

PLNT2530 PLANT BIOTECHNOLOGY

FINAL EXAMINATION

6:00 pm to 8:00 pm Wednesday, April 17, 2013

Answer any combination of questions totalling to exactly 100 points. If you answer questions totalling more than 100 points, answers will be discarded at random until the points equal 100. This exam is worth 40% of the course grade. The questions available total to 120 points.

Hand in these question sheets along with your exam book. Question sheets will be shredded.

Ways to write a readable and concise answer:

- i. Just answer the question. Save time by specifically addressing what is asked. Don't give irrelevant background if it doesn't contribute to the question that was asked.
 - ii. Avoid stream of consciousness. Plan your answer by organizing your key points, and then write a concise, coherent answer. Make your point once, clearly, rather than repeating the same thing several times with no new information.
 - iii. Point form, diagrams, tables, bar graphs, figures are welcome. Often they get the point across more clearly than a long paragraph.
 - iv. Your writing must be legible. If I can't read it, I can't give you any credit.
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1. (15 points) In the event that a gene from a transgenic crop gets transferred to a wild relative, what factors might govern the "fixation" of that gene in the wild population? (Fixation means that eventually, all plants in the population would have the gene.)

Discuss the likelihood for fixation of the following traits, introgressed from a transgenic plant into a wild plant species:

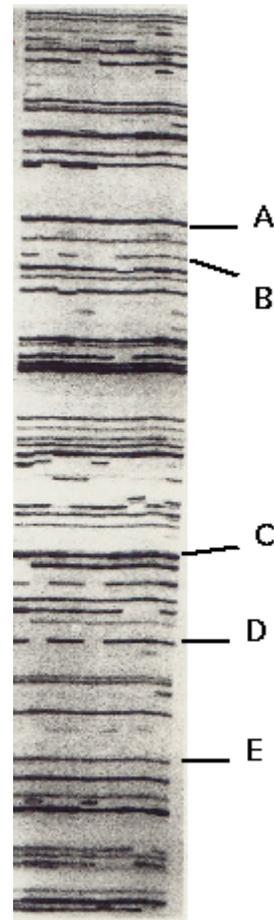
- a) a gene for antibiotic resistance
- b) a gene for herbicide resistance
- c) a gene for improved nutritional content

2. (5 points) For what types of crops might GURTs be used to ensure food safety?

3. (15 points) Define the following terms, and explain what we learn from each:

- a) Transcriptomics
- b) Proteomics
- c) Metabolomics

4. (10 points) Which of the AFLPs in the accompanying gel would be considered informative? Which would you use in a genetic mapping experiment, and why?



5. (10 points) Glyphosate (Roundup) is a herbicide that targets the _____a_____ pathway, leading to the production of many different classes of secondary metabolites. One example of a product from this pathway is _____b_____. In plant cells, the shikimic acid pathway occurs in the _____c_____. The target of glyphosate is the enzyme EPSP synthase.

Two different genes have been used for engineering glyphosate resistance in crops. One is an EPSP synthase gene from *Agrobacterium* for which differs from the plant enzyme because _____d_____. The other enzyme used is a bacterial enzyme called glyphosate oxidoreductase that confers glyphosate resistance by _____e_____.

6. (10 points) The majority of plant genetic engineering applications involve adding a new trait to a plant. Gene knockout can be more difficult. What unique challenges are posed by knocking out allergenicity in peanuts? What approach was taken to accomplish this goal?

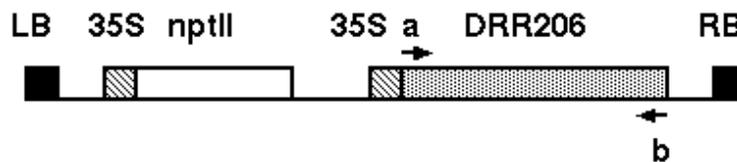
7. (10 points) Why is chloroplast transformation potentially a useful mechanism for preventing unintended outcrossing of transgenic plants with non-transgenic plants? What are the

difficulties associated with chloroplast transformation?

8. (15 points) There are many ways of verifying transformation of a plant, each with its advantages and disadvantages. The construct shown below contains two genes, under the control of the 35S promoter, between the T-DNA left and right borders. The DRR206 gene has been shown to provide some resistance to the blackleg fungus in transgenic canola. The nptII gene encodes neomycin phosphotransferase.

The following table lists a number of possible experiments, and the types of information that might be obtained. A "yes" means that the experiment is likely to provide a particular type of information. A "no" means that the experiment will not tell us that information. Some of the table has already been filled in.

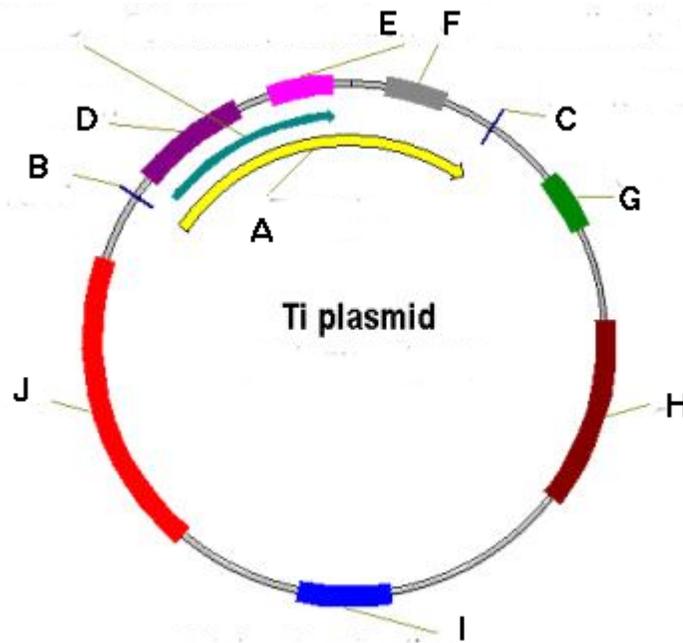
Your job is to rewrite the table in your answer book, and complete it using yes/no answers. To save time, feel free to shorten or abbreviate the column and row headings, as long as you keep them in the same order.



	What the experiment tells us:			
	Presence of DRR206 gene	Copy number of DRR206 gene	Expression of DRR206	Presence of nptII gene
Experiment:				
PCR using primers a and b	yes	no	no	no
Southern blot using DRR206 gene as a probe				
Northern blot using DRR206 as a probe				
assay for root growth in kanamycin				
test for resistance to blackleg		no		

9. (10 points) Two mechanisms have been described for why transgenes can become silenced in transgenic plants: TGS (transcriptional gene silencing) and PTGS (posttranscriptional gene silencing). Briefly describe the mechanisms behind each.

10. (10 points) For the map of the octopine Ti plasmid shown at right, give the name for each feature marked with a letter, A - J. You do not need to describe each feature, just list its name.



11. (5 points) What is the best type of cloning vector for creating a library if you plan to do chromosome walking? Explain your reason.

12. (5 points) Binary vector systems for plant transformation employ two plasmids. Briefly explain the function of the two types of plasmids in *Agrobacterium*-mediated transformation.