UNIT III

2. Animal propagation: Animal cloning.

Meaning

Cloning, the process of generating a genetically identical copy of a cell or an organism. Cloning happens often in nature—for example, when a cell replicates itself asexually without any genetic alteration or recombination. Prokaryotic organisms (organisms lacking a cell nucleus) such as bacteria create genetically identical duplicates of themselves using binary fission or budding. In eukaryotic organisms (organisms possessing a cell nucleus) such as humans, all the cells that undergo mitosis, such as skin cells and cells lining the gastrointestinal tract, are clones; the only exceptions are gametes (eggs and sperm), which undergo meiosis and genetic recombination.

Organism cloning. Organism cloning (also called reproductive cloning) refers to the procedure of creating a new multicellular organism, genetically identical to another. In essence this form of cloning is an asexual method of reproduction, where fertilization or inter-gamete contact does not take place. Similar

Natural Cloning

Natural cloning is seen within organisms such as the bacteria mentioned above. Yet, this is only one example. Bacteria are part of a larger group of organisms that reproduce asexually. Asexual reproduction is when organisms reproduce without a partner.

Bacteria reproduce asexually simply by replicating their genetic material, and then dividing in half. Each newly formed bacteria cell is a genetic replica, or clone, of the original. Other single-celled organisms, like yeast and mold, and even multicellular organisms, like starfish or strawberry plants, reproduce asexually. These organisms are natural clones.

Even identical twins are actually clones of each other. These twins are produced when a fertilized egg splits, thus creating two separate embryos that develop independently of one another. Each embryo is a genetic replica of the other, making them natural clones.

Artificial Cloning

Artificial cloning is when scientists create genetic replicas of organisms in ways that would not occur in nature. This is the stuff of science fiction but also science fact. A classic example of this process is when Dolly the sheep was cloned in 1996. Dolly was created using a somatic cell from her mother. A somatic cell is a mature body cell, such as skin, hair, or in this case, udder. Here are the highlights for how it worked:

sheep. The removed nucleus contained the exact genetic code from that sheep.

Scientists then removed the nucleus from another sheep's egg cell and inserted the first nucleus into it.

The embryo is implanted in surrogate mother.

This grows into full organism



Therapeutic cloning :

is intended to use cloned embryos for the purpose of extracting stem cells from them, without ever implanting the embryos in a womb. Therapeutic cloning enables the cultivation of stem cells that are genetically identical to a patient. The stem cells could be stimulated to differentiate into any of the more than 200 cell types in the human body. The differentiated cells then could be transplanted into the patient to replace diseased or damaged cells without the risk of rejection by the immune system. These cells could be used to treat a variety of conditions, including Alzheimer disease, Parkinson disease, diabetes mellitus, stroke, and spinal cord injury. In addition, stem cells could be used for in vitro (laboratory) studies of normal and abnormal embryo development or for testing drugs to see if they are toxic or cause birth defects.

ADVANTAGES AND DISADVANTAGES OF ANIMAL CLONING

The different techniques available today that offer animal cloning as a possibility. In some species, cloning occurs naturally because of asexual reproduction. Identical twins are sometimes referred to as clones, though this is technically inaccurate because their DNA is different.

we can use clonining for genetic purposes, therapeutic purposes, or reproductive purposes. Most animal cloning pros and cons refer only to the reproductive process, where an animal which is a genetic duplicate of its parent is produced.

The practical application of animal cloning is a relatively recent science. Dolly the sheep, created by Keith Campbell and Ian Wilmut, was born in 1996. Cumulina was the first cloned mouse, born in 1998. Since then, we’ve cloned pigs, rhesus monkeys, cats, rabbits, cows, horses, rats, mules, dogs, camels, deer, fruit flies, and even a buffalo.

It is an idea which dates back to 1938 when Hans Spemann proposed the idea of replacing the nucleus of an egg cell with the nucleus of another cell, then to grow an embryo from that egg.

The first known attempt to clone an animal occurred in 1952, when Thomas King and Robert Brigs attempted to clone a Rana pipiens frog.

As science continues to progress, it is essential that we continue to examine these animal cloning pros and cons.

List of the Advantages of Animal Cloning

1. Animal cloning creates desirable traits in each species.

When we clone animals, what we’re doing is an advancement of the natural evolutionary cycle. We are doing what others have done through selective breeding for more than 1,000 years. It is an opportunity to create specific traits in an animal that are desired for some reason. We might use animal cloning to create dairy cows that offer more milk. We might clone chickens to improve egg production. Pigs could be cloned to produce more meat for butchering.

