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## Final Exam - BI/FS 430/530 (H)

Closed-book, exam must be turned in within two hours

### Short Answer (1 pt each, use a few words or a phrase for your answers)

1. FIFRA, the Federal Insecticide, Fungicide, and Rodenticide Act, is meant to regulate what broad types of products that are widely used in agriculture and around the home?
2. The use of rBST to increase milk production in dairy cattle can lead to health problems if herds are not managed properly and given extra nutrition and care. One disease is caused by an inflammation of the udder leading to increased somatic cell counts. What is this disease?
3. What specific type of intellectual property protection was extended to life forms following a 1980 court decision involving bacteria?
4. Improvements in DNA sequencing and related DNA-typing technologies have reduced the cost of determining genome sequences, identifying genes, and developing DNA markers. Name one way, other than use of GE, in which such technologies are being used to make breeding more efficient.
5. Some people object to genetic engineering for moral reasons. In terms of the strength of their moral convictions, do people generally tend to feel more or less strongly about animals vs. plants, or about the same?
6. As of 2006, approximately what percentage of the US soybean crop is planted to varieties derived from GE?
7. Seafood is widely viewed as being a rich source of a dietary compound (or ingredient) believed to provide health benefits for people. What is this compound?
8. Round-up ready bentgrass was designed for what market?

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9. What was the main point of the Editorial from Nature magazine entitled “diversity in food technology”?
10. What was the main point of the article by Kirschenmann entitled “technologies for a sustainable future...”?
11. When visiting a physician, before medications are prescribed you might be asked to provide some background about your personal and medical history, eating habits, and whether or not you take dietary supplements. Why might a physician be interested in whether or not you consume dietary supplements?
12. Biopesticides are typically classified in terms of their origin. Microbial biopesticides, for example, come from microbes (e.g. bacteria or fungi). Give an example of a biopesticide that is also known as a plant-incorporated protectant or PIP.
13. In terms of husbandry practices for organically-certified livestock, name one situation or condition that must be provided for the animals themselves.
14. Dr. Alex Stone discussed a consumer boycott of Horizon organically-certified milk products. Briefly, what was this boycott about?
15. The production of BT corn is centered in what general region of the US?
16. Organically-certified animal manures, if applied as fertilizer, could pose a health hazard. Please name one of several possible precautions used to mitigate such a potential hazard.

**Short Answer (2 pts each, use a few words or a phrase for your answers)**

17. Ethicists considering the benefits and risks of agricultural biotechnology often consider “distributive justice.” What does this mean, and give one example about how GE crops might affect it.

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18. In Chapter 9 in Food Inc (Pringle), entitled “the cornfields of Oxaca,” why were these corn fields the subject of discussion and why did it receive extensive news coverage?
19. Are you aware (personally or otherwise) of the existence of human clones? If so, has technology dramatically altered how human clones have come to exist?
20. In toxicology, a complete exposure pathway must include a mechanism, or route, by which a toxic substance can enter the human body. Name two of the three common routes.
21. The first chapter of “Lords of the Harvest” by Dan Charles, was entitled “the first transformation.” What was it about in scientific and business terms?
22. True or false, and why? *Bacillus thuringiensis*-derived microbial pesticides are authorized for use as biopesticides in organically-certified agriculture, but not as PIPs.
23. Give an example of a pest or threat that BT is designed to guard against, and describe how BT proteins physiologically cause their effects?

**Mini-essay / analysis (3 pts each)**

24. How is it that mycotoxins (by-products of a fungal infection) can be reduced by corn harvested from GE varieties that were not specifically modified to reduce fungal infection?

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25. With respect to herbicide tolerance, what is meant by a “superweed” and what did Dr. Mallory-Smith think about the value of this term for discussion of herbicide tolerant crops, and why.
  
26. The Centers for Disease Control performed a follow-up investigation of Starlink corn. In general terms, why was it done, what was done, and what did the study conclude?
  
27. Name three environmental concerns of aquaculture practices.
  
28. In conducting a risk assessment, a toxicologist would take into account two main factors that affect the level of risk. What are they, and briefly contrast how these two risk components differ.

**Mini-essay / analysis (4 pts each)**

29. In considering the relative risks of GE methods vs. conventional breeding, how does the NRC view the overall risk of chemical mutagenesis compared with, say, the transfer of DNA from one species to another using *Agrobacterium*? Why?

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30. In evaluating food safety from GE plants, which of the following would generally be considered in determining substantial equivalence (circle them, there may be more than one) and discuss briefly (one sentence or less) why the ones that are not true are incorrect.
- Where the transgene originated
  - The quantities of major anti-nutrient compounds (e.g. certain glycoalkaloids, polyphenols, tannins, phytoestrogens, or other compounds that could interfere with normal metabolic processes) in GE and non-GE comparators
  - Whether or not the composition of GE and non-GE plants was indistinguishable, except for the introduced product
  - The overall nature and pattern of GE vs. non-GE plant growth and agronomic properties
31. Briefly and in qualitative terms, contrast recent production trends (over the last 20 years or so) in capture fisheries vs. that from aquaculture, and cite three major kinds of aquaculture fish or shellfish species.
32. Phytate is a compound in seeds of terrestrial plants in which phosphorus is stored. The EnviroPig has been engineered to metabolize phytate. Why would aquaculture scientists want to introduce phytase genes (to metabolize phytate) into fish?
33. What were two main points made by Steve Shapin in his article in New Yorker magazine "Paradise Sold"?

