Name: _____
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Quiz 6 on Agricultural Biotechnology

Part 1: Quiz 6 on Agricultural Biotechnology

Some of the Issues and Concerns from the public about GMOs in food and agriculture include: Uncertainty about safety; Regulatory issues; Right of choice and labeling; Environmental concerns; Globalization with Big science, big companies; Distrust of Science and issues about Food culture. Because of these concerns

- A. GMO crops have been discontinued in their use in the United States
- B. GMOs have not been well accepted by farmers in the United States
- C. The public remains undecided and relatively uniformed resulting in a compounding controversy
- D. GMOs have been shown to cause many human diseases
- E. GMO corn has been unsuccessful

How was genetics discovered? In the 1860s Gregor Mendel discovered “factors” that determined inheritance of traits in plants (notice how many great discoveries appear first from work on plants) By 1906, Thomas Hunt Morgan showed that ‘genes’ are the “factors” that Mendel had discovered, and that genes are located on chromosomes. Then in 1944 Oswald Avery showed that genes are made of DNA! (We have come a long way). We now have sequenced the genomes of

- A. all of these examples, and more
- B. rice, corn, wheat, and many other crop plants.
- C. humans, chimpanzees, and mountain gorillas
- D. mice, rats, and dogs and fruitflies
- E. puffer fish and zebra fish

The ability to transfer genetic material from one organism into plants for crop improvement is a well-established science. Genetic engineering of crop plants is controversial because

- A. big business has consistently lied and misled the public about their safety
- 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. so many people have died or become sickened as a consequence of eating them
- D. cloned DNA is used to create them and people are uncertain about the process
- E. they have been shown to cause heart disease in mice, humans and primates

How is engineered DNA put into plants? Gene constructs (or 'transgenes') can be readily made in the laboratory by fusing together DNA segments from different sources. If done correctly, these cloned constructs can be delivered into plants where they will be stably integrated into the plant's DNA and expressed to confer new and useful traits. Gene constructs can be introduced into plants by

- A. all of the examples have been shown to work
- B. micro-projectile bombardment(also known as the 'gene gun' or biolistics) delivers DNA by coating small particles of gold with the vector and shooting them into plant cells.
- C. Agrobacterium tumefaciens: a bacteria that acts as a natural gene transfer vector to deliver DNA into plats
- D. osmotic or electric shock treatments
- E. Microinjection: by using a small needle to inject DNA directly into plant cells.

The segments of DNA that we call genes usually code for proteins. The region of a strand of DNA, which is 'upstream' of the coding sequence either turns on or off the expression of a particular gene. When we say a gene is 'on' we mean that it is making mRNA and that protein is translated from that mRNA. In humans and in other animals, there must be eye specific genes, liver specific genes, and genes that are expressed in all cells. Similarly in plants there must be flower specific genes, leaf specific genes, root specific genes and so on. These genes make the proteins that are specific for each function in each tissue. These 'upstream' sequences that regulate cell and tissue specific expression are called

- A. transposable elements
- B. genomic shock absorbers.
- C. promoters
- D. gigabases
- E. termination signals

GMOs have been shown in substantiated peer reviewed scientific journals though reproduced research to cause long term negative health problems in humans.

- A. Inconclusive; there have been no short term or long term studies of their affect on any animals
- B. True
- C. False
- D. Greenpeace clearly states on their website that GMOs have a negative impact on human health therefore it must be true.
- E. Opinion editorial pieces on long term health consequences of GMOs clearly demonstrate their negative impact on humans.

It is now possible to make gene constructs in the laboratory by fusing together DNA segments from different sources. For example, genes that encode proteins from a bacteria can be moved into plants to make them resistant to pests without using pesticides. This process of plant improvement has been

- A. shown to be a link in the rising incidence of autism in the US
- B. has been shown to be fraudulent and dangerous to people and livestock.
- C. only theoretical but hotly debated for over ten years.
- D. applied widely and successfully in US agriculture for over twenty years.
- E. only accomplished by big companies but not by academic labs.

Where did dogs come from? The wolf is now widely accepted as the most likely ancestor of all domestic dogs. There are over four hundred described breeds of dogs today, which can be all genetically traced back to a wild wolf species that lived between 15,000 and 40,000 years ago, well before the first agricultural human societies. This fact shows

- A. Dogs must have existed before modern humans
- B. The power of animal cloning techniques developed by early humans
- C. That the domestication of dogs happened without human intervention.
- D. That dogs do not evolve.
- E. The impact of breeding and selection using conventional genetics.

There is a wide spread belief that organic foods are more healthy. Organic foods have been well documented to be

- A. Never carry food borne diseases, such as E. coli, Salmonella, or LIsteria
- B. Be produced without the use of synthetic pesticides, or fertilizers and contain no GMOs.
- C. Better for your health by providing increased nutritive value compared with conventional foods.
- D. More nutritious
- E. the best approach to large scale commercial agriculture that is sustainable.

The five major US crops that have been genetically modified and constitute the majority of GM crops that are currently on the market are:

- A. switchgrass, garlic, cotton, lettuce, tomatoes.
- B. alfalfa, sugar cane, wheat, sweet potato, onions
- C. corn, wheat, cassava, cranberries, wheat
- D. corn, canola, cotton, soybean, sugarbeets
- E. squash, beets, avocado, carrots, wheat

Apples as we know them today did not always exist. All apple varieties available to us today are derived from the wild relative Malus sieversii which is indigenous to Kazakhstan. The Romans developed over 23 varieties which they brought with them to England, which then the British brought to the Americas. What process was used to derive all of the varieties of apples we have today?

