The Alchemist's Laboratory: Systems & Innovation

(Year 7 - Ages 12-13)

Lesson 3 of 9

Teacher Preparation

Introduction for Teachers

In this lesson, we move from the emotional (Altruism/Empathy) to the logistical (Systems/Science). The "Future of Transplantation" isn't just about sci-fi tech; it's about the incredible system that exists right now to make donation possible.

The core goal is to demystify the process. Students often think donation happens "by accident" or is "scary." By framing it as a high-tech, highly organised "Laboratory Protocol," we reassure them that it is safe, respectful, and rigorous.

We also look forward. Year 7s love technology. By showing them the "Future Alchemy" (machines that keep hearts beating outside the body), we engage their sense of wonder.

Safety and Sensitivity Considerations

- Focus on "The System," not "The Surgery": Keep the discussion focused on logistics (helicopters, databases, matching, storage) rather than surgical gore.
- Say: "We are looking at the timeline and the teamwork, not the operation itself."
  - The "Death" Pre-requisite: We must touch on the fact that for organ donation, a person must die in ICU (Intensive Care).
  - Sensitivity: Be clear but gentle. "The doctors work 100% to save the patient's life. Donation is only considered when saving their life is no longer possible. It is a separate team that handles donation to ensure there is no conflict."
- Respecting the "Gift": Even when discussing "supply chains" and "storage," remind students that the "item" being moved is a precious gift from a person.

Teacher Resources

- Video Suggestions (Preview first):
- Search: "Heart in a Box Transmedics" (Shows a heart beating in a clear box during transport – very "Alchemist").
- Search: "3D Bioprinting Organs" (Shows the future of growing organs).
- Resource: "The Laboratory Cards" (Steps for the sequencing activity).
- Student Worksheet: "The Lab Report."

Key Concepts & Language for Teachers

- 1. The Two Pathways (Urgent vs. Banked)
  - This is the critical scientific distinction for this unit.
    - The Organ Pathway (The Sprint):
      - Organs: Heart, Lungs, Liver, Kidneys.
      - The Constraint: Ischaemia Time (Time without blood). Once retrieved, organs start to degrade. A heart must be transplanted within 4-6 hours.
      - The Logic: This requires speed, lights, sirens, jets, and immediate matching. It is a race against time.
    - The Tissue Pathway (The Marathon):
      - Tissues: Cornea, Bone, Skin, Heart Valves.
      - The Constraint: Less urgent. Cells can survive longer after death.
      - The Logic: Tissues are retrieved, processed, cleaned, and stored (Banked). A cornea can be stored for weeks; bone for years. They are "Inventory for the Future."
- 2. The "Great Work" (The Current System)
  - Explain that donation is a "Relay Race."
    - The Donor Coordinator: The "Conductor" who organises the logistics.
    - The Matching System: The "Algorithm" that ensures the right organ goes to the right person based on size, blood type, and urgency (not money or fame).
- 3. Future Alchemy (Innovation)
  - Use these examples to show how science is solving the problem of "scarcity."
    - Machine Perfusion ("Heart in a Box"): Instead of putting a heart on ice (where it stops), we now have machines that pump warm blood through it during transport. The heart keeps beating! This allows it to travel further and stay healthier.
    - Xenotransplantation: Using organs from animals (like pigs) that have been genetically modified to be compatible with humans.
    - 3D Bioprinting: Using a patient's own cells as "ink" to print a new kidney or skin structure. This would eliminate the need for anti-rejection drugs.

The Alchemist's Data: Time Limits (The "Use By" Date)

Share these "Magic Numbers" with students to highlight the urgency of the Organ Pathway:

- Heart / Lungs: 4 to 6 hours. (The "Golden Window").
- Liver: 8 to 12 hours.
- Kidneys: 24 to 36 hours. (The "Marathon Runners" of organs).
- Corneas (Tissue): Can be stored in a bank for up to 4 weeks.
- Bone (Tissue): Can be freeze-dried and stored for 5 years.