Stage 2 Research Project B –2022

**School Assessment Cover Sheet for**

* Assessment Type 2: Research Outcome

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **2** | **1** | **2** | **1** | **7** | **3** | **E** |

 **SACE Registration Number:**

|  |
| --- |
| **Research Question: How can animal cloning benefit our** **society? word count:** |
|  |

|  |  |
| --- | --- |
|  | **Synthesis** |
|  | S1 |
|  | S2 |
|  | S3 |

|  |
| --- |
|  Cloning Fact SheetHow does animal cloning benefit our society?  |
|  |

Table of contents

Table of contents & Glossary - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 2

Introduction & Background information - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 3

Introduction & Background information- -- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -4

* Agriculture benefits ------------------5
* Endangered species cloning --------5
* Pet cloning benefits-------------------5
* Medicine cloning ---------------------5
* Conclusion------------------------------

References-----------------------------------------------------------------------------------------------------7&8

Glossary

Somatic cell: Somatic cells are all cells in the body aside from sperm and egg cells

Oocyte: The oocyte is a developing egg cell

Nucleus: The nucleus controls the regulations in the cell and contains genes that carry hereditary information.

Embryo: The embryo is a multicellular organism in its early developing stage.

Animal cloning is the scientific procedure of taking an organism and making a copy of said organism through various ways this can be achieved. Ever since the year, 1996 scientists have been trying to mature the technology of animal cloning and have made breakthroughs and successfully advanced the method to clone animals.

Background information

Animal cloning is a method used to create exact replicates of genetics and traits from a host (animal), ever since the first successfully cloned animal dolly sheep3 scientists have been working on refining and advancing the process of cloning in the past 26 years3.

Throughout the years, scientists have made major breakthroughs regarding effective cloning and increasing cloned animal life span. All though through development, this technique has matured and is more complete, there are still major flaws to the methods used to clone animals. The two main methods to clone whole animals are reproductive cloning2 and embryo twinning2, reproductive cloning is the process of removing a mature somatic cell from the clone target, after extraction, the DNA from the target is transferred into an egg or oocyte which had its DNA nucleus removed1. Embryo twinning is the process of splitting an embryo in half and implanting each half into a carrier, the split embryo develops into two independent animals sharing the same genes2. The procedure of reproductive cloning splits into two methods, either extract the donor’s DNA nucleus and inject the nucleus into the carrier’s egg cell or fuse the entire nucleus with the empty egg cell using electrical currents. Post fertilization, the egg can develop into an early-stage embryo which is then placed into an adult female carrier’s womb, the carrier will give birth to an animal who shares the DNA of the donor. The most popular method is the reproductive cloning method, this method was first successfully applied on the first cloned animal Dolly the sheep, the technology of cloning has made a breakthrough with the creation of Dolly. Since the success of Dolly, scientists have been working on the technology and countries like China and the US have implemented cloning in agriculture benefits4 and now commercial pet cloning have gained increasing attention and is a booming industry in China5.

(1)<https://www.genome.gov/about-genomics/fact-sheets/Cloning-Fact-Sheet>

(2)<https://education.nationalgeographic.org/resource/cloning>

(3)<https://www.britannica.com/topic/Dolly-cloned-sheep>

(4)<https://www.scientificamerican.com/article/20-years-after-dolly-the-sheep-led-the-way-where-is-cloning-now/>

(5) <https://www.digitaljournal.com/pr/dog-cloning-market-to-see-booming-growth-viagen-sooam-biotech-boyalife-sinogene-pet-cloning>

(6) <https://www.drze.de/in-focus/research-cloning/modules/embryo-splitting?set_language=en#:~:text=The%20term%20embryo%20splitting%20(or,(blastomeres)%20are%20still%20totipotent>.

