Cloned animals: A safe, sustainable source of food and medicine?

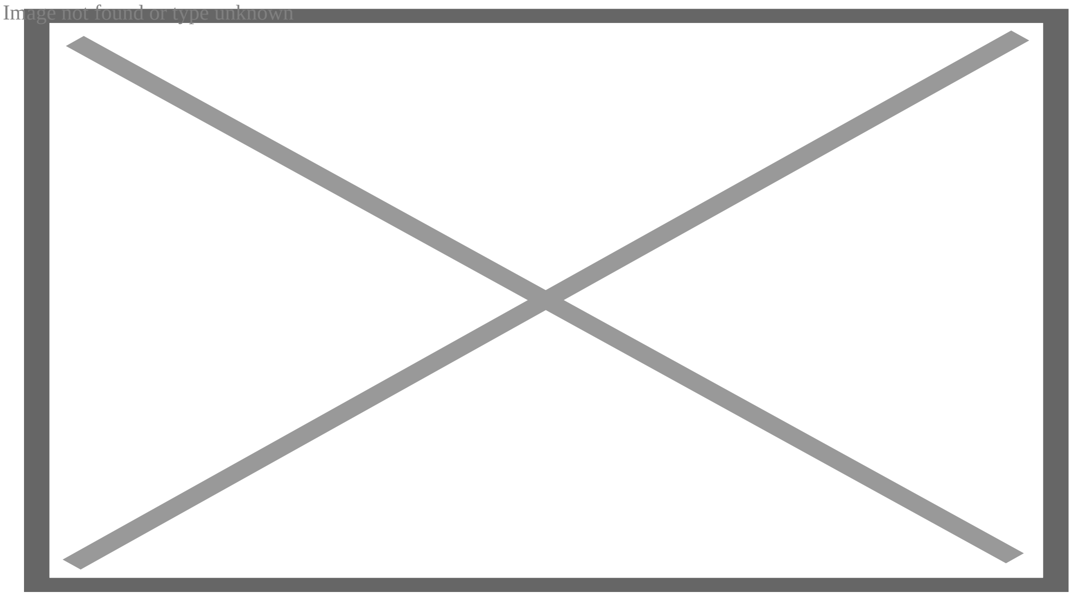
It's now possible to clone animals and use them to produce a wide variety of valuable products, including staple foods like meat and milk. But as is often the case with technological innovation, the pressing question isn't necessarily "can we do this?" but "how should we do this?" To provide an answer we need to examine the sustainability and safety of the technology, and of course how the public might react to all of its uses.

Before we get too far into the weeds, let's cover the basics. Cloning is a way to produce copies of animals by asexual means, and it can be achieved in two possible ways (Canada, 2003). The first technique utilizes embryonic cells; animal products and byproducts produced this way are allowed in the human food supply chain (Canada, 2003) and widely used to produce many foods that humans consume (Miller, 2007). More recently, a second technique known as somatic cell nuclear transfer (SCNT) was developed (Canada, 2003), which gave us Dolly the sheep and ignited a debate over the uses (and potential misuses) of cloning technology. Products and byproducts from these animals are not allowed in the human food supply chain (Canada, 2003).

This process of cloning is more complicated than the first technique, according to Canada's Food Directorate Interim Policy on Foods from Cloned Animals. Miller explains that cloning technology is another tool that will help biologists and animal breeders make foods more consistent, nutritious, and tasty (2007). According to Plume, 2.4 million Angus cattle have been registered and of those 2.4 million, 56 were clones (2009). If clones are being produced and have the ability to provide many different industries with useful benefits, why is one technique allowed but not the other?

A question of sustainability

Cloning is an alternative way to produce animals meant for human use. It can be utilized in medicine, to revive endangered species, and to help the producer looking to improve their herd's genetics, according to the Genetic Science Learning Center (2014). Cloning can, for example, increase an animal's feed efficiency; this is huge for the producer (Plume, 2009). Cloning of the Quantitative trait loci in the livestock population is feasible and can be of great use in production animals (Harlizius, 2004). Cloned animals can be more fertile, resist certain diseases, and produce more of the products we use. (Harlizius, 2004). However, cloning is not the most efficient way to produce production animals (Smith, 2000).



Dolly, the world’s first clone of her kind. Credit: Reuters

Harlizius also stated that the health and longevity of these animals can be compromised (2004), a high expense for the producer. For now, cloning has a success rate of 10% (Howard, 2016), and on average it costs about $15,000 to clone a cow and about $4,000 to clone a pig (Plume, 2009). Even though cloning comes with great benefits, it is expensive and the success rates are low, suggesting that it is not sustainable compared to conventional practices at this time. Moreover, this calculus does not include the expenses that go into raising the animal. If you were to purchase conventional cattle it would cost between $2,000-$5,000 per head on average, then another $556 to raise each animal (Griffith, 2019). Fortunately, as the efficiency of cloning increases, the price is expected to decrease (Plume, 2009). But this leads to another important question.

Should we eat animals cloned through SCNT?

The major food-safety concern with SCNT clones is this: does the nuclear reprogramming that occurs during the cloning process have any influence on the composition of foods derived from the animals (Eenennaam, 2006)? Various studies have compared SCNT animals to non-cloned animals, evaluating the biological and biochemical properties of the meat and milk. Results have indicated that the product compositions were all within the normal food industry range (Yang 2007). Yang suggested that any differences in the products could have been due to the animals’ breed, feed, season, and point in the lactational stage (2007). However, the cause for concern is that cloned cattle calves have displayed health issues such as fatty liver, cardiovascular failure and immature lungs. In one study, a cloned animal died due to immune deficiencies (Yang, 2007). Dolly the sheep, the first animal cloned through SCNT, lived a healthy six years (Feltman, 2019), although she did not live as long as expected.

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Cloned animals could serve all sorts of important functions, for example producing proteins used in human drug development (Eenennaam, 2006). Eenennaam also discussed one company that was able to produce spider silk proteins in milk from goats that have been genetically engineered (2006). These proteins could be used to produce BioSteel, which has important industrial and military applications (Eenennaam, 2006). But the public's reaction to such innovations would likely be the deciding factor in their success. And certain sectors of the food industry fear that consumers may reject the products and by-products of cloned animals (2007). With these concerns in mind, studies have not provided enough evidence that SCNT animal clones are safe for human consumption (Canada, 2003).

Conclusion

Cloning has enormous potential. Animal breeders could produce the caliber of livestock they are looking for while avoiding the uncertainty that comes with breeding, increasing the quality and quantity of their offerings in the process. Other industries would benefit from this advance, too, as we have seen. However, with a low success rate and a big price tag, cloning is not a sustainable tool for the time being. The uncertainty that surrounds SCNT cloned animals will keep their products and byproducts away from the human supply chain until further research can solve these problems.

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