

## Review question on stem cells

### Introduction

This is an exam style question on stem cells that might be useful towards the end of the topic.

### Suggested mark scheme

(a) (i)	<ul style="list-style-type: none"> <li>a non-specialised cell</li> <li>a cell that can give rise to different cell types</li> </ul>	<i>any 1 for 1 mark</i>	1
(ii)	<ul style="list-style-type: none"> <li>they will grow/specilaise to replace the damaged cells</li> </ul>	<i>any 1 for 1 mark</i>	1
(b) (i)	<ul style="list-style-type: none"> <li>role of media hype/ wide publicity for stem cells</li> <li>no other treatment / already very ill</li> </ul>	<i>for 1 mark each</i>	2
(ii)	<ul style="list-style-type: none"> <li>full information on risks</li> <li>no false promises</li> <li>informed consent</li> <li>right to withdraw</li> <li>willingness to stop trial if serious adverse reactions seen</li> </ul>	<i>any 2 for 1 mark each</i>	2
(c) (i)	<ul style="list-style-type: none"> <li>embryonic can develop into any cell type in body/ totally undifferentiated/ totipotent</li> <li>adult can only develop into limited range of cell types/ adult is already partly differentiated</li> <li>ESCs can reproduce indefinitely in culture</li> </ul>	<i>for 1 mark each</i>	2
(ii)	<ul style="list-style-type: none"> <li>surplus IVF embryos</li> </ul>	<i>for 1 mark</i>	1
(d) (i)	<ul style="list-style-type: none"> <li>immune system will recognise stem cell transplant as self</li> <li>genetically identical to patient</li> <li>other stem cells will require immunosuppressant drugs</li> <li>other stem cells have risk of rejection by immune system</li> </ul>	<i>any 2 for 1 mark each</i>	2
(ii)	<ul style="list-style-type: none"> <li>asexual reproduction</li> <li>genetically identical copy</li> <li>embryo is identical to donor of cell nucleus</li> </ul>	<i>any 2 for 1 mark each</i>	2
(iii)	<ul style="list-style-type: none"> <li>women who agree to donate</li> </ul>	<i>for 1 mark</i>	1
(iv)	after 14 days the embryo has begun to differentiate stem cells are no longer totipotent/ they have begun to specialise	<i>any 1 for 1 mark</i>	1
(e)	Mark according to three levels (see below for criteria)		
	points that might be made include: <ul style="list-style-type: none"> <li>moral status of embryo as potential human</li> <li>respect for life</li> <li>slippery slope to reproductive cloning</li> <li>treating life as a means not an end in itself</li> <li>duty to apply knowledge to relieve human suffering</li> <li>embryo no feelings</li> <li>moral status of embryo not equivalent to live human</li> <li>many embryos lost naturally at this stage</li> <li>strict controls prevent reproductive cloning</li> </ul>		6

There are no separate marks for quality of written communication but it is one of the criteria used to determine the level and the mark within a level

<b>Level</b>	<b>Descriptor</b>	<b>Mark range</b>	<b>Level guidance for this question</b>
3	<b>Good</b> An answer will meet most of the criteria given in the level descriptor Claims supported by an appropriate range of evidence Good use of information or ideas about science going beyond those given in the question Argument well structured with minimal repetition or irrelevant points Accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling	<b>5 - 6</b>	good argument must include humanitarian as well as risk issues  <b>and</b>  at least 4 specific points  quality of argument or of points made might decide 5/6
2	<b>Modest</b> Claims partially supported by evidence Good use of information or ideas about science given in the question but limited beyond this The argument shows some attempt at structure The ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling	<b>3 - 4</b>	at least 3 specific points  <b>or</b>  argument with 2 sides and some evidence for each
1	<b>Limited</b> Valid points but not clearly linked to an argument structure Limited use of new information or ideas about science Unstructured Errors in grammar, punctuation and spelling or lack of fluency	<b>1 - 2</b>	less than 3 points <b>or</b> points very general 'could go wrong' 'too risky'
0	<b>Incorrect or no response</b>	<b>0</b>	

April 2008

## Review question on stem cells

Stem cells have the potential to treat many diseases such as diabetes and Parkinson's. These diseases are caused by the death or malfunction of particular cells.

(a) (i) What is meant by a stem cell?

.....