- A. Genomics and DNA sequencing
- B. Gene cloning and by using transgenics
- C. Genetic modification and genetic engineering
- D. Conventional breeding
- E. Inbreeding depression

Life took about 3.2- 3.7 billion years to reach its present level of complexity. To maintain it, life must always come from life, replicating its DNA and passing that information, however changed, from generation to generation. Selective breeding has resulted in nearly all our crop plants and these plants will 'breed true' consistently to their variety. This inevitable conclusion comes from our modern understanding of the key role played by

- A. the spontaneous generation of new living organism which derive new varieties and species.
- B. modern agricultural biotechnology
- C. the role of carbon dioxide in our environment which cause mutations.
- D. the heritable information living organisms store within their DNA
- E. the still mysterious and as yet unknown supernatural forces, making breeding an art form.

What were the origins of agriculture? There are few wild plants consumed widely anymore, especially in the developed countries. Most of the plants we eat as fruits, vegetables, and grains:

- A. are harmful to humans because domestication has increased their allergenicity
- B. have been robbed of their basic nutritional value compared with their wild relatives.
- C. do not occur in the wild, but have been developed exclusively by humans through selection and domestication
- D. have been genetically modified using transgenics and genetic engineering.
- E. grow in the wild, but do better under agricultural situations

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 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.
- B. 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.
- C. like bad poetry, eventually to be discarded from the genome;introduced genes are not inherited by the next generation.
- D. like putting caustic substances into food for cosmetic purposes.
- E. like a foreign language that can not be read, giving only garbled protein sequences that may have catastrophic consequences on plant and human health.

Most of our cultivated plants are the result of intensive human intervention over many generations to select for desirable traits, and most of these plants would not even exist without humans. Hybrid corn was first commercialized on a large scale in the US in the 1930s and now, because of vastly improved yields these varieties dominate the $52 billion yr corn crop in the US. Hybrid corn

- A. is a ruse of the large seed companies to control the corn seed industry
- B. is the product of genetic engineering by insertion of foreign DNA
- C. is the product of conventional plant breeding involving the use of controlled crosses an in some plant, like corn, by developing inbred parental lines.
- D. was first developed in the Fertile Crescent of Mesopotamia~10,000 yrs ago
- E. has been all GMO using foreign DNA since 1938

A wide range of fruits and vegetables are available to us in our grocery stores. Very few of these actually exist in the wild, and most have been derived from wild relatives by humans through the process of breeding. The process of conventional breeding for crop plants involves

- A. the use of pesticides, synthetic fertilizers and herbicides.
- B. the use only of organic farming techniques
- C. genetic modification and genetic engineering.
- D. varietal selection, controlled crosses and sometimes making hybrids.
- E. the production of plants that are inherently less nutritious than their wild relatives.

Humans have been involved with the development of new crops for over ten thousand years. In its broadest sense then, Agricultural Biotechnology:

- A. an unnatural process for developing genetically modified (GMO) plants that have been shown to cause birth defects and wide spread allergies in humans
- B. is too recent of a technology to be of practical use, but has great promise for the future and to aid in security of global food resources.
- C. includes domestication, varietal selection, genetics, wide crosses, mutagenesis, tissue culture, genomics, and gene transfer for the overall goal to help produce new varieties of crop plants that are useful for people.
- D. has now been banned by all US farmers and grocery stores as inherently unsafe for human consumption.
- E. is a new form of organic agriculture that uses synthetic manure with the promise of providing safer and more healthy plants.

Plants that have been genetically modified for crop improvement, including several widely produced crops in the US, such as corn, soybean, sugarbeets, canola, and cotton. These crops have been widely adopted by farmers to reduce input costs and pesticides. The products from these plants

- A. are pending approval by the FDA but are expected to be on the market for the first time soon, drawing much controversy.
- B. have been included in many food products for years now without substantiated affect on human health
- C. are called GMOs and have been shown to be dangerous to humans
- D. have been promoted by the Agricultural-Industrial complex and must be unhealthy.
- E. are currently used for livestock feed only, and are not approved for human consumption.

It is interesting that because all life on this planet uses information in the form of either DNA, RNA or both, and that the same bases can be used, and that the genetic code is almost always the same using three of those bases to code for one of twenty amino acid. Because now genes can be cloned and moved from one organism into another and the foreign gene will make the same protein! So, a gene from a bacteria can be expressed in a plant to make the same protein that was made in the bacteria. The process of taking a gene from one species and expressing it in the genome of another species is called

- A. pharmacogenomics
- B. agricultural forensics.
- C. eugenics
- D. carcinogenics
- E. transgenics

Where do the plants we eat come from? Nearly all of our crops did not exist without human intervention and few could survive in the wild. When was the last time you saw a butternut squash growing in the woods? Or a corn plant in the median of I-95? What process(es) have been used to derive the plants we eat?

- A. Conventional Genetics and Hybrid Plants
- B. Domestication and Varietal Selection
- C. Gene Transfer and Genetic Modification
- D. Wide Crosses and Mutagenesis
- E. all of these techniques have been used.