Exam style question - Drugs and the brain

Introduction

This question is about the addictive effects of smoking and mainly examines Causal Links HSW ideas. It is similar in style to some of the exam questions in Unit 3, though longer than most.

Suggested answers

Many drugs are addictive.

- Addictive drugs elicit effects within the brain which are pleasant or rewarding
- Going without an addictive drug leads to unpleasant withdrawal symptoms. An addict may try to avoid these by continuing to take the drug.

(a) Addictive drugs are known to influence dopamine levels in the brain.

(i) Briefly explain the role of dopamine in the brain. (SE **Jd**, **Je**)

- *neurotransmitter*
- *transmits signal across synapses*
- *dopamine levels affect mood*
- *dopamine involved in transmission of signals related to movement*

(2 marks)

(ii) Give two ways in which a drug can act to change the effects caused byneurotransmitters such as dopamine in the brain. (SE **Jh**)

- *drugs can mimic neurotransmitters*
- *drugs can inhibit reuptake at synapses*

(2 marks)

(b) (i) Using Figure 1 estimate how many of the participants experienced a fall in dopamine levels (increase in BP) after smoking.

- *any value between 16 and 20*

(1 mark)

(ii) Which one of the following correlation coefficients do you think would most accurately describe the relationship between % change in BP and % change in mood, shown in Figure 1? Explain reasons for your choice. (HSW Bb)

+ 0.91, -0.91, -0.75, + 0.75, +0.33, -0.33,

- *-0.33 (for 2 marks, 1 for sign)*
- *wide variation in results/wide scatter*

(3 marks)

(iii) Using Figure 1 describe the relationship between % change in dopamine levels after smoking and % change in mood? (HSW Be)

- *There is a positive correlation*
- *does not apply to all individuals*
- *many experience no change in mood*

(2 marks)

(c) (i) The researchers describe one of the aims of the research as, "to determine if nicotine is necessary for smoking-induced dopamine release".

Use the results shown in Figure 2 to give a conclusion relating to this aim. (HSW B)

- *nicotine cigarettes increase dopamine*
- *nicotine-free cigarettes have little or no effect*
- *therefore nicotine appears to be necessary for dopamine release*

(2 marks)

(ii) How important is the role of nicotine in relieving smokers' withdrawal symptoms of craving and anxiety? Use the results from Figure 2 to explain your answer. (HSW Ab)

- *craving shows little/ no difference between two groups*
- *anxiety shows some difference*
- *but uncertainty /± very large/ overlaps two groups*
- *suggests that nicotine had no effect on these withdrawal symptoms*

(3 marks)

(d) At the end of the paper, which was published in a highly respected journal, there is a statement "The author(s) declare that, except for income received from my primary employer, no financial support or compensation has been received from any individual or corporate entity over the past 3 years for research or for professional service".

Discuss why this information is included and might be particularly important in a study related to smoking. (HSW Ef)

- *tobacco industry would have vested interest in certain conclusions*
- *industry has lots of money to tempt researchers*
- *shows that the author has no outside pressure to publish particular conclusions*
- *or to suppress results unfavourable to smoking*
- *known examples of bias created by a conflict of interests*

(3 marks)

(e) Imagine you were an advisor, developing health policies to encourage people to stop smoking. How would this research affect the recommendations you gave?

- *nicotine not the only factor in addiction*
- *withdrawal depends on other aspects of smoking*
- *nicotine patches will not stop craving*
- *need to consider different aspects of addiction separately*
- *explanation/understanding of processes might help addicts*

(2 marks)

Total 20 marks

December 2010

Exam style question - Drugs and the brain

Many drugs are addictive.

- Addictive drugs elicit effects within the brain which are pleasant or rewarding
- Going without an addictive drug leads to unpleasant withdrawal symptoms. An addict may try to avoid these by continuing to take the drug.

(a) Addictive drugs are known to influence dopamine levels in the brain.

(i) Briefly explain the role of dopamine in the brain.

.....

.....

.....

(2 marks)

(ii) Give two ways in which a drug can act to change the effects caused by neurotransmitters, such as dopamine, in the brain.

.....

.....

.....

.....

