

REPLACING ANIMAL RESEARCH

Millions of animals are still used around the world in tests to check the safety of chemicals and medicines. In this activity you will see how connections between different scientists are key to developing new testing approaches to replace animal tests.

🕒 30 minutes

Skills unlocked: Creative, Logical, Collaborative

📦 Kit list

Computer with internet access

Pen

Paper

📖 Instructions

- 1 Read the background information below:

You are a researcher who has developed a new medicinal drug 'Shrinkazine', which has the potential to shrink lung cancer tumours when inhaled directly into the lungs via an inhaler. You need to collect evidence for the UK medicines regulatory body, the Medicines and Healthcare products Regulatory Agency (MHRA), to show 'Shrinkazine' will be non-toxic to patients, or anyone else who breathes it in. Imagine a recent ban on animal use for medical research is preventing you from using animal tests.

- 2 You need to create an 'in vitro' (outside of the body) model of the lung using human cells. The model must reflect the physiology of the vessels, in particular the alveoli and the blood vessels around it, and allow the absorption of

particles between them. Scientists often collaborate to solve problems. You can call on others for advice, information and help. Who would you need to speak to and why? Use the worksheet on the next page to help you.

- 3 Write a step-by-step plan for designing this model.

➡ Next steps

A lung-on-a-chip model was the first organ-on-a-chip device to be developed. These have already been adapted to incorporate the mechanical and physiological properties you looked at in this activity. This was done in 2010. Read more here: [Living, Breathing Human Lung on a Chip, Harvard Medical School](#) 📄

🏠 At home

List some products in your house that may contain chemicals (not household cleaning chemicals). You could research if the companies use animal testing when making these products. How could they test these products without using animals?

↔ Career options

Developing new biological approaches can involve a variety of scientists including:

- cell culture scientists
- bioengineers
- chemists
- nurses
- surgeons.



You have experience of growing mouse lung cells in the lab, but for this you will need lung cells from a human patient. These human cells are much better for a lung model but they are tricky to grow.

You know a lung surgeon in a local hospital, Dr Inspiration, who has access to patient tissue during surgery and could collect samples. But she is very busy!

Patients need to give ethical approval and fill out paperwork to agree for their tissue to be taken for research. There are nurses at the hospital that are trained and have the time to do this.

Your friend Professor Knowledge has many years' experience of culturing and growing human tissue including lung (alveoli) cells in the lab.

You have heard of 'organ-on-a-chip' devices where cells from an organ are grown on a tiny chip. They incorporate a semi-permeable biomaterial, which the cells sit on to grow. The biomaterial lets oxygen and nutrients through.

Dr Substance is a local chemistry researcher working on the development of biomaterials which support cell growth.

You recently read an article by Dr Developer, who is working on an in vitro (in the lab) blood capillary model, using human endothelial cells.

A single alveolus in the lungs inflates as you breathe in and deflates as you breathe out. **Check out the diagram below to learn about the structure of an alveolus.**

'Shrinkazine' would have to be absorbed when it is breathed into the lungs, it would be absorbed through the cells of the alveolus and the cells of the capillary to reach the bloodstream. Both the layers of cells are 'semi-permeable'. This means they let some things through but not others.

