University of Sheffield | Neuroscience Institute

School Outreach

Inspiring the new generations into scientific research, physiology, discovery, and innovative thinking to create a visionary, life-changing future.

Contents

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From bench to class

Our Aims:

To promote science and provide hands-on exposure to cutting-edge research.

Our Impact:

To encourage innovative/creative thinking among students and inspire the next generation of scientists.

Our Activities:

Seminar sessions & Workshops

- *Illustrate key principles in human biology*
- *Understand the brain*
- *Develop treatments for disorders*
- *Modelling diseases using stem cells*
- *Using robotics and AI in research*
- *Music and sleep*
- *Touch receptors and brain*
- *Digital technologies to assess memory*

Our impact: What teachers say

'It was wonderful for the students to be able to meet 'real life scientists' whose work was not only fascinating, but also cutting edge, up to date science and could all be related to practical uses in the real world. I have no doubt that some of our students went away with a broader view of what 'research' might mean and how their future career pathways could look.'

'It was great for the students to have the opportunity to think about biology beyond the specification and in new and exciting contexts. The workshops were incredibly well planned and delivered, and the researcher's passion and knowledge about their subjects shone through'.

'Each workstation offered research insights that were pitched at exactly the right level - challenging enough to stretch their understanding, yet accessible and engaging throughout. Students were clearly captivated by the range of activities and discussions.'

At a recent workshop, 100% of students feedback that they found the sessions **useful and interesting**, and **90%** said they left with a **better understanding of life sciences careers**.

How it works

Formats:

- Activities for *large* groups/classes: 5-8 activities/interactive stations, 50-70 students
- Activities for *small* groups/classes: 1-4 activities/interactive stations, <30 students
- Lunchtime *seminars*: 2 short talks, 10 minutes each

Age/School Years:
16-18 years old

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Hearing function & dysfunction

Activity description:
This activity offers students the opportunity to embark on a journey through the auditory system and discover how we hear and what different degrees of hearing loss feel like.

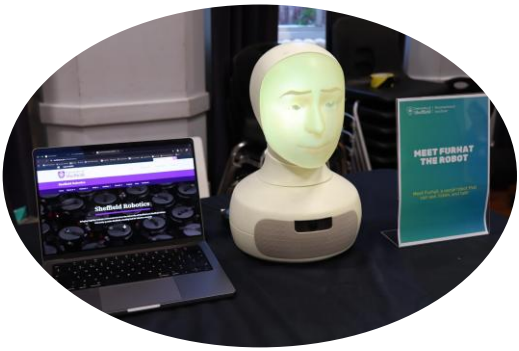
What will students do?

- Identify and understand different components of the auditory system.
- Learn how sound is converted to electrical signals.
- Identify the key cells of the auditory system viewed under microscopes.
- Understand the power of gene therapy for curing deafness.
- Experience different types of hearing loss.
- Test your own hearing functions.

Learning outcomes:

- Understand key concepts of human biology.
- Discover physiological processes
- Gain knowledge around sensory system malfunction
- Discuss mechanisms of disease prevention.

Meet Furhat the robot



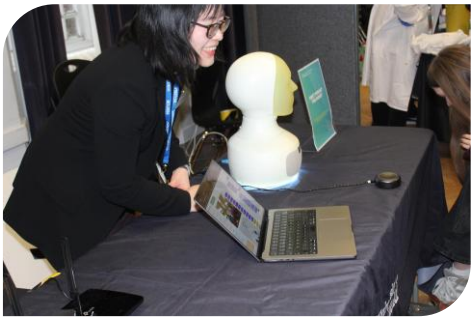
Activity description:
Students have the chance to interact with a Social robot head, which communicates using speech, facial expressions and eye gaze. The students can talk to the robot and learn about how its different features work.

What will students do?

- Speak to and interact with a social robot called “Furhat”.
- Learn how robots use speech recognition, dialogue systems, and facial animation to engage in natural conversation.
- Talk to a researcher about using these technologies in modern AI and robotics research.

Learning outcomes:

- Begin to understand how speech recognition and dialogue software work.
- Appreciate the applications and uses of these technologies.
- Develop an appreciation for the use of robotics and AI in research.



Designing music for sleep

Activity description

Can music help people with insomnia to fall asleep? What characteristics should music have to be helpful, and what are the psychological processes that allow music to support sleep?

What will students do?

In this activity, students will adapt the properties of music using music technology to make it fit different purposes: change it to make it relaxing, suitable for sleep or energising. Compare your responses to those of others to understand individual differences.

Learning outcomes

Understand the role of research to test whether music can help support sleep, develop insight into psychological processes that allow music to be supportive, and see how your responses may be similar or different to others.

