Molecular Biology BIO420
FINAL- FALL 2000

Write all answers on the answer sheets provided:
Make sure you put your name and social security number on each page of the answer sheets.

PART I  (2 point each)
1. Lambda DNA can be digested into a discrete set of fragments using ___________enzymes.
2. A ___________ ___________consists of a collection of bacteriophages containing inserted DNA sequences that are representative of the entire genome of another organism.
3. Transgenic organisms may contain one or more copies of a transgene. The number of copies could be estimated by ___________ of the radioactive transgene to a filter containing the genomic DNA of the transgenic organism.
4. Unstable mutations ("mutable phenotypes") are caused by insertion of ___________ into a gene.
5-7.__(5)______are proteins that interact with DNA to prevent transcription initiation in prokaryotes. An example is ____(6)________ which binds to upstream of _____(7)______ (name a specific DNA sequence).
8.________are proteins that interact with DNA to promote transcription initiation in prokaryotes. 9. A prokaryotic transcription unit containing several genes under the control of one promoter is a(n) ______.
10-11. A gel shift (or gel retardation) assay might show where ___(10)_________ binds to ___(11)_________.
12. In regulation of beta-galactosidase expression, only when _________is bound to CRP (or CAP), can CRP bind to DNA.
13. Transcription of lacZ is likely to occur only if ________is present as a sole carbon source.
14. If two or more open reading frames are contained within a transcript, the transcript is said to be ____________.
15. If SDS was added to beta galactosidase, how would this affect the activity of beta galactosidase? Explain why SDS has this effect.
16. In the technique known as Western blotting, proteins are immobilized on a nylon or nitrocellulose membrane and reacted with specific _____________________.
17. Transcription is the name of the process whereby DNA is used as the template for the synthesis of ________.
18. What is spliced out from a primary transcript that contains two introns and three exons?
19. What enzyme might use dGTP as a substrate?
20. The figure to the right contains maize genomic DNA which was digested by three different restriction enzymes, Bam H1, Hin dIII, and Sal I, and the digested DNAs loaded onto lanes 1, 2 and 3, respectively. The filter was probed by Gene X. Assuming that there are no Bam H1 sites within Gene X, how many copies of Gene X do you think exist in the genome and why?

21.-24. Attenuation of the trp operon is affected by a limitation of ____(21)___ in the medium, causing a limitation of ____(22)______ required for protein synthesis. The ribosome pausing in the leader region results in a secondary structure of the transcript, which does not have a    ____(23)____ termination site. This type of regulation only occurs in prokaryotes because ____(24)____________ and ____(24)________ are coupled.
25. The upstream (5') end of an intron forms a phosphodiester bond with an A residue at the branch point; the excised intron has the form of a _________.

26.-27. A cell containing an integrated Lambda phage genome is called a(n) (26)_____. The integrated genome is called a(n) (27)_____.

28. What is the function of a ribosome?

29. The _______ cycle of Lambda phage results in phage progeny.

30-31. Two proteins are essential for establishment of lysogeny; cI represses the ___(30)____ cycle and int is required for ___(31)_____________________

32-33. The function of an antiterminator is to prevent ___(32)____________ termination. An example of an antiterminator encoded by phage lambda is the ___(33)_______ protein.

34. -35. Most proteins located in mitochondria, chloroplasts, and nuclei are synthesized on ribosomes that are located in the ___(34)____ and are not associated with the ___(35)_____.

36. Most proteins translocated to the nucleus pass through ____ in the nuclear envelope.

37. Transport of a protein from the cytosol to the nucleus is assured by a basic amino acid sequence called the ____________________

38. If the temperature for hybridization is below the Tm, will you see a signal on a Southern?

39. True or False: A mitochondrion has its own genome, but a peroxisome does not.

40. True or False: Every protein found in a chloroplast is nuclear encoded.

**PART II [5 points each]**

41. Look at the figure at the right. Which gene appears to be regulated by light and WHY?

42. You have isolated Gene X from Arabidopsis, including its promoter. To learn more about how Gene X is expressed in Arabidopsis, you have fused its promoter upstream of the GUS (beta glucuronidase) reporter gene coding region. Then you made transgenic Arabidopsis plants containing this transgene. When these plants were stained for GUS activity, you obtained the result shown at the right, where the dark spots correspond to the GUS expression. What conclusions about the function of the promoter DNA fragment and the
expression of Gene X, can you draw based on these results and WHY?

**PART III** [10 points]

Choose one topic and write a half page essay.

A. What kind of regulatory activity do proteins Cro and cI have and what is their binding site? Explain how and why Cro and cI act to regulate transcription in an opposite temporal fashion.

B. Give an example and explain gene control by attenuation. Make a drawing of the relevant operon and indicate both the regulatory and structural components.

C. Explain how the *E. coli* lac operon is regulated both negatively and positively. Make a drawing of the operon and indicate both the regulatory and structural components.

D. Explain how proteins are targeted and imported into different organelles.