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34. The production of polyhydroxy-butyrate (PHB) in plants (as a precursor for bioplastics) is an example of which, a PMP, or a PMIP? List the correct acronym and define them both. Why would one want to make such a product in a plant (give one reason)?
35. The State of Oregon convened an advisory committee to consider the issue of growing biopharma crops within the State. Regarding this committee, which of the following would be generally regarded as true (circle them, there may be more than one) and discuss briefly (one sentence or less) why the ones that are not true are incorrect:
- The committee was assembled because consumers were concerned about the potential for rapid expansion of the biopharma crops already grown in the State.
  - The committee heard testimony from a broad spectrum of experts, including people whose work tends to support growth of the biopharma industry, as well as others who oppose the biopharma industry.
  - The committee considered testimony submitted by the Food Products Association, a trade organization representing the U.S. food and beverage industry.
  - After considering all testimony, the committee recommended that production of biopharma crops in Oregon be banned.

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**Essay / analysis (5 pts each)**

36. In considering aquaculture of transgenic fish, specifically the use of GE fish that grow very rapidly due to the presence of hormone-over producing genes, give one reason this is considered by some to be a serious environmental risk, and one reason it is unlikely to be a serious risk.

37. What is a “monoculture” and describe two ways it does two ways it does not apply to the effects of GE crops?

38. The company Ventria wishes to produce lactoferrin and lysozyme in rice, but has had a difficult time locating an approved site for production. The company recently received approval to grow it’s GE rice in Kansas. Where did the genes for these products derive from? What are the intended uses for these products? Name a key factor that influenced the decision to produce in Kansas.

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39. Which of the following statements regarding organic agriculture in the US would generally be regarded as true (circle them, there may be more than one) and discuss briefly (one sentence or less) why the ones that are not true are incorrect:
- a. The production of crops and animals without the used of synthetic, asexually inserted genes
  - b. The production of crops and animals using only what can be supplied from on-farm sources (no use of additives or amendments is allowed).
  - c. Organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, and aspects of biological pest control.
  - d. The production of crops and animals without the use of any pesticides or fertilizers.
  - e. Local farms, usually family farms, producing food or feed for local markets.
40. In contrasting drugs and dietary supplements, which of the following would be generally regarded as true (circle them, there may be more than one) and discuss briefly (one sentence or less) why the ones that are not true are incorrect (5 pts):
- a. Dietary supplements are regulated by DSHEA.
  - b. Labels and associated information for drugs must be precisely constituted to indicate their intended use, benefits, and possible side effects.
  - c. Dietary supplements must be labeled to specify the amount of active ingredient they contain.
  - d. Dietary supplements must include the disclaimer that any statements on the label or on advertisement that suggest benefits “have not been evaluated by the FDA.”
  - e. Dietary supplements must be subjected to toxicology studies before they are allowed to enter the marketplace.

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41. Regarding the saga of Starlink corn, which of the following statements would be generally regarded as true (circle them, there may be more than one), and discuss briefly (one sentence or less) why the ones that are not true are incorrect:
- Starlink corn had been engineered as a biopharma product.
  - Starlink corn had been approved for animal feed, but not for human consumption.
  - Starlink corn contained a gene encoding a type of BT protein.
  - Starlink corn was first detected in tortillas under the Taco Bell label.
  - The tolerance set for the presence of Starlink corn in human food was only 1 ppm.

**Essay / analysis (>5 pts each)**

42. The saga of genes from Brazil nut introduced into soy is noteworthy in several respects. What was the project intended to do? What was the outcome? Did it settle the science and public controversies over whether allergies can be predicted for GE crops? Why or why not? (6 pts)
43. Give two examples of biopharma products under development, two reasons for the interest in producing them, two reasons for production of biopharma products in food crops such as corn or canola, and two reasons why such production might be prohibited or highly restricted by regulations. (8 pts)

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44. Considering the mechanisms of gene flow from GE to non-GE crops (or to their wild relatives) and the consequences of adventitious presence (AP): Define gene flow and AP. What are four pathways by which gene flow or AP can occur? What is marketplace risk, and why can marketplace risk be much higher than biological risk? What kinds of mechanisms does society create to deal with the essentially unavoidable propensity for some level of AP with large scale commercial production and trade of crops grown out of doors? (10 pts)

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**Questions for graduate and honors students only (2 pts each)**

45. What was the main point made by Stephen Hilgartner in his article “acceptable intellectual property”?
  
  
  
  
  
  
  
  
  
  
46. According to Finucane, what social/psychological factors that are important to the perception of risks from foods derived from GEO crops (name two)?
  
  
  
  
  
  
  
  
  
  
47. In “is repugnance wise” bioethicist Leigh Turner urges caution in forming views toward new biotechnologies based on gut reactions like revulsion/the “yuk” factor? On what basis does he make this argument (cite two reasons or examples consistent with his viewpoint).
  
  
  
  
  
  
  
  
  
  
48. The Nuffield Foundation, in its report on the ethical responsibilities for development of GEOs for the developing world, made what warning about the conservative (i.e., strict) interpretation of the precautionary principle?
  
  
  
  
  
  
  
  
  
  
49. What were two points covered in the article “GE technology develops in the developing world” from Science magazine in 2007?