2. We can introduce specific outcomes through animal cloning.

There is a protein which is called antithrombin that circulates in the blood. If you don’t have enough of it, then your risk of developing a blood clot is higher. When clots form, they can lead to strokes, heart attacks, or worse. Through the process of animal cloning, goats have been bred in such a way that they now produce this protein on their own. We can then clone these animals to produce more of this medicine, which creates a supply that is theoretically endless.

3. It is a chance to keep memories alive.

One of the fastest-growing segments of the animal cloning industry involves dogs and cats. Pets are often integrated as full-fledged members of our family. Losing them is one of the most painful experiences that we endure. They really are our best friends without asking for much in return. Our pets keep us active, offer love, and even provide essential services. With the cloning process, there is an opportunity to provide continuity, even during moments of grief.

4. Cloned animals don’t have cloned personalities.

Even if the reproductive process involves cloning, the animal which is created is still a unique individual for their species. Their personality, memory engrams, and preferences are all different. Some people might believe the soul of the parent transfers to the child, but there is no science to back up that fact. Personalities develop in stages based on the temperament of the animals and people around, the character of the creature, and the overall environment. The DNA of a cloned animal might be the same, but their personalities are very different.

5. We get the chance to preserve endangered animals.

Humanity was able to save the Przewalski’s horse through a stroke of luck. In 1945, there were 13 horses that were captured from a wild herd. Two of the animals were hybrids. Under a collaborative effort between the Zoological Society of London, where the horses were kept, and scientists in Mongolia, the population went from a low of 9 horses to over 300 in the wild. Standard breeding practices helped to save the species.

What about the Northern White Rhino? Sudan was the last known male of the species, and he died in March 2018. There are now only two female rhinos of the same subspecies. The only way to save them now is through animal cloning.

6. Animal cloning provides additional research benefits.

The science which is used to create animal clones can be applied to other medical and veterinary applications. As we learn how to clone animals successfully, we could use those techniques to learn how to clone organs for human transplant. We might be able to clone specific cells that offer medical benefits. It has sparked an advancement in stem cell research that includes deriving these cells from adults. Because of this scientific practice, we now know that an adult cell’s nucleus has everything needed to produce another member of the same species.

7. We would be able to ease future food supply shortages.

By the year 2050, most experts agree that there will be at least 9 billion people living on our planet. Many estimates say that there will be 10 billion people here. That means we are going to need a lot more food to eat. Push that figure out to 2150 and the United Nations suggests the planet may need to support 20 billion people. Through the science of animal cloning, we would be able to stabilize our food chain. This process could reduce the pressure placed on croplands to produce, which might preserve human life in times of pestilence or famine.

8. It could provide a process to restore lost species to the planet.

When looking at the history of our planet, we know that at least 1.9 million different animal species have gone extinct. With the presence of humanity, the rate of extinction is estimated by National Geographic to be progressing 1,000 times faster than it should be. Thanks to the science behind animal cloning, the preserved DNA of extinct animals could be artificially brought to term as an embryo to restore their presence. If you’re thinking that sounds like a plot from Jurassic Park, you’d be right. What was once considered science fiction is approaching “science fact.”

9. Animal cloning could eradicate problematic diseases from the Earth.

Influenza is arguably one of the deadliest diseases to ever hit humanity. It originates from various animal species, including pigs and birds. When a new flu virus strain makes it way into humans, the results are devastating. In 1918, over 50 million people were killed because of the influenza epidemic, with 20% of the global population infected by the virus. Some people died within hours of symptom development. Through animal cloning, we could eradicate some of these diseases before they even have the opportunity to develop.

10. It is currently believed to be safe to eat cloned animals.

The Food and Drug Administration in the United States ruled in 2008 that it was safe to eat meat and consume dairy products from cloned animals. They made their ruling for livestock animals, such as goats, pigs, and cows. That makes it possible for food producers to research cloning processes that could improve human nutrition.

List of the Disadvantages of Animal Cloning

1. Animal cloning is an expensive process.

Since the millions that were spent to clone Dolly the sheep, science has helped to bring cloning toward mainstream society ever so slowly. At the moment, however, it is an opportunity which is still available to only a select few.

2. From a reproduction standpoint, every other method is better than cloning.

Animal cloning is the least reliable method of reproduction right now. Numerous defects occur during the cloning process that are potentially fatal to the offspring there is a 25%  chance that the animal will suffer from “hydrops,’ which causes edema. About 6% of cloned animals cloned are oversized, which may threaten the life of the mother. It took hundreds of attempts to produce the first successful animal clone. Today’s rates of success are better, but it is still far from a perfect science.

