

Stem Cell review/CLONING Section

A. True/False: Circle "T" if the statement is true; circle "F" if the statement is false.

If true, leave the sentence alone.

If false, correct only **one** of the underlined words to make the statement true.

T/ F A pluripotent cell can give rise to every type of cell.

totipotent

T/ F A kidney cell and a muscle cell from your body have different genomes.

The same genome

T/ F In humans, most if not all the of the cells in the adult body are stem cells.

Embryo or differentiated

T/ F A fully differentiated cell is more likely to go through mitosis than a stem cell.

less

T/ F In a lab, ES cells are extracted from zygotes.

Blastula or blastocyst

T/ F For the organism, it is more dangerous if a fully differentiated cell acquires a mutation than a stem cell. *less*

T/ F Dolly the sheep was cloned from an ES cell.

Udder or differentiated or somatic

B. Circle the statement(s) that correctly complete(s) the sentence.

a) A concern about using a differentiated cell to provide the genome for a human clone is that...

i) each differentiated cell has a different genome, so it wouldn't be able to contribute all of the genes necessary to make a human.

ii) the cell could have acquired de novo mutations that make no difference to the donor, but could be detrimental to the emerging clone.

iii) the resulting cells would be haploid.

b) When an ES cell is implanted into a recipient blastula, the cells of the resulting animal will...

i) attack each other.

ii) be a mixed population each having one of two genomes.

iii) each have a unique genome.

c) Stem cells from your body can potentially be used to...

i) re-populate your damaged organs.

ii) grow a pig.

iii) re-populate your friend's damaged organs.

d) A blastula from a pure breeding black mouse is injected with an ES cell from a pure breeding tan colored mouse. The resulting animal may be able to produce offspring such that...

i) all of the offspring are tan colored.

ii) each offspring is part black and part tan colored.

iii) some of the offspring are black and some are tan colored

C. a) What are two differences between a zygote and a stem cell derived from an adult?

Almost totipotent ves Pluripotent

D. When Dolly the sheep was cloned in the 1990's, it has become apparent that cloning of mammals is a real possibility. It has since been found that although cloning is still an extremely inefficient procedure, some cell types are better nuclear donors than others.

Ian Wilmut and colleagues used udder cells for cloning, but before they removed their nuclei, they starved them in culture. Depriving donor cells of nutrients is now routinely done during cloning of other animals and has shown to be a useful procedure. Briefly describe why this is important.

News Flash: Dolly the sheep dies young ...from NewScientist.com

(<http://www.newscientist.com/hottopics/cloning/cloning.jsp?id=ns99993393>)

Dolly the sheep, the first mammal to be cloned from an adult cell, was put down on Friday Feb 14th, 2003, after developing a progressive lung disease.

Dolly's birth six-and-a-half years ago caused a sensation around the world. But as many sheep live to twice this age, her death will refuel the intense debate over the health and life expectancy of cloned animals.

The type of lung disease Dolly developed is most common in older sheep. And in January 2002, it was revealed that Dolly had developed arthritis prematurely. She was cloned using a cell taken from a healthy six-year-old sheep, and was born on 5 July 1996 at the Roslin Institute, Edinburgh, Scotland.

The Institute's Harry Griffin says: "Sheep can live to 11 or 12 years of age. A full post mortem is being conducted and we will report any significant findings". Following the post mortem, Dolly will be donated to the National Museum of Scotland in Edinburgh, where she will be stuffed and put on display.

Some cloned mammals, including Dolly, have shorter telomeres than other animals of the same age. Telomeres are pieces of DNA that protect the ends of chromosomes. They shorten as cells divide and are therefore considered a measure of ageing in cells.

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Given what you know about DNA replication, why do telomeres shorten as cells divide?

In the cell the primers are made of RNA and as a result the ones on the ends of the linear chromosomes are degraded and are not replaced with DNA as internal primers are. This results in some single stranded DNA ends of the chromosomes after replication, which is unstable and subject to degradation resulting in shorter chromosomes after each cell division.



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b) In the distant future, humans will discover the small mammal, *Thecheat strongbadius*, in the last remaining patch of rainforest. This animal, commonly known as a The Cheat, becomes wildly popular as a household pet. Cheats isolated in the wild have a green coat. An industrious pet store owner, who is a molecular biologist on the side, genetically engineers a cheat which develops a gold color coat as an adult. Knowing that this particular color of cheat will be extremely popular among his customers, he decides to clone the gold cheat.

Assuming that the principles used to produce the cloned sheep Dolly in the late 20th century are still applicable, describe how the pet store owner would clone the gold cheat.

Catch a female green cheat in the wild.

Isolate an egg from the green cheat and remove its nucleus with a micropipette.

Isolate a cell from the gold cheat that can be grown in culture.

Deprive the cultured cells of nutrients to arrest the cells in G1.

Fuse one of these cells with the enucleated egg.

Stimulate mitotic inducers in the cytoplasm of the egg.

Transplant the early embryo into a surrogate green cheat mother.

The embryo develops and a gold cheat is born!

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c) While websurfing one night, you come across a provocative website:

<http://www.rael.org>

It's a group interested in human cloning.

a) You immediately join this group. How much does it cost to join?

Well first you have to speak a language other than English. Their web site currently isn't working if you speak English. French works, though. Then if you're a student it is a mere \$150 bucks (tax deductible). If you're gainfully employed its 3% of your annual income as long as it's not less than \$300 bucks.

Because your 7.013 knowledge, you're chosen not only to be the second human cloned, but also to be in charge of your own cloning strategy!!

b) Outline below the procedure for making your very own clone.

Isolate an egg and remove its nucleus with a micropipette.

Isolate a cell from your body that can be grown in culture.

Deprive the cultured cells of nutrients to arrest the cells in G1.

Fuse the nucleus of one of these cells with the enucleated egg.

Stimulate mitotic inducers in the cytoplasm of the egg.

Transplant the early embryo into a surrogate mother.

The embryo develops and your clone is born!

You make your clone and Rael tells you that the clone is not as genetically identical as it might be.

c) Male Students only:

i) If you're male, assuming no mutations occurred in development, why might your clone not be identical to you.

the mitochondria DNA will not look like mine.

ii) How might you get around this?

Get an egg from my mother or sister.

c) Female Students only:

i) If you're female, assuming no mutations occurred in development, why might your clone not be identical to you.

If you used a stranger's egg than the mitochondrial DNA would be different.

ii) How could you make your clone as genetically similar to you as possible?

Use my own egg as to ensure the same mitochondrial DNA.

d) One member of your rael clan buddies suggests that the clone be made from your mature red blood cells, while another member argues that fibroblast cells would be better. Which cell type would you choose? Why?

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