

A. Short assay questions. (88%)

1. Why eukaryotic cells need compartmentalization, i.e. what are the advantages? What is the factor(s) determine the size of a eukaryotic cell?
2. The current model of cell membrane is the "fluid-mosaic model" of the lipid bilayer. How was the membrane fluidity proven? What is the role of cholesterol in the membrane fluidity?
3. A genetic disease cause early atherosclerosis due to high concentration of cholesterol in blood. Can you explain what is the defect in people with the genetic disease?
4. Please describe the experiments which showed evidences that DNA is the genetic material.
5. A wild-type fruit fly (heterozygous for gray body and red eyes) was mated with a black fruit fly with purple eyes. The offspring was as follows: wild-type, 721; black-purple, 751; gray-purple, 49; black-red, 45. What is the recombination frequency between these genes for body color and eye color?
6. Vinblastin is a drug that interferes with the assembly of microtubule. It is widely used for chemotherapy in treating cancer patients. Suggest a hypothesis to explain how vinblastin slows tumor growth.
7. AIDS is not a disease, just new to the Western world. HIV probably originated in central Africa and may have been infecting humans for decades. In what ways might modern technology and social changes contribute to the emerge of viruses that make new epidemics like AIDS possible?
8. Abnormal immune function leads to disease. In some cases, it is caused spontaneously, but in another cases, it is caused by viral infections. Please give examples of both cases, and explain them.
9. Please explain the changes of ions in the four phases of an action potential.
10. Please describe how a sheep replica like Dolly was generated.
11. What is the role of muscle fibril sarcoplasmic reticulum and T-tubules in muscle contraction?

B. Thinking question. (12%)

1. During the summer of 1988, huge forest fires burned a large portion of Yellowstone National Park. The National Park Service has a natural-burn policy: Fires that start naturally are allowed to spread and burn themselves out with fire fighters primarily protecting people. This drew a lot of

(背面仍有題目,請繼續作答)

public criticism; the Park Service was accused of letting a national treasure go up in flames. Park Service scientists stuck with the natural-burn policy. Do you think this was the best decision? Support your position.

2. You have just joined a lab that is engaged in defining the nuclear transport machinery in yeast. Your advisor has given you a project with enormous potential. She gave you the two plasmids shown in the following figure. Each plasmid contains a hybrid gene under the control of a regulatory promoter. The hybrid gene is a fusion between a gene whose product is normally imported into the nucleus and the gene for restriction enzyme *EcoRI*. The plasmid pNL^+ contains a functional nuclear localization signal, and the plasmid pNL^- contains the nonfunctional signal. The promoter, which is from the yeast *GAL1* gene, allows transcription of the hybrid gene only when the sugar galactose is present in the growth medium.

Following her instructions, you introduced the plasmids into yeast (in the absence of galactose) and then assay the transformed yeast in medium containing glucose and in medium containing galactose. Your results are shown in Table 1. Please explain why do yeasts with pNL^+ plasmid grow in the presence of glucose but die in the presence of galactose.

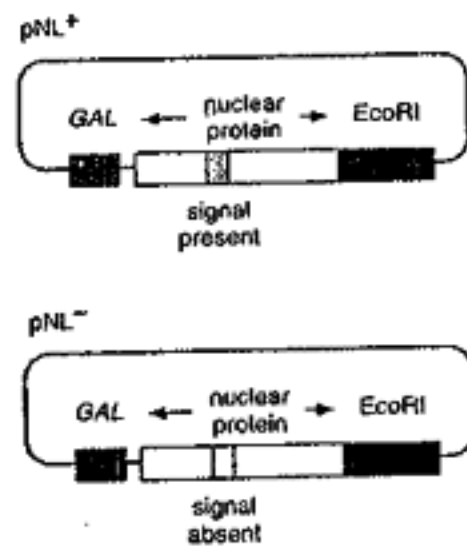


Figure. Two plasmids for investigating nuclear localization in yeast

Table 1. Results of growth experiments with yeast carrying the plasmids pNL^+ or pNL^-

Plasmid	Glucose medium	Galactose medium
pNL^+	growth	death
pNL^-	growth	growth