

## Case study – propranolol for PTSD

### Introduction

This activity is designed to help students prepare for the Unit 4 assessment. It is shorter than the exam and uses only two articles with the option of a third to help with the last question. The main focus will be on helping students to look at the scientific paper and extract some of the important features that are relevant to how science works.

The topic chosen is one that has important ethical issues that might be explored as an extension with supplementary material in part 2.

We suggest that this case study should be completed almost entirely in class with students discussing their answers with each other and the teacher.

### Resources

[Scientists find drug to banish bad memories](#) Daily Telegraph 30 June 2007.

Brunet et al *Effect of post-retrieval propranolol on psychophysiological responding during subsequent script-driven traumatic imagery in post-traumatic stress disorder*. *Journal of Psychiatric Research* **42** (2008) 503–506.

#### How Science Works

**Cc** An event is often explained by relating it to a particular scientific theory (or theories). A scientific theory proposes an underlying process that results in the observations we have made. Many scientific theories involve objects or properties that cannot be directly observed. Scientific theories do not 'emerge' from data by a process of logical deduction; proposing an explanation always involves imagination and conjecture. An explanation is not just a summary of the data, but is distinct from it.

**Cd** Scientists test an explanation by seeing if specific predictions based upon it are in agreement with data from observation or from an experiment (a deliberate intervention to generate data). If data agree with predictions that are very novel or unexpected, this is particularly influential. The aim is to rule out alternative explanations, and so reach a single explanation that most scientists can agree about.

**Ce** Scientists are more confident about theories that include a plausible mechanism for causing the events observed. It is also important that a new theory is consistent with existing theories that are well-established and generally accepted.

**Eb** Findings reported by an individual scientist or research group, and their interpretations of these, are carefully checked by the scientific community before they are accepted as reliable scientific knowledge. This process of 'peer review' is essential both for detecting invalid claims and adding weight to valid ones.

**Ec** Scientists publish their work in technical journals, in conference papers and on the internet. This enables other scientists to see and comment on the data collected, the methods used, and the interpretations made.

**Ed** Scientists value observations and measurements that are replicable (on different occasions and/or by different people), and are generally sceptical of findings that cannot be repeated.

**Fa** The interests and concerns of society influence the directions of scientific research and technological development, and the extent of funding for work in different areas.

**Fb** The popular media play a part in providing information, setting the agenda and influencing opinion on issues involving science and technology.

**Fc** Media reports of scientific developments are always simplified, and sometimes inaccurate. A newspaper report of a new development has not been through the stringent peer review process that articles in scientific journals must undergo (though it may be reporting on work that has).

#### Science explanations

**Jb** There are about  $10^{11}$  neurons in a brain. Each neuron is connected to many others giving over  $10^{14}$  interconnections.

**Jk** The pattern of connections made between neurons in the brain is unique to each individual and influences our subsequent behaviour and personality.

## Part 1

Look at the article from the Daily Telegraph

- (a) (i) How do you react to the title of the article?  
*It implies certainty, suggests it is beneficial. Possibly scary mind manipulation*
- (ii) What do you think is the reporter's attitude to the new drugs? Describe the clues you use.  
*Probably negative, unwanted outcome in film, concern among parliamentary advisers, quotes from concerned scientists*
- (iii) Do you think this is a balanced, fair article? Give reasons for your answer.
- (b) The article describes a model of memory recall to help the reader understand what the drug does.
- (i) Describe **one** way in which this is helpful.  
*Helps understand how memory might be altered, easily understood*
- (ii) Describe **one** way in which this might confuse the reader.  
*Memory is not a fixed object like glass. It is connections within the brain.*

Now look at the scientific journal article. You do not have to read it all and do not worry if there are words you do not understand. You can discuss these in class.

First look at the structure. There are 6 main sections

- Abstract
- Objectives
- Materials and methods
- Results
- Discussion
- References

- (c) **The abstract** summarises the method and the main results of the research.
- (i) Explain whether or not the abstract might be helpful to the general public.  
*Not really – it is very hard to understand and not particularly helpful.*
- (ii) How might such an abstract be helpful to busy scientists?  
*They can decide whether it is relevant to their own work without reading the whole article.*

(d) **The objectives**

The first paragraph of this section describes the theoretical model the research uses for PTSD. It uses the idea of conditioned response. If a stimulus is associated with an event, such as a bell ringing whenever a dog's food appears, then the stimulus alone will later produce the response that was originally caused by the event. Dogs salivate when they hear the bell. The creation of this association between stimulus and response is called conditioning. It means that people may respond with the same fear and stress when they merely recall the original event even though they are no longer in danger. The memory triggers a conditioned response. (i) Explain the role that hormones are thought to play in influencing the distressing reactions of PTSD when a traumatic event is recalled.

