Two Mothers, No Father = One Embryo

One egg plus one egg equals a developing embryo, at least under special laboratory conditions. And eventually this may add up to animal husbandry without male animals. A successful first step in fatherless reproduction of mammals has been reported by Pierre Soupart of Vanderbilt University in Nashville. His findings have been submitted for publication.

Parthenogenesis (egg development without the entrance of a sperm) can occur in reptiles, fish and birds, but in no experiments with mammals have entirely fatherless embryos successfully reached birth, says Soupart. His recent experiments with mouse eggs, however, suggest that such an experiment may soon be successful. What Soupart has done is combine two unfertilized mouse eggs by a standard cell fusion technique (using Sendai virus). The resulting cell has the same chromosome count as a sperm-fertilized egg, but no other sperm factors, Soupart told SCIENCE NEWS. Even so, he found that the double-egg cell divides in the laboratory as if it were a fertilized egg and eventually achieves an apparently normal 64-cell blastocyst stage.

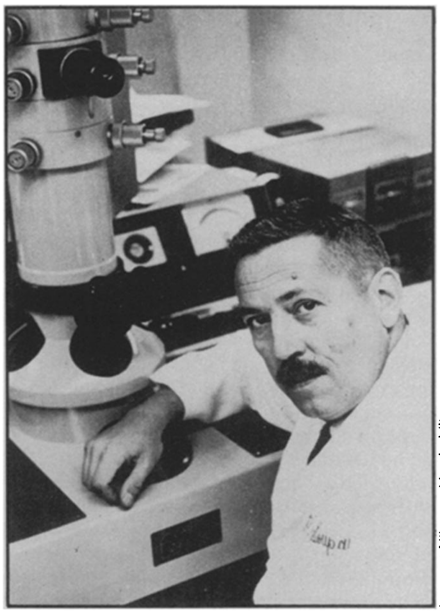
Ironically, this dual-egg conception came about during an attempt to learn more about the role of sperm. "What does the fertilizing sperm bring into an egg besides its chromosomes?" Soupart had asked. His experiment suggests that there may be nothing special that the sperm contributes, at least to early embryonic development, beyond chromosomes and a membrane perturbation.

The next step, if true spermless reproduction is to be achieved, will be to transfer the embryos to mouse foster mothers to see whether normal development will continue. To do that researchers must first improve the success rate of their egg-fusing operation. Soupart says they'll need to establish a reliable embryo "production line."

Animal husbandry minus males is one potential application of the egg-fusing technique — that is if the method succeeds in producing healthy offspring. Not only is no father required, but no sons would be born. Because each egg cell contains one X chromosome, the fused cell and its descendants would all bear two X's and thus be female.

Breeders, especially in the dairy industry, have long searched for practical ways to guarantee producing female animals. "You can kill a steer only once," Soupart says, "but you can milk a cow for years." That distinction is especially important in areas such as India where meat consumption is prohibited, but dairy products are consumed.

Soupart believes that fusing cattle egg cells and implanting the embryo in cow foster mothers is more promising for ensuring female offspring than is separating X-chromosome and Y-chromosome bearing sperm before artificial insemination. Animal producers are already freezing and transferring into foster mothers embryos derived more traditionally from egg and sperm (SN: 9/16/79, p. 203).


Lennart Nilsson, Vanderbilt

Pierre Soupart observes early embryos.

The egg fusion experiments add one more achievement to the rapid advance of embryo manipulations, some of which are useful for investigating parthenogenesis. Previously, researchers at Jackson Laboratories in Bar Harbor, Maine, showed that mouse eggs occasionally begin to divide spontaneously as if they had been fertilized. But these embryos either are rejected by the uterus or develop into tumors. If the early parthenogenic embryos are combined with a normal embryo, however, a mouse is born composed of cells derived from each embryo. Thus parthenogenic cells, when mixed with normal cells, can contribute to embryonic development (SN: 10/22/77, p. 263).

More recent work by Karl Illmensee produced all female offspring by a different manipulation (SN: 7/28/79, p. 68). He took fertilized mouse eggs and removed the pronucleus containing the chromosomes contributed by one parent. Then he chemically coaxed the cell to duplicate its chromosomal content. Because embryos containing two Y chromosomes do not survive, all offspring had two X chromosomes. The resulting viable embryos, although they may contain no chromosomes derived from the male parent, are not equivalent to the parthenogenic embryos for research purposes. Soupart explains, "Originally there was a sperm in the business." □

Molecular clouds: Birthplace of the stars

The realm of the stars and galaxies has been traditionally considered the playground of physics: general relativity, celestial mechanics, nuclear physics. In the last decade or so it has become clear as well that there is a sizable amount of chemistry going on there, and that the chemistry produces some fairly heavy molecules. Not heavy in the industrial sense, although some of the molecules found in tank cars are also found in the far reaches of the galaxy, but to many scientists surprisingly heavy for the tenuousness and coolness of the regions where they are found.

Chemistry does not take place in the stars, where conditions are much too hot for it, but in cool clouds located in the space between stars. Exactly how it does is still a matter of vigorous debate, but upwards of three dozen different compounds have been detected by their radio emanations. Most of them are in only a few locations. Molecular astronomers are always going back to the Orion neubula or the constellation Sagittarius.

Now Philip Solomon and David B. Sanders of the State University of New York at Stony Brook and Nicholas Z. Scoville of the University of Massachusetts report that such molecular clouds are much more common than astronomers have known. They told a Symposium on Interstellar Molecules of the International Astronomical Union that met at Mont Tremblant, Quebec, last week that their investigations of the millimeter-wave emanations of carbon monoxide have found an estimated 5,000 such clouds.

Observations with the two largest antennas in the United States designed specifically for millimeter-wave observations, the 36-foot paraboloid of the National Radio Astronomy Observatory located on Kitt Peak in Arizona and the 45-foot antenna at the Five College Radio Observatory in Massachusetts, indicate that such clouds form a belt around our galaxy. The ring lies in the inward parts of the galaxy between 12,000 and 24,000 light-years from the center (the radius of the galaxy is about 50,000 light-years) and between us and the center. On the average, a cloud would be 200 light-years in diameter and have a mass 500,000 times the sun's. That makes them the most massive objects in the galaxy.