3. Even with modern science, animal cloning is usually unsuccessful.

Animal cloning is often unsuccessful, even when everything goes right during the process. Only 5% of cloning attempts are ever successful. When there is an unsuccessful attempt, serious interventions are often necessary if the offspring is born alive. Most cloned animals that are born alive are eventually euthanized to prevent their suffering. Cloning increases the risk of birth defect development, sensory impairment, and disease susceptibility. The success found with Dolly the sheep are incredibly rare.

4. Successful cloning reduces genetic diversity for the species.

We already know what happens when a lack of diversity occurs in the animal kingdom. When each animal of a species is genetically similar to one another, then one viral mutation can create an extinction. Every percentage of extra diversity matters to the survival of a species. Take the cheetah as an example. 99% of these cats share a similar genetic profile to one another. If a disease would affect the entire species for some reason, you would still have a 1% potential survival rate. With animal cloning, you wouldn’t even have that.

5. The current process of animal cloning destroys numerous embryos.

For the first successful cloned animal, there were 277 cloned embryos implanted. From that number, only 13 pregnancies were triggered. Those results in one successful birth, which would be Dolly. Only 17% of somatic cell nuclear transfers develop into embryos. About half of the embryos are eventually implanted successfully using current techniques. In each series, only 1 or 2 animals are ever successfully born, with 18% of them dying at birth. Over half die within the first month.

6. Animal cloning creates abnormal pregnancies for the mothers.

About 45% of the pregnancies which are achieved through cloning are lost in either the second or third trimester. These losses are uncommon in a “traditional” pregnancy, which means the cloning process threatens the welfare of the mother. There are additional abnormalities to consider as well, such as dystocia, delivery interventions, and defects which threaten the life of the mother. There is a stronger chance that the mother and fetus will die when animal cloning is practiced compared to the likelihood of a healthy birth.

7. A majority of births from cloning require a C-section to complete the process.

When mothers are artificially inseminated to produce offspring, the animals required a surgical intervention less than 1% of the time. When surrogate mothers are implanted with an embryo produced by animal cloning, they required a cesarean section for delivery 54% of the time. Another 30% of the animals required a non-surgical intervention to deliver their offspring with a cloned embryo. That means there are extended veterinary costs to consider with this process in addition to the actual costs to create the embryo clone in the first place.

8. Healthy animals who are clones can experience unexpected health complications.

Cloned animals which are able to live 6 months or longer, appearing to be otherwise healthy, have been known to experience life-threatening health consequences. Many of their health issues arrive unexpectedly. Studies on cloned cattle have also found that their reproductive capabilities may be impaired for both male and female clones. There is very little data available for older cloned animals as so few have made it beyond the first few years of life. Even Dolly the sheep died when she was 6 years old.

9. Cloned animals may not be able to produce any offspring.

Cloning companies have recently provided some anecdotal data concerning the likelihood of an older animal being able to reproduce. Although the offspring from a clone will typically have fewer health problems than their parents, there is still some physical evidence to suggest that the next generation is not biologically “normal” when compared to offspring created from traditional processes.

10. Reintroducing extinct animals would have unforeseen consequences.

If we introduce new life to our planet (or even restore it), then we create new opportunities for bacteria and viruses to develop. We have no way to know what ancient bacterial strains might do to human health. There is a very real possibility that our animal cloning processes could go too far, putting all of us at risk for an unknown health concern for the future. The threat of the flu is often enough to send people running for vaccines. Imagine what an unknown viral agent or infectious disease would do to the world.

11. Animal cloning is a process which could lead to human cloning.

Although there have been claims of successful human cloning attempts, there is no supported scientific evidence to suggest that a cloned human embryo has moved out of the world of fiction. Cloning humans is more difficult than other mammals because of where spindle proteins are located to the chromosomes. Removing the nucleus removes those proteins, which interferes with cell division. As technologies improve, however, the science behind animal cloning could lead to human cloning and the plethora of moral and intellectual arguments which would come with it.

12. There are striking similarities between stem cells and cancer cells.

From a medical research standpoint, there are many who believe that it is worthwhile to look at the use of embryonic stem cells as a way to treat diseases in humans. There are also experts in this field who are concerned about the ways that stem cells and cancer cells are similar. Both types have an ability to proliferate indefinitely. After 60 cycles of division, stem cells can even develop mutations that might lead to cancer. That means we have a long way to go before knowing what science could do one day.

13. Therapeutic cloning requires the destruction of an embryo.

When using therapeutic cloning, embryos are destroyed to provide treatment to another animal that is suffering from disease. Although this process receives some objection, the threat that people see with this part of animal cloning science is how it could be applied to humans one day. Human therapeutic cloning would require the destruction of an embryo in the test tube, ending the potential viability of life. This process could be a way to prevent unwanted genes from being passed along. It could also create an abundance of problems as embryos are destroyed for personal use.