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Honors 444B Quiz II

GMOs and Cloning

1. **List and briefly describe the different types of cloning. (20 points)**  
   There are many different types of artificial cloning: gene cloning, reproductive cloning therapeutic cloning, organismal cloning and cell cloning. Gene cloning produces copies of genes or individual segments of DNA for downstream applications such as sequencing, mutagenesis and genotyping. Reproductive cloning produces copies of whole animals. This process is where controversy begins politically and ethically. Therapeutic cloning produces embryonic stem cells aimed to create tissues to replace injured or diseased animals or humans. Organismal cloning is a method to create a clone or identical copy of an entire multi-cellular organism. One animal is the cytoplasmic donor and the other is the nuclear donor. A blastocyst can be formed which leads to clone, like Dolly who was the first animal to be cloned. Cell cloning is the production of identical cells that can be used for medical research as well as agricultural use.People also forget that cloning occurs naturally. Some plants and single-celled organisms can produce identical offspring in a process called asexual reproduction. We also see natural clones that are known as identical twins that have the same genetic make-up with each other, but not from either parent.
2. **List and describe four potential benefits of cloning (plants or animals or human) and four potential problems of cloning. (24 points)**

Four potential benefits of cloning include: the cloning of animals that are superior in food production, the eradication of defective genes in the human body, large-scale drug production, and to build populations of endangered or even extinct species. Cloning an animal or plant that is known to be a high producer of its good is highly desirable in the food industry. Techniques in mating allow the best producers to reproduce to have a greater chance of getting another high producing organism, but cloning allows farms to always have a high producing animal or plant being born, which leads to a higher yield of the product. You can also eradicate defective genes from the human body. Each person is born with around 8 defective genes that lead to getting sick or death. The potential of cloning humans can help lead humans to have less defective genes with each generation. There have also been significant strides in applying large-scale drug production in cloning. They can make animals produce a type of drug either in something that we eat or drink that can have a benefit to the person, whether it be nutritional or medical. Cloning of animals and plants can also be used to bring an endangered species back into acceptable population levels by cloning the animal that fosters good traits to survive. Cloning can also exist to bring back species that have been extinct, whether that be from man or natural causes. Simply put, there are many applicable benefits of cloning that can increase the standard of living for life on earth, but does come at a cost to humanity, whether ethically or environmentally.

Four potential problems of cloning include: the destruction of human embryos, miscarriage probability, no bio-diversity, and the increased probability of mutational defects. Therapeutic cloning requires many embryos. These embryos can be considered the potential of life that should not be meddled with. Many embryos are also wasted in the process of cloning due to the miscarriage probability that is just below 1%. This means that over 100 embryos are wasted for every successful clone. There is also the risk of spreading the genetic material of clones to organisms that are not meant to be shared. This by-product safety is crucial to make sure that we are not destroying the eco-system of the organisms we are affecting. There is also the risk of making an entire yield all the same, genetically. If one plant is clones millions of time to create a yield, there is no bio-diversity. Bio-diversity is needed to ensure that one disease can not easily spread to every plant, and that some crop will always be able to be harvested. Mutation defects also occur often, like the birth of a sheep with two heads, or a lizard with 5 legs, for example. If we begin to clone animals and even humans, we must pay close attention to the by-product of our creations and ensure that mutational defects will not continue to spread.

1. **What are the ethical issues with cloning? Are there ethical issues for cloning organisms other than humans? (10 points)**

Gene cloning is a commonly accepted practice in many labs worldwide. Reproductive cloning would allow the potential of creating another human that is identical to another person who has previously existed or who still exists. This conflicts with many long-standing religious values about human uniqueness, while also infringing on individual freedom and autonomy. Do we want to venture into a society where you can find clones of yourself on the street? This can lead down a road that enables us to create people to do certain jobs based on what they would grow up to be good at. Therapeutic cloning requires the destruction of human embryos which is seen as the murder of another person to many religions and people. Activists on the subject say that this technique to collect embryonic stem cells is wrong, no matter if it is used to heal the sick or injured. This is a question of ethics: when does something become ‘human.’ Animal cloning is a different story because killing an animal is deeply engrained in the human psyche. What is more unethical: to clone animals for agricultural and medical use, or slaughtering millions of animals everyday after being fattened up? Animals do not have a choice in this subject, so is that unethical? Humans are the only species that have had the ability to pass on crucial knowledge through generations to improve our standard of living. Other animals are simply role models to their young, but humans have acquired the ability to write knowledge down and disseminate over many people. Is it unethical to believe we have the right to clone animals because they don’t have the ability to argue it? Should cloning be moved to humans once we have come to terms that the benefits outweigh the potential costs?