CognoStroke, automated computer memory assessment

Activity description

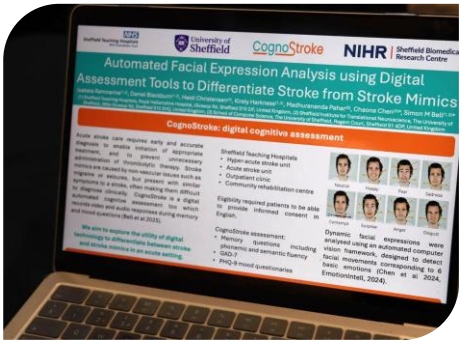
An interactive session exploring how memory and mood is assessed in healthcare settings using traditional pen and paper tests and CognoSpeak, a new digital, automated memory assessment.

What will students do?

- Learn about memory assessments and conditions which affect memory such as Stroke.
- Use CognoSpeak to answer memory questions and give feedback.

Learning outcomes

- Understand when memory assessments are needed in healthcare.
- Explore challenges with traditional and digital memory assessments.
- Explore how digital technologies can be used to assess memory in hospital and the community



Brain versus skin: The Homunculus challenge

Activity description

This hands-on activity introduces students to the sense of touch and shows how the brain does not represent every part of the body equally. Students will explore the sensory homunculus and discover why highly sensitive body regions, such as the fingertips and lips, take up more space in the somatosensory cortex than less sensitive areas like the arm or back.

What will students do?

- Test touch sensitivity on different parts of the body using simple comparison tasks such as two-point discrimination.
- Predict which body areas are most sensitive.
- Link their findings to how the brain maps sensation across the body.

Learning outcomes

- Understand how touch receptors send information to the brain.
- Recognise and understand why some body parts are more sensitive than others and have a larger representation in the sensory homunculus.
- Develop confidence in observing, comparing results, and linking touch to brain function.

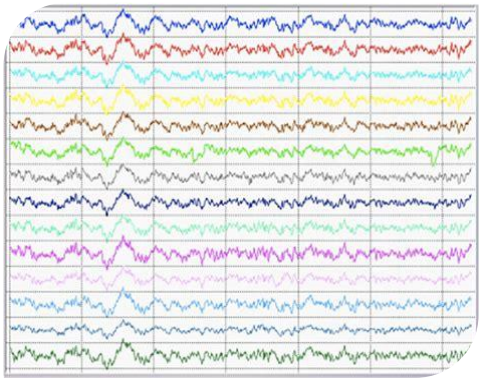
Brains beyond the lab

Activity description:

How do neuroscience and engineering come together in real technology? This demo uses a portable EEG headset to show how scientists quickly and safely record brain signals and what these look like.

What will students do?

- Take part in a live EEG and see real brain waves!
- Learn about brain-computer interfaces.
- Learn about engineering challenges and solutions in EEG.



Learning outcomes:

- Understand how EEG is used to image the brain
- Develop an understanding of how brain-computer interfaces are used to translate research into therapies
- Understand how scientists work together creatively to solve technical challenges.

Inside the cell: How brain cells work and fail

Activity description:
Understanding the way in which a disease starts and spreads is important. The students will act as researchers and use patient tissue to tell apart healthy and unhealthy brains as well as get the chance to dissect fruit flies and design an effective drug.

What will students do?

- Differentiate between 'healthy' and 'diseased" brains using histology slides.
- Learn how researchers use the common fruit fly as a model in research, and experience dissecting them.
- Understand the requirements for a good drug and use Molymods to model known drugs.

Learning outcomes:

- Understanding the need for disease modelling and why *Drosophila melanogaster* is a useful tool.
- Appreciating the use of histological stains and learning to find neurons and other cells within brain tissue.
- Learning about fluorescent staining and optogenetic approaches.

Brain diseases in a dish

Activity description:

The activity aims to introduce students to the concept of modelling diseases of the central nervous system in laboratory conditions using stem cells and other related models. The activity will also explain what the purpose and downstream applications of these models are.

What will students do?

- Handle and learn to use real-life laboratory equipment;
- Have a closer look at fixed brain samples;
- Learn why cell models are important;
- Talk to neurodegenerative disease researchers.

Learning outcomes:

- Name sources of cells for stem cell models;
- Explain what stem cells can be used for and why;
- Understand what gene therapies are and what they entail.

Seminar sessions

Activity description

Our seminar sessions are short, research-based talks which give students the chance to meet a scientist and learn about cutting-edge research happening in their city. These talks are varied and can be delivered on a range of topics, depending on what academics are available and what works best for the school.

Learning outcomes:

- Opportunity to discuss a wide range of neuroscience-related topics with researcher working on cutting edge science.
- Understand how researchers addresses current unknown in biology.
- Interacting with researcher at different career progression.

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www.sheffield.ac.uk/neuroscience-institute

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MRC Medical Research Council
BBSRC bioscience for the future
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