

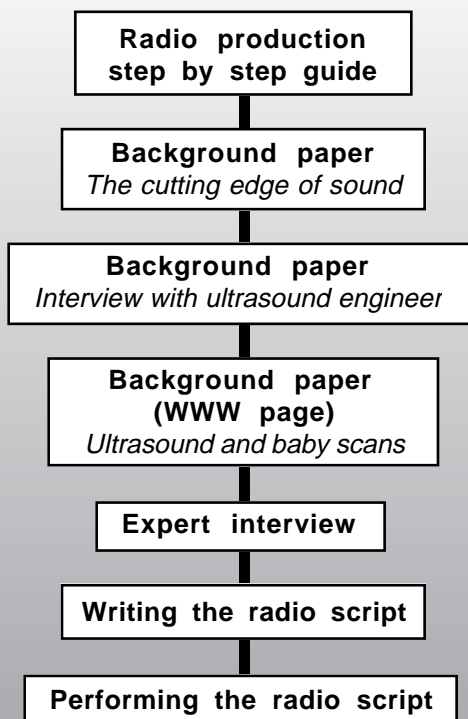
## Pupil Research Brief

### Teachers' Notes

#### Syllabus Coverage *Subject Knowledge and Understanding*

- ❑ sounds are produced when objects vibrate
- ❑ the number of complete vibrations each second is called the frequency (hertz [Hz])
- ❑ the higher the frequency of a sound the higher the pitch
- ❑ electrical oscillations can be used to produce ultrasonic waves
- ❑ ultrasonic waves have a frequency higher than the upper limit of the hearing range for humans
- ❑ ultrasound has a wide range of uses in medicine and industry, e.g. in pre-natal scanning and cleaning of materials
- ❑ ultrasonic waves, like other waves, carry energy and can be reflected

#### Route through the Brief



#### Introduction

The aim of this Brief is for pupils to learn about ultrasound and to develop their communication skills, in an enjoyable way. The Brief is set in the context of producing a script for a radio programme on science. The idea is that, by explaining scientific concepts to a non-scientific audience, the pupils will understand them better themselves.

Pupils are invited to take on a novel role; they will be scientists learning about the media by doing a placement in the Science Unit at STS Radio. Working on the series **Science Alive**, their assignment will be to prepare a 4-minute feature about ultrasound and its uses. To help them there is a step-by-step guide to radio production.

Pupils are provided with much of the information they need in the form of research documents. As well as covering the established uses of ultrasound in medicine and industry, pupils learn about a new application - an ultrasound knife.

You are also actively involved. As producer you set the scene at the beginning, and listen to or read the finished scripts to see if they are worthy of broadcast. And as the 'ultrasound expert' you are interviewed by each team about the uses of ultrasound (briefing notes are supplied).

This Brief also gives details of how your pupils can produce, to a professional standard, recordings of their ultrasound features using the Science Museum's replica radio station.

# Pupil Research Brief

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## Teachers' Notes continued

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### Prior knowledge

Before attempting the Brief, pupils need to be familiar with the idea that sound and ultrasound travel as waves.

### Running the Brief

#### Pupil grouping

In radio jargon pupils work as 'researchers' in 'production teams'. Teams with 3 to 5 researchers have been found to work best. It is up to the teams to allocate the different jobs at each stage of production among team members and resolve any editorial disputes. This could be a role for an 'assistant producer' within each team.

#### Timing

The Brief will take about 2 hours to run - 15 minutes for setting the scene and explaining the assignment, 1 hour 15 minutes for the production exercise itself and 30 minutes for script read-throughs. You could reduce the time by setting some research and script-writing for homework.

It is almost inevitable in production exercises like this that teams will work quite slowly to begin with and end in a frenzy of last minute script-writing. To help teams stay on target to meet the deadline, you might like to call the assistant producers together every 20 minutes and ask for a quick progress report.

#### Activities

The teacher should issue pupils with the **Study Guide** which provides pupils with a summary of what they should produce as they work through the Brief. It can also act as a checklist for pupils to monitor their own progress. No sophisticated recording or editing equipment is needed for the production exercise. Everything has been adapted for a classroom 'recording studio'. Interviews can be written out by hand, unless you have access to tape recorders. Editing is a cut-and-paste job with scissors and glue (described in 'Radio production - step-by-step').

For the read-throughs teams will need 2 scripts, so that everybody who is reading a part can see a copy. If you are not word-processing, photocopying the scripts at the end of the production exercise would be ideal. If this is not possible the teams will have to make a duplicate copy of their interview and commentary themselves, and cut and paste these to make two scripts. Giving each team sheets of carbon paper would save them time.

