

Study Guide Lesson 13: Agricultural Biotechnology

18. Genetic engineering of crop plants is controversial because:

- (A) so many people have died or become sickened as a consequence of eating them
- (B) they have been shown to be massively destructive to the environment when the genes they contained are transferred from plants to the insects that feed on them
- (C) cloned DNA is used to create them and people are uncertain about the process
- (D) big business has consistently lied and misled the public about their safety
- (E) they have been shown to cause heart disease in mice, humans and primates

19. There is an interesting parallel between the language of DNA and our own written language (Is this a coincidence?). A nucleotide is like a letter (not much information); a triplet, or codon, is like a word (slightly better, a word has meaning); a gene, then would be like a paragraph and a chromosome would be like a one volume of a set of encyclopedias with the whole set being like the entire genome. A genetic construct used for crop improvement is:

- (A) like a foreign language that can not be read, giving only garbled protein sequences that may have catastrophic consequences on plant and human health
- (B) like a cut and paste document; it is a synthetic sequence of DNA that will be transcribed into RNA and will be translated into a particular protein that corresponds to the sequence of the gene
- (C) like a political manifesto on agriculture for the future declaring all the good it can do for the world under false pretenses that have yet to be realized by the real world of commercial agriculture production by large companies
- (D) like bad poetry, eventually to be discarded from the genome; introduced genes are not inherited by the next generation
- (E) like putting caustic substances into food for cosmetic purposes

20. Plants that have been genetically modified for crop improvement, including corn, canola, cotton, and soybean in the US, have been widely adopted by farmers to reduce input costs and pesticides. The products from these plants:

- (A) have been shown to be widely dangerous to humans and the environment
- (B) are currently used for livestock feed only
- (C) have been included in many food products for years now without substantiated affect on human health
- (D) are pending approval by the FDA but are expected to be on the market for the first time soon
- (E) having been promoted only by the Agricultural-Industrial complex, must be unhealthy, and as advocated by the USDA, should be labeled

21. GMOs have been shown to cause long term negative health problems in humans.

- (A) true (B) false
- (C) inconclusive: there have been no long term studies of their affect on any animals
- (D) inconclusive: GMOs are only theoretical
- (E) inconclusive: no one has studied this in humans

22. Genetic constructs can be made using DNA fragments from different sources through the methods of gene cloning and used to introduce new traits in plants important for agricultural purposes. Gel electrophoresis is used to separate DNA fragments. What feature(s) of a DNA fragment causes it to move through a gel during electrophoresis?

- (A) the molecular weight (size) of the fragment
- (B) its nucleotide sequence alone
- (C) the hydrogen bonds between the base pairs in DNA
- (D) its double helix structure
- (E) none of these answers are correct

23. Enzymes can be used to “cut” and “paste” DNA fragments to make transgenes that can confer new traits in genetically modified plants. It is possible to isolate a promoter region from one plant and fuse it to a gene from a bacteria and a termination signal from another plant to construct a transgene that can be put into plants that will confer expression of the bacterial gene. When DNA is cut it can be analyzed using gel electrophoresis. After a gel electrophoresis procedure is run, the pattern of bands in the gel show:

- (A) the order of bases in a particular transgene
- (B) the presence of various-sized fragments of DNA
- (C) the order of genes along a particular chromosome
- (D) the exact location of a gene in a genomic library
- (E) none of these answers are correct

24. In 1962, Rachel Carson wrote: “A truly extraordinary variety of alternatives to the chemical control of insects is available. Some are already in use and have achieved brilliant success. Others are in the stage of laboratory testing. Still others are little more than ideas in the minds of imaginative scientists, waiting for the opportunity to put them to the test. All have this in common: they are *biological* solutions, based on understanding of the living organisms they seek to control, and of the whole fabric of life to which these organisms belong.” GMO plants offer solutions to agricultural problems:

- (A) that rely only on synthetic chemicals
- (B) kill insects indiscriminately
- (C) result in plants shown to be harmful to human health
- (D) based on biological solutions
- (E) none of these answers are correct

