

A. Short assay questions. (88%)

1. How does the cell wall relate to the control of cell growth?
2. Centrosome is also named as MTOC. What is MTOC? Which type of cytoskeleton is responsible for radiating of cytoskeleton? How would you prove?
3. The lipid bilayer structure can be either the more highly ordered arrangement of phospholipid as semisolid gel phase, or the bilayers can melt into a fluid state in which individual molecules are free to flex, rotate or exchange places. (A) Please give examples of experiments how the membrane fluidity was proven. (B) Please discuss the effects of cholesterol on the fluidity of the lipid bilayer.
4. Homeotic genes are firstly studied by E. B. Lewis in *Drosophila*, and later it was found that homeotic genes occur in all animals and even in plant development. What are the homeotic genes and what structure motif is common to homeotic regulatory proteins? What sequence elements are recognized in genes controlled by homeotic regulatory proteins?
5. "The Signal Hypothesis" was first raised in 1972 concerning the mechanism of protein sorting and distributing proteins to different organelles. Please outline how proteins are sorted to ER and how SRP works in this model.
6. There are various forms of DNA conformation, i.e. A, B, C, D, E, and Z form. What is the function of Z form DNA?
7. In 1974, R. D. Kornberg has observed DNA fiber under electron microscopy, and described it as beads-on-a-string. What are the beads? Please explain how they are formed.
8. As we know, 90-97% of the genome is heterochromatic region. To your knowledge, what is the pay off for the presence of this high percentage of heterochromatic region in the genome?
9. rRNA plays important roles in ribosome formation as structural framework. What other roles that rRNA may play in protein synthesis? How did scientists find out?
10. MPF include both CDK2 (CDC2) and cyclins. The activities of MPF fluctuate through cell cycle. Please explain how and why MPF fluctuates.
11. The hyaluronic acid (HA) and proteoglycan combine into molecular superstructures (HA-GAG). What are the functions of the known largest biological molecule HA-GAG in the extracellular matrix?

(背面仍有題目,請繼續作答)

B. Thinking question. (12%)

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.

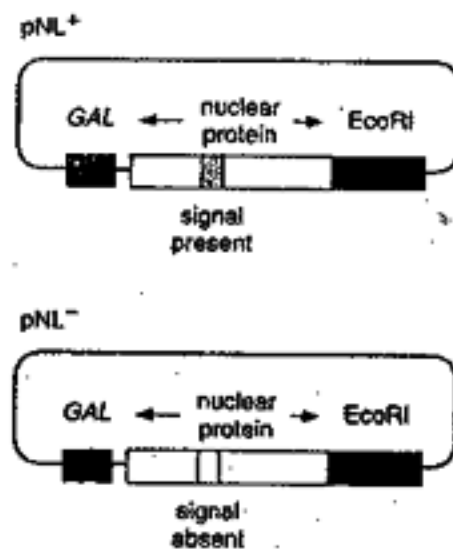


Figure 1. Two plasmids for investigating nuclear localization in yeast

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