Agriculture benefits

Cloning is a selective assisted breeding process; The use of cloning in agriculture is to produce superior quality livestock and keep the high quality and traits for future generations9. Farmers benefit from cloning healthiest and most reproductive animals in the farm to produce safer and healthier food as well as boost the population and production rates of animals, however, the cloned animals are not to be consumed but rather to reproduce high-quality offspring8, farmers clone an animal from the most reproductive donor in the herd and the offspring from the cloned animal is the food producing animal7. The main benefits of cloning are that the offspring inherit beneficial characteristics8 like better immunity against diseases, animals that are sick produce less meat/milk, and by cloning an animal immune to diseases their offspring will have immunity against diseases as well7.

Some animals can adapt to climate8 and some don’t, by cloning an animal that can survive and produce products while bearing extreme climates farmers can always ensure the highest quality of products regardless of the climate. Furthermore, body type is an important factor in the industry, different body shapes can have different production rates and quality, for example, a milk cow should have a large udder, so it can produce more milk than others and should be able to deliver calves easily. Fertilization7 is major factor farmers look for in meat producing animals, preferred cows should be fertile, and by cloning donors that are fertile the production rate of meat is ensured as each year new animals are needed to replace sold ones, this does not just apply to females, but male animals should be able to inseminate effectively as well. People tend to have preferences for meat products, and animals that produce a specific trait in meat can be cloned to keep the trait in the offspring to fit the market’s desires. By providing high-quality products and keeping the quality farmers can sell more products in the same period as they would without cloning, and customers will get better nutrience from the same amount of food they normally consume because of the high-quality foods produced with cloning, this creates a positive reaction between customers and the product provider, people would favor the cloned source over regular sources of food thus pushing the industry and provide financial benefits.

(7)<https://www.genome.gov/about-genomics/fact-sheets/Cloning-Fact-Sheet>

(8)<https://www.fda.gov/animal-veterinary/animal-cloning/primer-cloning-and-its-use-livestock-operations>

(9) <https://www.bio.org/sites/default/files/legacy/bioorg/docs/files/Cloning_onepager.pdf>

Endangered species

Endangered species have always been a recurring issue society has been most concerned about in recent years. With the increasing number of natural resources being harvested by humans, more animals are losing their natural habitats and ecosystems are ruined. According to figure 1, approximately 10000 endangered species were reported and recorded in 2000, the most recent data shows around 40000 endangered species in 2022. Due to pollution, breaking of natural habitats, and illegal poaching due to demands, the number of endangered species has increased drastically over the years. Endangered species

Figure 1 (Redlist of endangered species growth between 2000-2022)1

are a danger to our society because of the potential destruction of ecosystems, ecosystems operate with a variety of organisms and once an organism is endangered, the entire ecosystem falls apart. By reserving endangered species’ DNA scientists can clone and replicate endangered species creating an identical twin, this way scientists can ensure the species’ survival through cloning. The reason why endangered species should be cloned is to prevent extinction, once extinct, there is no reverse. Some endangered species are going extinct due to the extremely low birth rates within the species, by cloning scientists can pick out individuals form the population that are most reproductive, this ensures the sustainability of the species in the long term.

Pet cloning

Most of the mainstream domestic animals have a shorter lifespan compared to humans, cats generally live 12-18 years max with a few special cases. Due to the short lifespan of pets, people are starting to clone pets in order to cope the mental damage caused from the loss of pets. For children pets are friends and family, loss of a pet can potentially trigger grief for children that is prolonged and can lead to mental health issues, potentially physical damage and self-harm. Children have strong emotional attachments to pets, the passing of a pet can cause mental distress and lead to depression, this effect can continue up to three years and longer for children and teenagers, even adults. The passing of a pet is often the first major loss a child can experience, and it can be traumatizing. There are over 29 million pets10 currently in Australia, that’s more than the population of humans in Australia, in the 29 million of pets dogs and cats takes up the majority, and generally have a shorter life span compared to humans. children learn how to be affectionate, protective and how to take care of something. People tend to clone their pets to avoid trauma, humans’ bond with animals’ overtime and eventually outlive their pets, adults often have difficulties overcoming the passing of a pet because the pet is a symbol of unconditional love, security, comfort and a companion in life. Pet cloning uses the same technology as agricultural livestock cloning, scientists create an identical twin with skin cells of the original pet and creates a clone of it. The clone will share the same genes of its donor but the personality may vary.

