



Pet Cloning: Science

Understanding the Science of Cloning

The majority of the experimentation on the cloning of animals is concerned with: 1) agriculture; 2) biomedical research; and 3) propagation of endangered species. All of these areas have potential commercial applications, despite the inefficiency of cloning.

Cats, cattle, goats, horses, mice, mules, pigs, rabbits, rats, sheep, Siberian ibex, and white-tailed deer are examples of animals who have been cloned. No dog has ever been cloned. Researchers are still trying to clone monkeys, chickens, and other animals.

The Process

Using cats as an example, attempting to clone an animal begins with performing a biopsy on a live or very recently deceased animal to collect DNA. Next, the tissues are cultured (grown), and the cells are preserved until the next phase of the cloning process.



To produce a cloned embryo, the cells are treated to prevent them from being assigned to a particular function (e.g. hair, neuron, skin). The nuclei (genetic material) are removed from oocytes (eggs) obtained from other, random cats. The eggs from other cats and cells from the original pet are then fused together by electricity, resulting in cloned embryos. Next, multiple cloned embryos are surgically implanted into female 'surrogate' cats during an artificially-induced reproductive cycle. The cats may or may not develop pregnancies and are monitored by ultrasound. Fetuses are surgically removed via Caesarian section if they die *in utero* or when they are considered to be viable.

The Failures

The public rarely hears about animal cloning failures. However, in reviewing discussions and papers published about human cloning, it is conclusive that animals suffer a variety of consequences in cloning experiments.

Two well-known scientists in the animal cloning field are Ian Wilmut of the Roslin Institute in Scotland and Gerald Schatten of the Magee Women's Hospital/University of Pittsburgh School of Medicine. Wilmut was credited with cloning Dolly the sheep. Schatten was credited with the first ever 'successful' genetic modification of a monkey named ANDi, and he is now actively trying to clone monkeys. Both men, along with other scientists, continue

to remind the public and the scientific community of the common failures of animal cloning, particularly within the context of human cloning.

A published letter co-authored by Schatten and Wilmut in the journal *Science* stated, "...[A]nimal cloning so far results in high rates of abortions and neonatal losses. Attempts to produce children...would be grossly irresponsible because the outcome would almost certainly include late abortions, stillbirths, and children with abnormalities that would prevent them from leading a normal life. Many cloned animals display birth defects, including respiratory failure, immune deficiency, and inadequate renal function—all leading to premature deaths...."

Another paper published in *Science* stated, "In all mammalian species where cloning has been successful, at best a few percent of nuclear transfer embryos develop to term, and of those, many die shortly after birth.... Even apparently healthy survivors may suffer from immune dysfunction or kidney or brain malformation, perhaps contributing to their death at later stages. Most frequently cloned animals that have survived to term are overgrown, a condition referred to as 'large offspring syndrome.'"

A 2002 report from the National Academy of Sciences stated, "...[I]t is quite clear that across multiple species there are far more failures in the development of cloned fetuses than there are live normal births.... The most notable defects are increased birth size, placental defects, and lung, kidney, and cardiovascular problems. Other problems have included liver, joint, and brain defects, immune dysfunction, and postnatal weight gain. Thus, a wide variety of tissues and organs can fail to develop properly in cloned animals.... Animal cloning can also result in danger to the mother of any cloned offspring."

To learn more or for references, please see the AAVS report
Pet Cloning: Separating Facts from Fluff.
Available at www.NoPetCloning.org.



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