Virgin birth and mixed mice

Turkeys lay eggs, but they needn't always procreate with the help of a tom turkey. In other words, virgin birth is possible among turkeys. The process by which it happens is known as parthenogenesis. Several species of mammals—rabbits, guinea pigs and mice—have also been known to develop parthenogenetic embryos, but only part way. Now there is evidence that complete embryonic development and virgin birth are possible among mammals, at least with some laboratory manipulation.

Six healthy mice have been born from parthenogenetic embryos fused with normal mouse embryos and carried to term by foster mother mice, according to a report in the Oct. 6 NATURE by Leroy C. Stevens, Don S. Varnum and Eva M. Eicher of the Jackson Laboratory in Bar Harbor, Me.

In 1974, Stevens reported the discovery of virgin mice pregnant with parthenogenetic embryos. However, none of these embryos seemed to develop beyond eight days of gestation. Instead, some of the embryos became ovarian tumors (SN: 4/27/74, p. 268). Even though none of the eggs developed into mice, Stevens remained sure that they still had the genetic capacity for such development.

Work by other researchers had suggested the possibility that parthenogenetic embryos might be brought to full term if combined with normal embryos. Stevens, with Jackson Laboratory colleagues Varnum and Eicher, tested this idea. They obtained parthenogenetic eight-cell embryos from inbred female mice that were particularly prone to spontaneous parthenogenetic development. They then obtained normal eight-cell embryos from female mice fertilized by sperm from male mice.

Previously, Beatrice Mintz and Carl Illmensee of the Cancer Institute in Philadelphia had used a particular enzyme called pronase to remove the zona pellucida (protective covering) surrounding embryos. After the coverings were removed, the embryonic cells were sticky, and two embryos could be pushed together to form a single embryo. The Philadelphia investigators then managed to get two united embryos to develop full term into a baby mouse, that is, a mouse derived from four parents. Stevens and his co-workers then applied this same technique to combine two parthenogenetic embryos with one normal embryo.

All three embryos were exposed to pronase and cultured overnight. By morning, all three embryos appeared to have fused into one. The investigators then transplanted this "triplet" embryo containing genetic information from normal parents as well as from two virgin mothers into a foster mother mouse, where it remained for the mouse's 20-day gestation period. They repeated this procedure 54 times, so that altogether 55 "triplet" embryos were transferred into six foster mother mice.

These foster mothers gave birth to litters not only containing offspring derived from normal embryos (apparently the attempt to fuse them with parthenogenetic embryos had been unsuccessful), but also containing offspring that appeared to result from a combination of normal and parthenogenetic embryos.

For instance, one litter contained three female albino mice that had developed from normal embryos (both parents of the normal embryos had been albinos). In contrast, their one male littermate was white, but with small patches of pigmented hair on his back and head, indicating that he had developed from a parthenogenetic embryo fused with a normal embryo. In addition, the three females had pink eyes, indicative of a totally albino heritage while the male had eyes with both pigmented and nonpigmented areas, showing a combined albino-nonalbino heritage. The three females were also found to contain a particular form of red blood cell chemical known to come from the parents of the normal embryos. The male contained another form of the same chemical, known to come from the females that had produced parthenogenetic embryos.

These results show that virgin birth is possible among mammals, at least with some laboratory tampering, and that cells of parthenogenetic origin can participate with normal cells in normal physiological development. Female mice partially resulting from parthenogenetic embryos are of particular interest to Stevens and his co-workers for future studies. Because parthenotes develop from unfertilized eggs, the female's germ cells can be studied to find out what causes the cells to give rise to eggs that develop parthenogenetically. Once these biological properties are identified, the investigators might then be in a position to answer two important questions in developmental biology: how does an egg begin to differentiate from a single cell into the many different types of cells needed to form a new individual? and what are the early biological processes that turn a normal cell into a cancer cell?

The Jackson Labs

Part parthenote, part natural mouse.

Will their techniques ever be used to produce partially parthenogenetic humans? Stevens doubts it, although ovarian tumors occur in women and may well be derived from short-lived parthenogenetic embryos. □

U.S.—Soviet exchange: Politics lead science

Despite findings that "the United States has, on the whole, been teaching the Soviets more than we are learning from them," the U.S.—U.S.S.R. Interacademy Science Exchange Program is politically important and should be continued. So writes the National Academy of Sciences' Board on International Scientific Exchange in a 300-page, two-year assessment of the 18-year program it manages in this country. The Academy of Sciences of the U.S.S.R. runs the Soviet portion.

To date, about 400 scientists from each country have participated in this program (not to be confused with similar government-administered programs that may also involve engineering exchanges).

The NAS board had been asked to assess whether the program had outlived its usefulness or was made obsolete by competing programs. The board said it had not and that its two most important benefits were a strengthening of the world science community and opportunity to monitor and communicate developments "between representatives of two antagonistic societies, thereby helping to improve relations between them." In fact, the NAS panel said that "maintenance of the exchange will do more to increase the freedom of [dissident] scientists in the Soviet Union" than abandoning or reducing it.

The program is also worthwhile scientifically, but because the United States tends to learn less than the Soviets from the exchange, the program is deemed more important for its political value, the report says. Findings such as this one were culled from answers to questionnaires sent to former participants, to scientists who hosted Soviet colleagues and to other prominent science leaders.

One of the panel's chief recommendations was to alleviate much of the red tape preceding an exchange of scientists. It is now so time-consuming that many would-be participants cannot get travel permission and funds in time to attend science meetings.

The panel also said that Soviet excellence and activity in mathematics, biochemistry, biophysics and physics made these fields especially ripe for new collaborative research, workshops and short visits to centers of parallel research. It recommends that the program adopt such studies, perhaps with cycling periods of emphasis on particular subfields. It said, however, that caution should be taken against undesirable transfer of sensitive technologies, such as lasers and semiconductors. □