

# Advanced Biotechnology Center (ABC) at the University of Yamanashi

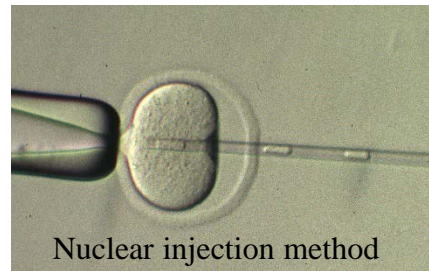
At the Advanced Biotechnology Center (ABC), we use mice to conduct a wide variety of research in the field of reproductive biotechnology. Three of our main focus areas are the improvement of somatic cell nuclear transfer “cloning” technologies, the development of new gamete (egg and sperm) preservation methods, and research on reproduction in space station, which will likely play a pivotal role in the distant future.

**Cloning technologies have the potential to change the way we live, not only in terms of advancing agricultural innovation and accelerating progress in regenerative medicine, but also in contributing to our understanding of long-extinct species if it was resurrected by cloning.**



## First cloned mice

At that time, mouse was one of most difficult species to produce cloned animal. However, as we reported in Nature in 1998, it became possible by improving the nuclear transfer techniques.

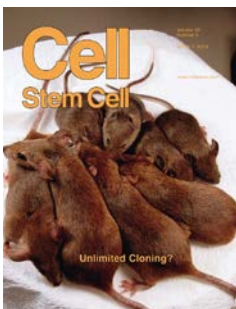


Nuclear injection method

One landmark achievement reported in 2008 was the creation of healthy cloned mice “resurrected” from dead mice that had been frozen for 16 years. This achievement led to widespread speculation that resurrecting the woolly mammoth and creating a real-life Jurassic Park might no longer be very far off. Although current technology does not yet apply, it might in future be possible.



Cloned mice from frozen dead cadaver preserved for 16 years



## Unlimited cloning

Previously, serial cloning was impossible. However, we succeeded to repeat mouse cloning over 25 times, and the success rate was increased.

Exploring the possibility of “unlimited” cloning (the idea of producing successive generations of clones from a single-source donor) could be useful for the large-scale production of superior-quality domestic animals. We are now reached the 34th generation of mouse re-clones with no evidence of genetic damage

The ABC develops new methods for obtaining offspring from infertile mice by combining with nuclear transfer and some other artificial breeding techniques.



## Offspring from infertile mouse

The mouse had no germ cell due to the mutation. However, using cloning techniques, we got offspring from the mouse.

**Development the new gamete preservation method at room temperature: If it will be possible, the method is revolutionary, as there's no need to use liquid nitrogen, so the cost can be reduced and it's more safe.**



### Mice were generated from freeze-dried sperm

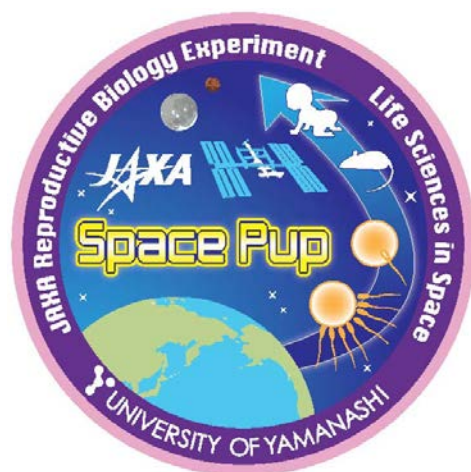
Nobody thought it would be possible to generate mice from freeze-dried sperm. Therefore, nobody tried to do this before. We tried, and succeeded.



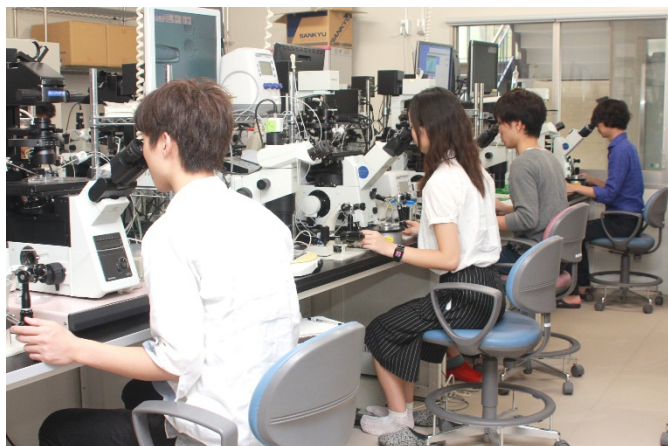
We work on freeze-dried sperm, published in *Nature Biotechnology* in 1998, showed for the first time that it was possible to generate mice from freeze-dried sperm preserved at room temperature. But so far, we can preserve at room temperature only for a few months.”

**Study for Mammalian Space Reproduction. Through our “Space Pup” experiment conducted in collaboration with the Japan Aerospace Exploration Agency (JAXA), we are investigating the effects of space radiation and zero gravity on mouse germ cells. The first mice generated from space-preserved were born in 2014.**

We study for research on space reproductive biology using International Space Station, striving to lay a solid foundation for a future where humans and animals will need to reproduce in space.



Other sperm are still keeping in ISS to expose space radiation up to 5 years. We are also planning to launch mouse embryo to ISS and culture it under zero gravity (“Space embryo” project).



Technique is very important. This may be one advantage of working at a relatively small university; we can hone our techniques and concentrate on these niche fields

Supporting these research initiatives is one of the ABC’s most distinctive assets: its seventeen sets of fully equipped and highly specialized micromanipulator, an array that ranks among the largest in the world. Taking advantage of these technologies and facilities, researchers at the ABC engage in numerous joint research projects include overseas organizations and aid in the effort to create genetically modified mice that other facilities have never been able to produce. The fostering of researchers in future generations through these researches is also important aim of our ABC.