First mammal born from lab-grown egg cell

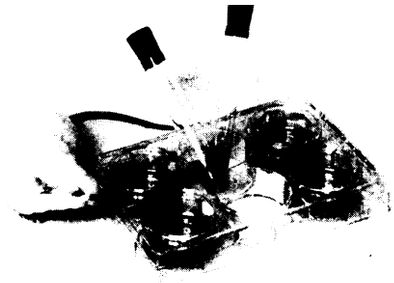
A pudgy, 7-month-old mouse scurrying around a cage at the Jackson Laboratory in Bar Harbor, Maine, represents the latest thought-provoking experiment in the reproductive sciences. The implications of this unique animal range from the recovery of endangered species to the protection of a cancer patient's reproductive capability.

Two Jackson investigators, John J. Eppig and Marilyn J. O'Brien, created the rodent from an immature egg cell harvested from the ovary of a newborn mouse. By growing this so-called primordial oocyte to maturity outside the mouse's body, the scientists have taken a significant step beyond traditional in vitro fertilization (IVF), the test-tube technique in which investigators fertilize an already mature egg with sperm.

"It's a real important feat. On the other hand, it's a long way from practical use. It's a much more difficult problem in species other than rodents," says George E. Seidel Jr. of the Animal Reproduction Laboratory at Colorado State University in Fort Collins.

For their experiments, Eppig and O'Brien first removed the ovaries from a newborn mouse and grew the organs in laboratory dishes. At the end of a week, they used enzymes to digest everything but the ovary's primordial follicles, balls of support cells with an oocyte at the center.

Jackson Lab.



Investigators created this mouse from an immature egg cell grown in the lab.

Though the follicles hold many thousands of primordial oocytes, only a few hundred will ever produce a mature egg. To draw on that untapped resource, the investigators placed the primordial follicles in a broth of carefully selected hormones and nutrients that triggered further oocyte development. After about 2 weeks, slightly more than 30 percent of the oocytes had matured into eggs ready for insemination.

If a successfully fertilized egg cell then completed its first cell division, a relatively rare event, the researchers inserted the resulting two-cell embryo into the oviduct of a female mouse. Of 190 embryo implantations, only two mice gave birth, Eppig and O'Brien report in the January BIOLOGY OF REPRODUCTION. One pup is thriving, but the other was stillborn or died within hours of birth.

As an immediate consequence of their work, Eppig and O'Brien suggest that lab-grown primordial oocytes offer a novel opportunity to study how oocytes develop into mature eggs, to test compounds that may cause birth defects or infertility by damaging oocytes, and to develop new contraceptives.

On a more speculative level, says Eppig, the ability to artificially mature other species' primordial oocytes could provide agricultural breeders and those seeking to protect endangered species with a valuable new way of quickly generating progeny from a specific animal. "You could produce a herd [from a fetus] before that fetus would ever be old enough to give birth," says Eppig.

Eppig has also had discussions with conservation biologists about whether they could increase the dwindling Florida panther population by using the primordial oocytes of the cats to impregnate closely related panther species.

Further down the road, says Eppig, girls and young women who face potentially sterilizing cancer therapies might freeze primordial oocytes that could later be matured to permit pregnancy through IVF. Lab-grown oocytes might also alleviate the severe shortage of donor eggs for infertile couples, he adds.

— J. Travis

The loitering El Niño: Greenhouse guest?

The weather outside the window may seem wacky these days, but it can't compare to conditions in the middle of the Pacific. Starting in 1976, oceanic warmings known as El Niños have popped up with a frequency unmatched in the last 113 years. Then in 1991, the Pacific spawned the longest-running El Niño on record; it lingered in equatorial waters until midway through 1995.

Two climate researchers now suggest that El Niño's recent antics do not represent a natural pattern. According to statistical tests, the frequency of El Niños during the last 20 years and the length of the most recent one should occur only once every few thousand years, report Kevin E. Trenberth and Timothy J. Hoar of the National Center for Atmospheric Research in Boulder, Colo.

"This opens up the possibility that the [El Niño] changes may be partly caused by the observed increases in greenhouse gases," produced by the burning of fossil fuels, they conclude in the Jan. 1 GEOPHYSICAL RESEARCH LETTERS.

Others argue that natural climate variations could shoulder the blame.

El Niño warmings recur irregularly, usually once every 3 to 7 years, and normally last 12 to 18 months. The oceanic event is accompanied by shifts in air pressure patterns that upset weather around much of the globe.

Because reliable measurements of ocean temperature in the central Pacific do not go back very far, Trenberth and Hoar focused their analysis on a 113-year-long record of atmospheric pressure at sea level from Darwin, Australia. During El Niño events, pressure tends to rise at Darwin and drop near Tahiti.

In the Australian record, the most recent span of high pressure started in late 1989 and lasted 5.7 years. The second-longest period persisted for 4.1 years, from 1911 through mid-1915.

The researchers used the historical data to test the rarity of the recent changes. With a statistical model, they generated a million years' worth of artificial variations, based on a century of real measurements. Though extremely simple, the model produced pressure swings similar to those in the real data, says Trenberth.

The synthesized record confirms that the recent Pacific events are highly unusual. Long-lasting deviations such as the last El Niño occur only once every 1,500 to 3,000 years. Twenty-year-long periods of frequent warmings occur only once every 2,000 years. "The conclusion we came to is that what has occurred recently does seem to be a change in behavior. The question is why. Is it related to the increase in greenhouse gases?" asks Trenberth.

For most of the last 100 years, the Pacific has swung equally between warm spells and cold ones. As greenhouse gases heat the globe, however, the balance may tilt in favor of more frequent, longer-lasting El Niños, he says.

Tim P. Barnett of the Scripps Institution of Oceanography in La Jolla, Calif., takes issue with the test used by Trenberth. "I have problems, just statistically, with generating 1 million years' of variation using 100 years' worth of data," says Barnett. "It's an interesting analysis, but it doesn't convince me that this thing is as rare as what he's saying."

Barnett and others posit that the recent Pacific behavior could represent a natural pattern of oceanic changes that plays out over a decade or longer. The relatively short El Niño record makes it difficult to determine what's natural.

"In the last 100 years, we have had between 20 and 25 warm episodes," says Vernon E. Kousky of the National Weather Service in Camp Springs, Md. "That's a relatively small sample to understand all of the variation."

After the recent El Niño died, the central Pacific cooled, a phenomenon known as La Niña. Although relatively weak, the cooling is now disrupting weather in the tropics of the Southern Hemisphere.

— R. Monastersky