Oxford Cambridge and RSA

A Level Biology A

H420/02 Biological Diversity

Question Set 17

1 It is possible to clone animals using a technique called somatic cell nuclear transfer (SCNT).

The most well-known example of this was the cloning of Dolly the sheep in 1996.

(a) Thirty years before Dolly the sheep, successful cloning of an animal was carried out using afrog, *Xenopus laevis*.

The cloning process is outlined in Fig. 19.1.

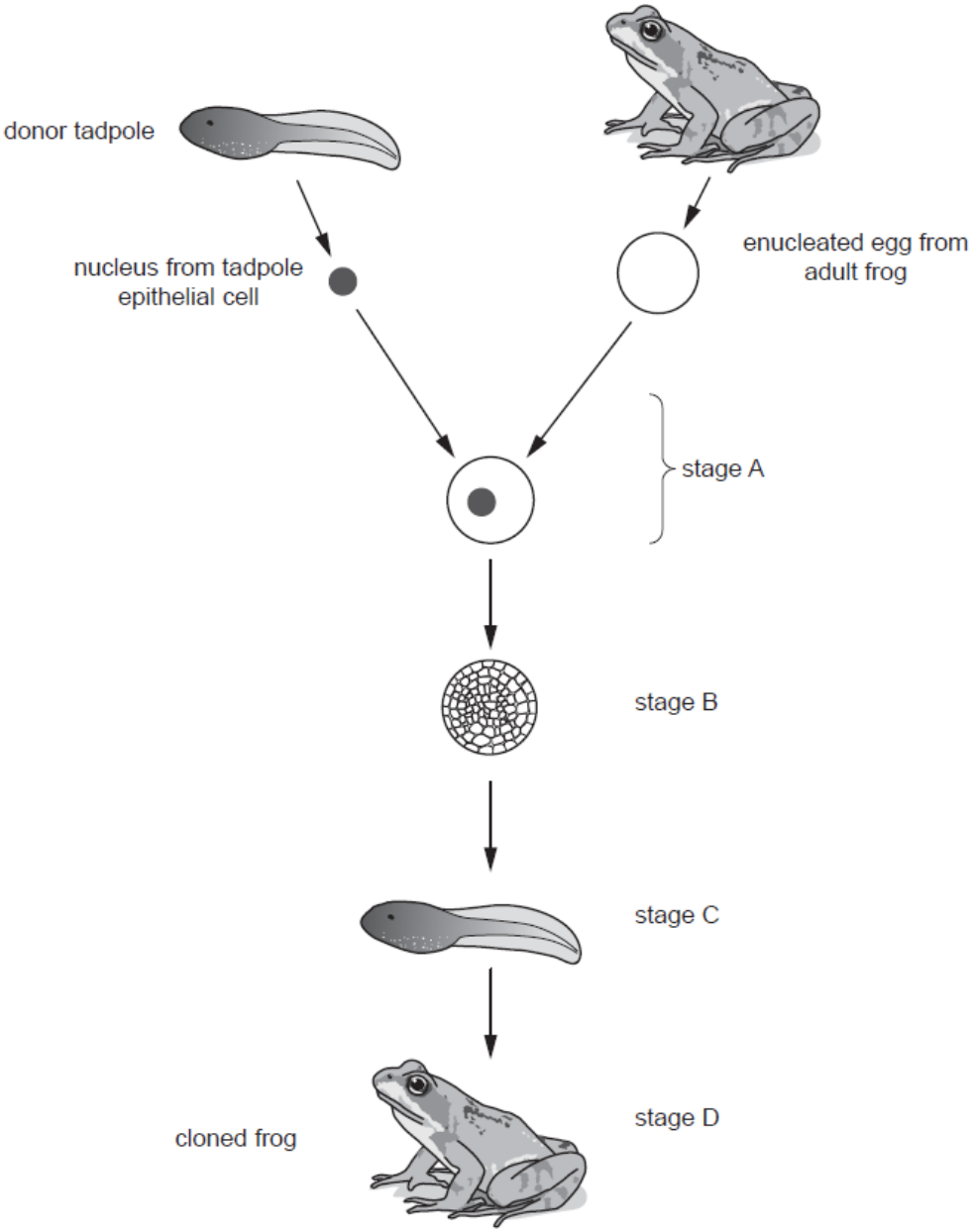

Fig. 19.1

(i) Describe what is happening at stage A **and** suggest a practical procedure that could allow this to occur. **[2]**

Nucleus from tadpole is tranferred to the cytoplasm of an enucleated egg (without nucleus). Nucleus can be fused with the empty egg cell by adding detergent to break down the egg's cell membrane and allow nucleus to get in.