### Scene setting

One good way to get pupils thinking about science and the media would be to ask: "What science programmes have you listened to or watched? Did you understand the science in them? Was it interesting, and why?"

After you have outlined what the pupils will be doing, everyone moves into role and the classroom is transformed into a production studio. Welcome the 'researchers' to the Radio Science Unit and tell them about the series they are working on.

"**Science Alive** is a lively, fast-paced series, exploring exciting new developments in the world of science and technology. It is aimed at an audience which has little or no scientific background."

#### The assignment

Give out the document '**RADIO PRODUCTION - STEP BY STEP**' which sets out the assignment and acts as a 'worksheet-in-context', guiding pupils through the stages of research, interviewing, script-writing and editing. Three documents have been provided to help teams with their research:

- an article called **The Cutting edge of sound** - about the ultrasound knife
- a page about sound, ultrasound and baby scans downloaded from the World Wide Web
- a transcript of an **interview with the engineer** who developed the ultrasound knife (each team will need 2 copies of the interview if they are doing cut-and-paste editing).

Tell the teams they will be interviewing you in your other guise of '**ultrasound expert**' to find out about uses of ultrasound other than pre-natal scanning (which is covered in the Web page). The interviews will need to be short, about 5-10 minutes, and one way to organise this would be to have a sign-up sheet. With a large class it might be necessary for pairs of teams to interview you together, to save time. The notes below may help you to prepare for the interviews.

#### Ultrasound expert briefing notes

Uses of ultrasound take advantage of two important properties.

(1) *Ultrasound can be reflected off things* - useful in quality control (and pre-natal scanning). Ultrasound helps companies make high quality machines by checking them for tiny cracks. Normally ultrasound passes through a piece of metal without

# Pupil Research Brief

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## Teachers' Notes continued

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much of it being reflected. But any cracks inside will act like a new layer and reflect the waves more strongly (just as the baby's body does in pre-natal scanning). The echoes are picked up by a sensor connected to a computer, which can then pinpoint the crack.

(2) *The waves carry energy* - useful in surgery and for cleaning materials.

In the past, people who suffered from painful stones in their gall bladder had to undergo surgery. Now, ultrasound can destroy the stones without having to cut the patient open. What happens is the ultrasound causes bubbles of air to form on the stone. In a very short time the bubbles grow and collapse violently. Shock waves are forced out, smashing the stone into tiny pieces which pass harmlessly out of the body. This process is called **cavitation**.

Ultrasound can also be used to clean delicate objects and old fabrics, which might be damaged if handled. Directing ultrasound waves at the object, which is placed in a chemical bath, causes bubbles to form as in the example above. This time when the bubbles collapse the shock waves force all the dirt and grease off the surface, leaving it spotlessly clean.

### The script read-throughs

This is where you, as producer, decide if the finished scripts are good enough for broadcasting. Here are some 'production criteria' on which you might base your decision:

- how interesting is the feature?
- does it cover the important science?
- how appropriate is it for the audience?

If time allows, give each group some feedback after their performance.

### Scottish syllabus coverage

Standard Grade Physics - *Health Physics*

### Further pupil research opportunities

Using 'On Air' - a replica radio station at the Science Museum.

If you are considering a trip to the Science Museum, then here is another good reason to go. The experience of working in *On Air* - a high-tech recording studio - could be highly motivating for your pupils. You will be able to take away a professional standard recording of the feature which you could use in lots of ways e.g. at an open evening, in assembly, or at a school science fair or other event.

You can book sessions in *On Air* which give pupils 40 minutes in the radio station. A good arrangement is to have two teams, i.e. 6-8 pupils operating the studio at once. So for a class of 24, three sessions would give everyone a chance to make their recordings. While one team is in the studio the others could be visiting the galleries.

*On Air* is fully equipped with the editing and recording equipment needed to produce live programmes. Pupils do not need any technical knowledge because the museum's explainers show them exactly what to do. In the studio, pupils take one of two roles - either presenter or sound engineer. Sound engineers do the mixing of the different sound sources: microphones, interviews from tape and even musical jingles from CD.

If you're planning to use *On Air* it would be worth getting the teams to actually record their interviews with the ultrasound expert (yourself) on tape. They could then edit these in the studio, which would be rather more realistic than having the interview read by a presenter. A tape of the interview with the ultrasound engineer could also be provided in the studio for your pupils to use.

Bookings for *On Air* can be made through the Education Booking Office at the Science Museum (Tel: 0171 938 8222). They also publish a guide to the studio and a range of other *On Air* resources.