(2 marks)

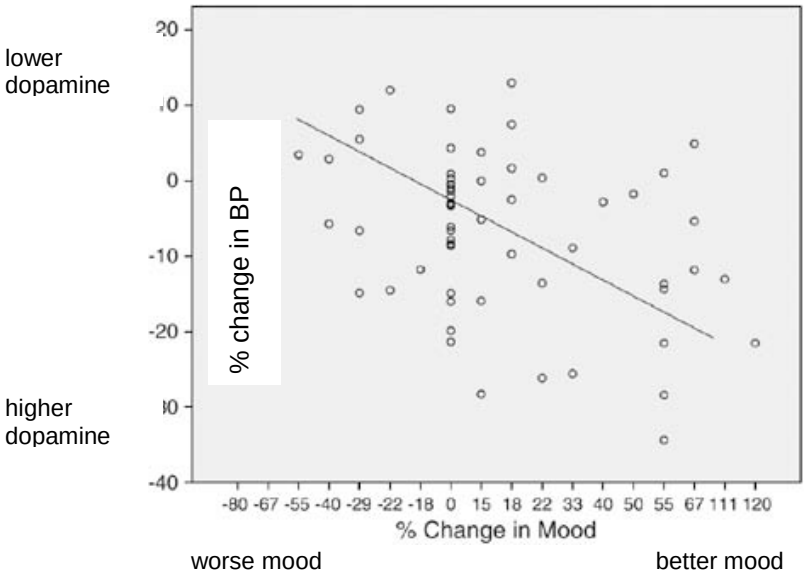
Smoking is addictive. It gives pleasure by improving mood. During withdrawal smokers experience the two unpleasant withdrawal symptoms of anxiety and craving, which are relieved by smoking another cigarette.

Researchers designed experiments to find out more about the specific effects of the drug nicotine in cigarettes on these three different aspects of addiction to smoking.

- Two matched groups of smokers did not have a cigarette for 3 hours.
- One group was then given a cigarette with no nicotine, the other was given a normal cigarette. This was double-blinded by the researchers.
- Both groups were tested before, and after the cigarette, for mood, anxiety and craving.
- They were tested for dopamine levels in a part of the brain known to be associated with pleasure. Dopamine levels are inversely related to the binding potential, BP, of a chemical known as ^{11}C-R, **the lower the BP, the higher the level of dopamine.**

Figure 1 is a scatterplot showing the relationship between change in ^{11}C-R binding potential, BP, and the percentage change in mood of smokers when they smoke after a 3 hour withdrawal period. There were 62 participants in the experiment.

Figure 1 The relationship between dopamine levels, as indicated by BP, and mood



http://www.nature.com/npp/journal/v34/n2/full/npp200887a.html

(b) (i) Using Figure 1 estimate how many of the participants experienced a fall in dopamine levels (increase in BP) after smoking.

.....

(1 mark)

(ii) Which one of the following correlation coefficients do you think would most accurately describe the relationship between % change in BP and % change in mood, shown in Figure 1? Explain reasons for your choice.

+ 0.91, -0.91, -0.75, + 0.75, +0.33, -0.33,

.....

.....

(3 marks)

(iii) Using Figure 1 describe the relationship between % change in dopamine levels after smoking and % change in mood.

.....

.....

(2 marks)

Figure 2 Responses to smoking regular and nicotine free cigarettes

Variable	normal cigarettes with nicotine (n=46)	cigarettes without nicotine (n=16)
% change in craving with smoking	-76.0	-71.8
% change in anxiety with smoking	-26.1	-21.7
% change in mood with smoking	15.2	-0.5
% change in BP (decrease means increase in dopamine)	-8.4	-1.2

(c) (i) The researchers describe one of the aims of the research as, "to determine if nicotine is necessary for smoking-induced dopamine release".

Use the results shown in Figure 2 to give a conclusion relating to this aim.

.....

.....

(2 marks)

(ii) How important is the role of nicotine in relieving smokers' withdrawal symptoms of craving and anxiety? Use the results from Figure 2 to explain your answer.

.....

.....

.....

.....

(3 marks)

(d) At the end of the paper, which was published in a highly respected journal, there is a statement "The author(s) declare that, except for income received from my primary employer, no financial support or compensation has been received from any individual or corporate entity over the past 3 years for research or for professional service".

Discuss why this information is included and might be particularly important in a study related to smoking.

.....

.....

.....

.....

(3 marks)

(e) Imagine you were an advisor, developing health policies to encourage people to stop smoking. How would this research affect the recommendations you gave?

.....

.....

.....

.....

(2 marks)

Total 20 marks