Conclusion

Through the development of animal cloning technologies, it has become commonly used in various ways to benefit our society and science developments. Livestock cloning provides excellent food source that is nutritious and sustainable for future generations, pet cloning for a longer lasting relationship between owners and pets and provide comfort and secureness for people. Cloning endangered species in order to protect and keep the species alive to prevent extinction and clones that can be studied for specific medical research purposes.

References

Center, F. (2019). *A Primer on Cloning and Its Use in Livestock Operations*. [online] Fda.gov. Available at: https://www.fda.gov/animal-veterinary/animal-cloning/primer-cloning-and-its-use-livestock-operations.

Edwards, D. (2010). *Animal cloning offers great benefits to consumers, farmers, and endangered species*. [online] Available at: https://www.bio.org/sites/default/files/legacy/bioorg/docs/files/Cloning\_onepager.pdf.

National Geographic Society (2022). *Cloning | National Geographic Society*. [online] education.nationalgeographic.org. Available at: https://education.nationalgeographic.org/resource/cloning.

National Human Genome Research Institute (2020a). *Cloning Fact Sheet*. [online] Genome.gov. Available at: https://www.genome.gov/about-genomics/fact-sheets/Cloning-Fact-Sheet.

National Human Genome Research Institute (2020b). *Cloning Fact Sheet*. [online] Genome.gov. Available at: https://www.genome.gov/about-genomics/fact-sheets/Cloning-Fact-Sheet.

Newsmantraa (n.d.). *Dog Cloning Market to See Booming Growth | ViaGen, Sooam Biotech, BoyaLife, Sinogene Pet Cloning*. [online] Digital Journal. Available at: https://www.digitaljournal.com/pr/dog-cloning-market-to-see-booming-growth-viagen-sooam-biotech-boyalife-sinogene-pet-cloning [Accessed 13 Sep. 2022].

Weintraub, K. (2016). *20 Years after Dolly the Sheep Led the Way—Where Is Cloning Now?* [online] Scientific American. Available at: https://www.scientificamerican.com/article/20-years-after-dolly-the-sheep-led-the-way-where-is-cloning-now/.

www.drze.de. (n.d.). *https://www.drze.de/in-focus/research-cloning/modules/embryo-splitting?set\_language=en#:~:text=The%2520term%2520embryo%2520splitting%2520(or*. [online] Available at: https://www.drze.de/in-focus/research-cloning/modules/embryo-splitting?set\_language=en#:~:text=The%20term%20embryo%20splitting%20(or.

ScienceDaily. (2020). *Loss of a pet can potentially trigger mental health issues in children*. [online] Available at: https://www.sciencedaily.com/releases/2020/09/200910130412.htm.

Smith, L., Bordignon, V., Babkine, M., Fecteau, G. and Keefer, C. (2000). *ARTICLE DE REVUE Benefits and problems with cloning animals*. [online] Available at: https://www.ncbi.nlm.nih.gov/pmc/articles /PMC1476349/pdf/canvetj00024-0021.pdf.

Miller, K. (2018). *9 Advantages and Disadvantages of Cloning Animals | FutureofWorking.com*. [online] Futureofworking.com. Available at: https://futureofworking.com/9-advantages-and-disadvantages-of-cloning-animals/.

Ayres, C. (2017). *10 Advantages and Disadvantages of Cloning Animals*. [online] Vittana.org. Available at: https://vittana.org/10-advantages-and-disadvantages-of-cloning-animals.

Study.com. (2022). [online] Available at: https://study.com/learn/lesson/animal-cloning-process-pros-cons.html.

learn.genetics.utah.edu. (n.d.). *Why Clone?* [online] Available at: https://learn.genetics.utah.edu/content/cloning/whyclone.

Pets in Australia. (n.d.). [online] Available at: https://www.aph.gov.au/DocumentStore.ashx?id=04b744d5-783e-4983-82ba-8c73effcb980&subId=691105#:~:text=There%20are%20almost%2029%20million.