

MEDICAL TIPS

EQUINE CLONING

By Dr. Oliver Pynn, England

MUCH HAS BEEN REPORTED RECENTLY IN THE EQUINE MEDIA ON THE SUCCESSFUL CLONING OF HORSES, WITH THE EMPHASIS ON THE POSSIBILITY OF REPRODUCING A HORSE OF EQUAL TALENT AND SUCCESS TO ITS DONOR. SINCE THE FIRST EQUINE CLONE IN 2003 THERE ARE NOW PRIVATE LABORATORIES OFFERING THIS SERVICE TO HORSE OWNERS, TO REPRODUCE AN EXACT GENETIC REPLICA OF THE CLIENT'S HORSE. THIS IS CERTAINLY AN EXCLUSIVE SERVICE WITH COSTS RISING INTO SIX FIGURE SUMS, BUT NO DOUBT THESE COSTS WILL FALL AS THE EFFICIENCY OF THE PROCESS IMPROVES. THERE HAVE BEEN GREAT ADVANCES MADE SINCE THE FIRST MAMMAL CLONE, "DOLLY" THE SHEEP THAT WAS CLONED IN 1996. INDEED, IT APPEARS THAT HORSES ARE WELL SUITED TO CLONING, AND NOT AS SUSCEPTIBLE TO COMPLICATIONS AS MANY OTHER SPECIES ARE.

WHAT IS CLONING AND HOW IS IT DONE?

Cloning is defined as making a genetically identical copy of another cell or organism through non-sexual means. Cloning a horse means using the genetic material (DNA) from a donor horse to produce a genetically identical foal. This involves collecting the DNA from the donor and inserting that DNA into an egg from another mare whose DNA content has been removed, which then develops as an embryo within the uterus of a recipient mare. This starts with a simple biopsy sample taken from the donor, usually from the neck. At the laboratory cells are then harvested from this sample to extract their DNA content. An oocyte (egg) is then collected from a mare after ovulation, the contents are removed to create an empty shell, and the donor's DNA extract is inserted in its place. This modified oocyte is then activated with a small electric shock to imitate the act of fertilisation, which then develops into an embryo. This can be then cultured in the

laboratory until it reaches a fit state to be inserted in a recipient mare's uterus. With luck, this will then develop normally with the obvious aim of a full-term healthy foal being born.

IS THE CLONED FOAL AN EXACT REPLICA?

In simple terms the answer is 'almost but not quite'. The majority of the genetic makeup will be identical but there is something called mitochondrial DNA that is inherited from the egg. Each egg contains mitochondria that are responsible for energy production and these cannot be stripped from the egg and so this will contribute, albeit a tiny fraction, of the genetic makeup of the clone. However, it is still unknown if this mitochondrial DNA leads to any differences in the resulting appearance or characteristics of the clone. The mitochondrial DNA does not get transferred to the offspring of a clone stallion, and so such a stallion only passes on the genetic material from the donor horse.

Other factors will obviously influence the outcome of the cloned horse; the uterine environment in which the clone develops, nutrition of the dam and any other variances associated with gestation will all have an effect on the developing embryo. Once born, there will be a huge number of environmental factors, which will all impact on the clone's development to make it an individual, rather than an exact replica. It brings us back to the age-old question of whether it is nature or nurture that makes us what we are?

WHY DO HORSES GET CLONED?

The pros and cons of cloning animals have long been debated and these debates will surely continue for some time. However, people are now willing to invest in the procedure of cloning and many do so in order to preserve the genetics of their horse. In the case of a gelding that then shows exceptional talent in its performance, cloning allows its



DNA to be accessible in the form of a stallion, which may never need to compete but can serve mares and so pass on the DNA of the original talented horse. Other reasons for cloning include, creating a copy of a top performing horse in order to compete or simply to double the breeding capacity of a stallion or mare. Genetic material of a horse can also now be stored so that if a horse dies or is sold, then the owners have the option of making a clone in the future. If buying a horse in the future you may have to guarantee rights to all genetic material so that a seller can't then just replace the champion with its replica!

There are also potential health benefits by cloning horses, which do not have any inheritable genetic disorders. The American Quarter Horse Association was ordered by a court to permit the registration of cloned horses. The argument put forward by those in favour of allowing cloned horses to be registered was in creating a superior gene pool by breeding those horses that were not carrying the genes for hyperkalemic periodic paralysis (HYPP) and hereditary equine regional dermal asthenia (HERDA), both disorders that are characteristic of the breed. Allowing registration of cloned horses free from these diseases therefore enhances the breed.

The FEI has now permitted registration of cloned horses and so this technique will surely be on the rise in the world of sport horses. The world of polo breeding has been among the first to recognise its advantages, by cloning the most successful ponies and then using them in their breeding programs. In the Thoroughbred breeding industry, registration of offspring is still restricted to those conceived by way of natural cover, and

whilst even artificial insemination and embryo transfer are still forbidden, cloning is not likely to be on the cards any time soon.

WHAT ARE THE POTENTIAL COMPLICATIONS OF CLONING?

Health problems associated with cloned horses are not as debilitating as in other species. In cattle and sheep, for example, there is a high reported rate of pregnancy loss and birth defects. In foals there have been reports of increased incidence of angular limb deformities, neonatal maladjustment syndrome, and septicaemia. It is therefore advisable that these cloned foals be delivered in premises equipped to deal with such issues. A bad start can have detrimental effects for the rest of the horse's life and so these complications should not be underestimated. Another issue that may be of some concern surrounds the potential premature ageing of cloned animals.

THE DEBATE WILL CONTINUE....

The ethical debate of whether or not cloning should be allowed will no doubt go on, however the fact that cloned animals are now being allowed to compete under many different equestrian rules indicate that it is a process that is likely to get more widespread rather than less so. The argument that cloning is not natural and akin to playing god is a common counter argument. However, such are the advances of equine assisted reproductive techniques, much of what occurs in the equine breeding industry is not natural any more.

Whilst it is unlikely that cloned horses will enter the human food chain, horses are considered food-producing animals in many



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A foal cloned from the grand prix champion gelding ET poses next to former Austrian Olympic rider Hugo Simon

parts of the world and this must be considered. It is all well and good if horses are cloned to run faster and jump higher but cloned meat in the human food chain, whilst allowed, is a much bigger debate.

Cloning is a very attractive proposition to those rich enough to afford it and while the cloned horse sounds very good in theory, the success in practice

is yet to be confirmed. And there is a lot of uncertainty as to the future generations of cloned horses. If it becomes a very common practice then there may be significant impact on the gene pool of some breeds. It must also be remembered that horses have evolved to become what they are today without this degree of human interference, and we cannot be sure cloning will improve things still further. Nature

is beautiful in its unpredictability. If we concentrate on cloning our current champions, are we not reducing the possibility of natural advances of evolution? Could it be that the Thoroughbred industry is the one that has got it right? Only time will tell. 🐾

About the author:
Dr. Oliver Pynn is a Partner at Rosssdales, an internationally

renowned equine veterinary practice in Newmarket, England. His professional interests include stud medicine, lameness investigation and the treatment of sports horses, especially eventers. In 2008, Ollie became the Team Vet for the New Zealand Event Team and was part of the bronze medal winning team at the London Olympics.