



Immunology

with Dr Anukul Shenoy

Talking points

Knowledge & Comprehension

1. What are barrier epithelial cells, and how do they help protect the lungs from harmful microbes and pollutants?
2. What are T cells, and what key roles do helper, killer and regulatory T cells play in the immune system?
3. What is *Streptococcus pneumoniae*, and why is it described as both a commensal organism and a pathogen?
4. How do epithelial cells and lung-resident T cells work together to detect and respond to invading microbes?
5. How does the immune system normally prevent *S. pneumoniae* from causing illness, and what changes when a person becomes immunocompromised?

Application

6. How might understanding the communication between epithelial cells and T cells help scientists design more effective vaccines or therapies?
7. How could lessons from Anukul's research be applied to other respiratory diseases such as asthma or long-COVID?

Analysis

8. Why might *S. pneumoniae* be particularly challenging to control through vaccination and antibiotic treatment?
9. How do the interactions between epithelial cells, immune cells and microbes illustrate the balance between tolerance and defence in the lungs?

Evaluation

10. Just as a coordinated immune response depends on different cells working together, scientific discovery relies on teamwork and diversity. In what ways do collaboration, inclusion and varied perspectives strengthen scientific progress and lead to more innovative breakthroughs?

Activity

Antibiotic resistance is one of the most urgent threats to global health. Bacteria such as *S. pneumoniae* can acquire new genes that make them resistant to antibiotics, allowing infections to spread and making them harder to treat. Anukul's research highlights how understanding the immune system's natural defences, including epithelial cells and T cells, could offer new ways to prevent infections before they require antibiotics. But what is the best strategy to protect people in a world where antibiotics are losing their power?

Divide into two groups: One group will argue that scientific innovation (e.g., new drugs, vaccines and immune-based therapies) is the best way to combat antibiotic resistance. The other group will argue that behavioural and social change (e.g., reducing misuse of antibiotics, improving hygiene and strengthening public-health systems) offers the most effective solution. Each group should come up with 3–5 key points supporting their position.

- Group 1: Research examples of recent scientific breakthroughs that aim to reduce antibiotic resistance. These could include new vaccine technologies, bacteriophage therapy or the development of immune-boosting treatments inspired by studies like Anukul's. Consider how these innovations could reduce the need for antibiotics or make infections easier to control.
- Group 2: Investigate the human factors that drive antibiotic resistance, such as overprescription, agricultural use of antibiotics or lack of access to proper healthcare. Think about how education, policy and community action can change behaviour and slow resistance on a global scale.

Take it in turns to present your arguments and respond to each other's points, challenging ideas and offering counterarguments. At the end of the discussion, reflect on what you learnt:

- How does antibiotic resistance illustrate the importance of balancing human behaviour with scientific innovation?
- In what ways could strengthening our immune defences, as explored in Anukul's research, reduce dependence on antibiotics?
- To what extent should global health funding prioritise developing new antibiotics vs preventing infections through vaccines and education, and why?
- What actions can individuals take to reduce the spread of antibiotic resistance in everyday life?

More resources

- Watch the following lecture series on YouTube to learn more about the fundamentals of immunology: [youtube.com/playlist?list=PLUI4u3cNGP63LmSVIVzy584-ZbjbJ-Y63](https://www.youtube.com/playlist?list=PLUI4u3cNGP63LmSVIVzy584-ZbjbJ-Y63)
- Anukul recommends this YouTube channel as a great place to find out about the latest immunology research: [youtube.com/@GLOBALIMMUNOTALKS](https://www.youtube.com/@GLOBALIMMUNOTALKS)