(ii) Identify a key difference between the processes between stages A and C and the cloning of Dolly the sheep. **[1]**

Electric shock is used to speed up the process between stages A and C for Dolly but not for the frog.

(iii) The frog produced by the process in Fig. 19.1 is not a complete clone of the donor tadpole.

Suggest why the cloned frog might not be considered a complete clone of the donor tadpole.

Not everything is from the tadpole only nucleus is. Cell is from an adult frog. **[1]**

(b) It is possible to clone animals using a technique called somatic cell nuclear transfer (SCNT).

The most well-known example of this was the cloning of Dolly the sheep in 1996.

Thirty years before Dolly the sheep, successful cloning of an animal was carried out using afrog, *Xenopus laevis*.

Frogs lay eggs in water. These eggs then develop and hatch into swimming tadpoles. When the tadpoles grow to a certain size they develop into adult frogs.

The success of SCNT has been investigated in many species.

Sheep are more closely related to mice than they are to *Xenopus* frogs.

Fig. 19.2 shows the percentage of SCNT procedures that were successful in mice and *Xenopus* when the donor nucleus was taken from cells at different stages of development.

- The *Xenopus* data were published in 1962.
- The mouse data were published in 1998.

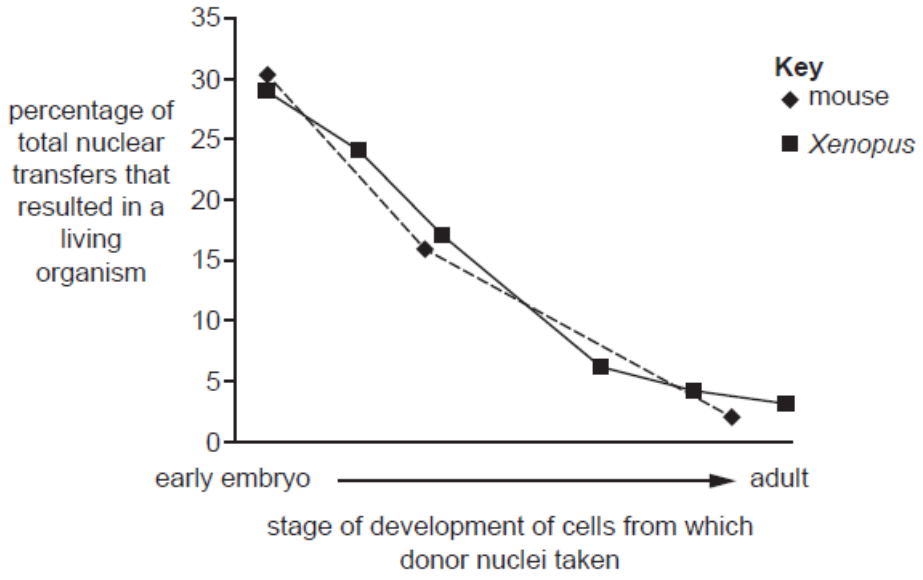

Fig. 19.2

(i) Suggest why the x-axis does not show the age of the donor nuclei. **[2]**

Because mouse and Xenopus have different lifespan and embryonic period. Comparing percentage of transfer within same age may be not a valid comparison.

(ii) Dolly the sheep suffered health problems throughout her life and died at an early age.

The donor nucleus that was used to create Dolly came from a sheep that was already five years old. The normal lifespan of a domestic sheep is ten years.

A student concluded that Dolly's health problems were caused by the stage of development of the sheep that provided the donor nucleus.

List three reasons why the information in Fig. 19.2 does **not** support the student's conclusion. **[3]**

Percentage of successful transfers does not suggest/represent health level. Also the sheep has different biology and lifespan to mice and Xenopus thus the data is not comparable. The time period in Fig 19.2 is different time period to Dolly's.

(c) One measure of the success of cloning procedures is the number of pregnancies that resultin live births.

Table 19 shows information from the work of many scientists about the success of SCNT infour different species.

Species	Number of pregnancies	Number of live births
Goat	26	8
Monkey	3	2
Mouse	438	56
Sheep	110	48

Table 19

(i) Calculate the percentage of pregnancies that resulted in live births in goats and mice.

$\frac{8}{26} \times 100 = 30.769$

live births in goats = 30.8 %

$\frac{56}{438} \times 100 = 12.785$

live births in mice = 12.8 %

[2]

(ii) List **three** factors that should have been controlled when compiling the data to include inTable 19.

[3]

Health
time
Environment (sufficent food + water and good habitat)

Total Marks for Question Set 17: 14