetic Biology Competition**
- Started in **Massachusetts Institute of Technology in 2003**
- Engineering + Biology →Solve local and global problems

47+
Countries

350+
Teams

4000+
Participants

Meet the Team

We, the young leaders of the Global Biotechnology Revolution, are glad to interact with stakeholders of the society and share some exciting insights on where science continues to lead and how future technologies look. The session intended to highlight the importance of bioengineering with increasing advancement. Also, we encourage you to have more open discussions with your teachers and invest in problem-solving. We urge that each and everyone shall take the responsibility of being an Antibiotic Guardian, and educate your friends and family in the same regard. Stay healthy and love science.

Sanjeevani Marcha
Team Leader

Harkirat Singh Arora | **Pradum Kumar** | **Tishee Natani** | **Yash Aggarwal** | **Kanishka Sugotra** | **Siddharth Fitwe**

Lakshya Jain | **Kushagra Rustagi** | **Muskaan Bhambri** | **Kartikey Kansal** | **Nitish Kumar**

Contact Us

The Department of Biotechnology,
Indian Institute of Technology, Roorkee
Roorkee, Uttarakhand,
India - 247667

https://igembtiitr.github.io/wiki/

igembtiitr@gmail.com

+91 6376 912 644
+91 8875 372 143