( 1mark)

(ii) If stem cell therapies work as hoped what role will the stem cells in the patient's body?

.....  
.....

(1 mark)

(b) One potential treatment uses adult stem cells from the patient's own bone marrow to treat damaged heart muscle. Stage II trials have been carried out, mostly on subjects who were already seriously ill. A report which analysed the results of such trials concluded; "few deaths followed the introduction of stem cells into the heart; and the therapy was even marginally successful in treating disease". It also admits that no one really understands the mechanisms involved.

(i) Desperate patients are willing to join trials despite the low success rate. Some people are travelling to other countries for such treatments. Many other clinical trials find it hard to enrol enough patients. Suggest **two** reasons why these stem cell trials are so popular.

.....  
.....  
.....  
.....

(2 marks)

(ii) There are ethical guidelines that cover clinical trials. Describe **two** ways in which researchers could ensure that this trial meets such guidelines.

.....  
.....  
.....

(2 marks)

(c) For many conditions adult stem cells are not suitable and researchers are hoping to use embryonic stem cells from a 6 day-old developing embryo.

(i) What is the difference between an embryonic stem cell and an adult stem cell?

.....  
 .....

(2 marks)

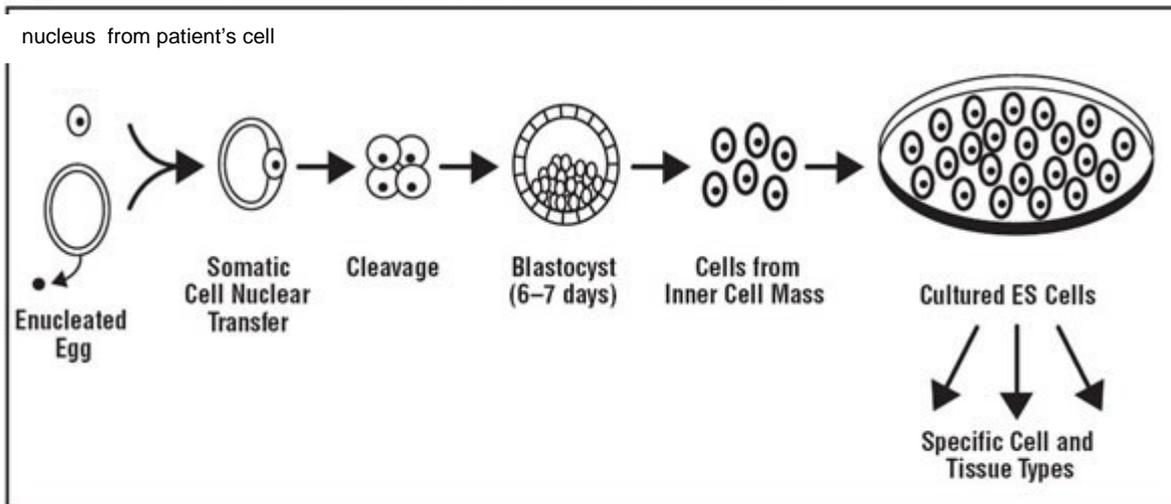
(ii) What is the main source of embryos to provide stem cells for this research?

.....

(1 mark)

(d) Many researchers hope to be able to produce embryonic stem cells derived from the patient's own cells. Figure 1 outlines the process they would use.

**Figure 1 Production of embryonic stem cells by cloning**



<http://media.www.dailyvanguard.com/media/storage/paper941/news/2004/02/26/News/Is.Cloning.Ethical-2612583.shtml>

(i) Why is it a significant advantage to make the embryonic stem cells from the patient's own cells in the way shown in Figure 1 ?

.....  
 .....

(2marks)

(ii) Why is this process called cloning?

.....  
.....

*(2 marks)*

(iii) What are the potential sources of human eggs to provide the enucleated eggs for the process?

.....  
.....

*(1 mark)*

(iv) Why do the researchers choose to harvest the cells for culturing at six days and not a week later when there would be far more cells?

.....  
.....

*(1 mark)*

(e) Many people are opposed to the use of embryonic stem cells on ethical grounds. Others feel there are good ethical reasons for doing this research. Outline the two main arguments used on both sides and explain your own position.

The quality of your written communication will be taken into account in awarding marks for your answer to this question.

*(6 marks)*

***(Total 21 marks)***