25. Organic Foods are known to be better for you since:

- (A) they have been shown to have quantitatively higher levels of proteins compared with their conventional counterparts
- (B) they have been shown to have quantitatively higher levels of vitamins compared with their conventional counterparts
- (C) they have no GMOs which have been demonstrated to have negative effects on human health
- (D) they are only grown from heirloom varieties that have not been robbed of their inherent nutritional value the way conventional crops have been
- (E) they are safer than their conventional counterparts regarding food borne diseases like E coli

26. Suppose you were a farmer living in a country facing famine and you had access to a genetically modified seed stock for growing 1000 hectares of drought tolerant maize that was 30 percent more productive than your existing seed stocks. Your country allows production of GM crops and you have received funding from the Gates Foundation to purchase the seed. Which group would you be most likely to obtain the seeds from?

- (A) The United Nations
- (B) Greenpeace
- (C) Monsanto
- (D) The Salvation Army
- (E) Church World Service

27. Suppose you were a farmer living in a developing country. You can grow crops for subsistence, but you have no money to send your children to school or for medical care. You have access to a genetically modified seed stock for 1000 hectares of maize that is 30 percent more productive than your existing seed stocks. One problem is that you might not be able to sell your seed to market since:

- (A) you don't want to exposure your children to the known risks of GM crops
- (B) your country exports to Europe which has a ban on GM crops and ingredients
- (C) GM crops are known to be useless for human and livestock nutrition
- (D) GM crops are inherently risky in every farm environment
- (E) the buyers in all developing countries accept only organically grown crops (no GMOs)

28. The implementation of agricultural biotechnology is moving much faster than the public education about it. Hence there is no meaningful public discussion and there are no collective decisions. Therefore, momentous collective moral decisions about agricultural biotechnology are being made largely by:

- (A) a well educated public
- (B) well informed scientists at Greenpeace
- (C) default
- (D) educated clergy
- (E) Church World Service

29. Norman Borlaug:

- (A) was a Nobel Laureate for his role in The Green Revolution
- (B) invented Genetic Modification of Agricultural crops
- (C) played for the New York Yankees before becoming an advocate of World Agriculture
- (D) was an outspoken critic of Agricultural Biotechnology citing its detriments to sustainable agriculture
- (E) believed that Agricultural Biotechnology could not play a significant role in ending world Hunger

30. There are currently 7 billion people on the planet and projected to reach 9 billion by 2050. One question is whether biotechnology can be used to feed the poor. Another question erroneously asks whether biotechnology *should* be used to feed the poor (with the presumption that the poor will generate more poor). How many people can the planet sustain? What is the best estimate of the carrying capacity for the planet?

- (A) 10 billion
- (B) 100 billion
- (C) 1000 billion
- (D) 10,000 billion
- (E) it can not be accurately determined based on a variety of yet unknown factors

31. There are currently more than 7 billion people on the planet and projected to reach 9 billion by 2050. Considering the use of biotechnology and the crises of rising population, decline of arable land and water resources, limited energy supplies, unequal distribution of food, and a growing decline in global food security. What are the major risks (real or perceived) concerning the deployment of biotechnology application to agricultural?

- (A) risk to worldview
- (B) risk to human health
- (C) risk to environment
- (D) risk to sustainable environment
- (E) all of the risks shown have been expressed as concerns

32. The majority of climate scientists believe that current trends in climate change are:

- (A) a natural occurrence that routinely happens on earth routinely but not connected to atmospheric CO₂ concentration
- (B) anthropogenic, that is caused by humans' release of CO₂ and other greenhouse gases
- (C) the result of CO₂ that comes plant derive respiration from trees
- (D) entirely the result of recent sun flares, such as the cause of the dinosaur extinctions
- (E) none of these answers are correct

33. Climate change is now well documented. The Earth is warming. CO₂ concentrations have also risen concomitantly with the burning of fossil fuels and rising population. Some propose that that this is a part of normal fluctuations in surface temperatures while others cite evidence for anthropogenic impacts, such as greenhouse gases like CO₂ (And others argue that it doesn't matter what the cause is, the earth is warming). As a reason to support the production of biofuels, which biological reaction would be useful for directly removing large amounts of CO₂ from the atmosphere?

- (A) respiration
- (B) fermentation
- (C) digestion
- (D) photosynthesis
- (E) DNA replication

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