1. **List and describe three pros and three cons of GMO foods. (10 points)**

Three benefits of GMO foods are increased crop yield, reduced needs for pesticides and enhanced nutrient composition. GMOs are organisms that have been genetically modified in a laboratory. ‘Designer’ crops are crops that have been modified to produce a bigger crop yield as well as alter other factors of the plant. This includes the release of natural pesticides that make the plant resistant to certain insects that usually destroy much of the crop. Plants can release BT toxin that enables the plants to naturally kill insects that try to eat it. This reduces the need for spraying fields with pesticides which has a negative environmental impact. GMOs also can be altered to have enhanced nutrient composition. Golden Rice is a different rice plant that contains nutrients that cultures who eat mainly rice lack. This includes nutrients that help with the loss of eye sight that is seen in many of these societies that rely heavily on rice to survive. This method has been applied to many crops including corn. Three potential cons of GMO foods include the existence of round-up ready, the creation of ‘super weeds,’ and the very short testing period of new GMOs. Round-up ready is a GMO that is able to target specific harmful insects and bacteria and kill them. This modification allows the creation of ‘super weeds.’ Super weeds arise when round up ready is sprayed on a field and a resistant weed survives, either from some mutation that makes it resistant or the round up ready was not designed to kill that type of plant. This process is repeated and continues to require a stronger and stronger round-up ready. This predicament is like the anti-biotic crisis of super bacteria. Is this something to worry about now, or will it be a problem only when we no longer can combat the strongest of weeds and insects. People are also concerned with the short testing periods that GMOs are under. If a specific GMO was tested and began agricultural use after 90 days, does that accurately account for what could happen after a year of use? What if there is a toxic by-product that sits dormant for over 90 days and then begins to show? Do the benefits of what GMOs have done for the world outweigh what could happen later?

1. **Should human embryos be used for cloning stem cells for research; why or why not? (10 points)**

Human embryos should be used for cloning because of its huge potential in the application of the medical industry. But, this question brings up huge ethical consequences regarding when human life begins, almost identical to the argument of abortion. A human embryo has the potential of life, therefore does anyone have the right to kill it? Unfortunately, therapeutic cloning requires human embryos to provide medical help to the sick or injured. Do the benefits of this research outweigh the cost? Human life begins with the development of a brain and central nervous system which occurs around 2 months after the point at which embryos are taken from the human body. This does not consist of killing a human life, but merely using that potential of life to save another. This brings up a very relevant thought question: would you rather save a crying baby from a fire, or a frozen embryo in a cup? The answer is clear.

1. **As a thought question or personal opinion question: why do you think that GMO foods have becomes such a controversial issue? (10 points)**

People do not like to eat things that are different. This traces back to the start of humanity when we were still picking natural food off the ground. We survived because of our innate instincts to eat what we know. We have recently been able to modify our foods with artificial means to produce a more desirable yield. The controversy begins with the potential hazards of constantly eating foods that are GMOs. Although some arguments stem from uneducated people on the subject, some are very justified. We do not know the long term affects of GMO foods. The average study time of a GMO is only 90 days. What if it takes longer then a year for a health problem to arise? There are also risks to the environment that might begin to build-up into an unprecedented problem. The creation of ‘super weeds’ and the spread of small but very constant antibiotic exposure can lead to adverse health effects. But do the pros justify the cons of GMO foods? Increased crop yields, the reduction of pesticides and enhanced nutrient composition can help farms output bigger and higher quality yields that can help sustain the growing population of humanity. There is also the ethical question of adding genes of very different species to another. Should we add bacteria genes to a plant? Or add a fish gene to an animal? With every industry that is changing, there are always concerns among the people it affects, and there should be. GMOs can easily spread between fields, either by pollen or other natural means. This makes the option of some farms to be non-GMO very difficult. Should another farm have their hand forced to convert to GMO foods when they do not think it is safe yet? People must carefully watch the explosion of a changing food industry and ensure that safety of the consumers and the environment always comes first. Education is key to enact change that will safely transition us into a higher functioning and more environmentally friendly species.