*Conditioning means that reminders of the event act as a stimulus to produce the fear response. Stress hormones strengthen the conditioning so that fear response to the stimulus is stronger and more durable.*

- (ii) How is propranolol thought to act to reduce these distressing reactions.  
*It opposes the effects of the stress hormones, therefore reducing conditioning.*

- (iii) Previous research is referred to in the second paragraph of this section. Give the authors of one animal and of one human study referred to.  
 Animal - *Ji et al 2003 / Przybyslawski et al 1999 / Debiec and Ledoux 2004*  
 Human - *Pitman et al 1987/ Orr et al 2002*
- (iv) Explain what *et al* means in the reference.  
*et al means 'and others' it is used where a reference contain several other authors, to save space writing them out each time.*
- (v) In order to investigate the issue researchers need a testable hypothesis. What was the testable hypothesis in this research? (last paragraph)  
*Subjects who received post-activation propranolol a week earlier would show smaller physiologic responses than those who received placebo.*

### (e) Materials and methods

The authors tell us that they used 19 people with PTSD.

- (i) It is important that they all really had PTSD. How did the researchers decide this? (Second paragraph)  
*Used structured interview for DSM-IV.*
- (ii) The rest of this paragraph tells us details about the two groups propranolol or placebo. Why might we want to know the age or gender of participants in each group?  
*To check that there was no bias in the selection of the groups.*
- (iii) What three things did they actually measure to compare the two groups?  
*Heart rate, skin conductance, EMG*

### (f) Results

- (i) Explain whether or not the results confirm the hypothesis you described in (d)(iv).  
*Yes the physiologic responses were all smaller in the propranolol group*
- (iii) All three measures indicate lower stress responses from the propranolol group. Explain how the error bars indicate that this difference is not significant for EMG measurements.  
*The true results for each group are known with 95% certainty to lie within the range of the error bars. As the error bars for the two groups overlap the difference in the means are not significant.*

### (g) Discussion

- (i) The first paragraph of the discussion mentions that these results are similar to those obtained by Pitman et al. 2002  
 Why do the scientists mention this?  
*Repeat gives credibility*  
*It credits those who did the earlier work*
- (ii) In the second paragraph of the discussion they say that they think they know the explanation for the effect they saw, which is that propranolol blocks memories from being re-consolidated after recall. However, they go on to say that they can't be sure without more experiments with more controls. They also do not know whether the effect is lasting.

Suggest why they have published this paper even though they still have doubts about the causes of the effects they describe.

*The effect is genuinely new, previous work was done using propranolol immediately after the traumatic event.*

*Effect appears to be a real one, doubt is over theoretical explanation.  
It will stimulate other researchers to do similar work. Repeating results strengthens certainty about the effect.  
Scientists need to publish papers for their status and career advancement.*

## Part 2

- (a) PTSD is a distressing and debilitating illness. In getting sufferers to recall the source of their trauma researchers were stimulating the stressful responses. What sort of issues might an ethics committee raise whilst making a decision on whether to allow this research to take place?

*Informed consent, are the participants fully aware of what will happen?  
Are they free to refuse participation without affecting any other care they receive.  
Do they know that the control group will not get any direct benefit but will still be stimulated to experience the stress responses of PTSD?  
Is extra support available to the subjects if they need it?  
Is there a risk of serious side effect?  
Is there a reasonable chance of a beneficial effect from the research that might justify the disadvantage to a few subjects?*

- (b) Write a short summary of the research that would be suitable for GCSE students who are learning about PTSD in PHSE.
- (c) Some people are concerned about the use of propranolol in this way. Read the BBC article which raises some of these concerns.

<http://news.bbc.co.uk/1/hi/health/4722225.stm>

New research is planned to study the effects of propranolol on subjects who are suffering PTSD as a result of military service in Iraq and Afghanistan.

There are now proposals to give soldiers propranolol on the battlefield to prevent PTSD. Would you support or oppose such use of the drug? Give a reasoned and balanced argument for your opinion.

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This activity is designed to help you prepare for the Unit 4 examination, the case study. It also teaches you about one drug that may be used to help those with a real problem, Post Traumatic Stress Disorder, PTSD, but might also be introduced to prevent PTSD developing in some 'normal' people in abnormal saturations. Much of the focus of this activity will be on learning to read and interpret a scientific paper about the issue.

### Part 1

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(ii) What do you think is the reporter's attitude to the new drugs? Describe the clues you use.

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**(b)** The article describes a model of memory recall to help the reader understand what the drug does.

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(v) In order to investigate the issue researchers need a testable hypothesis. What was the testable hypothesis in this research? (last paragraph)

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- (ii) All three measures indicate lower stress responses from the propranolol group. Explain how the error bars indicate that this difference is not significant for EMG measurements.

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**Part 2**

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- (b)** Write a short summary of the research that would be suitable for GCSE students who are learning about PTSD in PHSE.
  
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