

A Morphologic and Histochemical Study of the Rat Conceptus Following Ovariectomy.* (31275)

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In our previous studies on fetal-placental lysosome interaction during resorption, resorption was induced by antimetabolites or a non-ionic detergent(1,2). In each study, the degree of induced resorption varied considerably from animal to animal and it was impossible to predict whether an individual rat would resorb its litter. It became important to produce resorption by a method in which the process was inevitable so that one could correlate lysosome appearance and distribution in the various areas of the placenta and fetus with the process of death and resorption. Ovariectomy was selected as the method which would have a minimum effect on the mother but would always produce death of the litter.

Materials and methods. Pregnant Sprague-Dawley rats were bilaterally ovariectomized on day 11 of pregnancy and autopsied on day 12 of pregnancy, 12 or 24 hours after surgery. Sham-operated pregnant rats were used as controls.

Whole conceptuses were removed from the uterus, fixed in Pease's modification of Millonig's fixative(3), pH 7.3-7.5, for 4 hours, and washed overnight in buffered sucrose, pH 7.3-7.5. Frozen sections (6 μ) were prepared with a cryostat. Acid phosphatase activity of the sections was determined at pH 5 by the Barka-Anderson technique(4), using naphthol AS-BI phosphate, and by the Gomori technique(5). For morphological study, sections of paraffin embedded tissues were stained with a polychrome stain.

Results and discussion. Resorption of

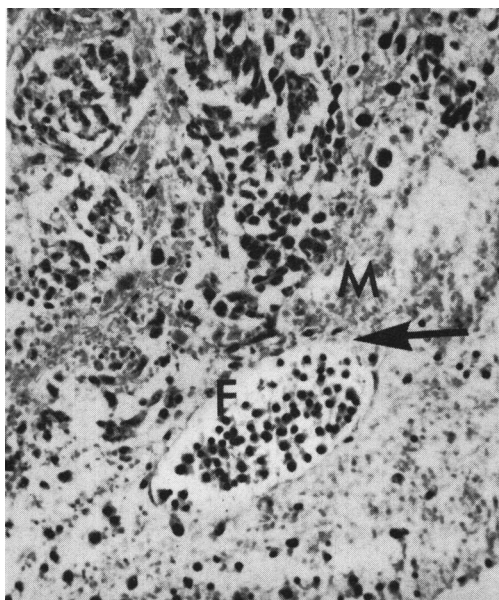


FIG. 1. Section of placental labyrinth, 24 hours post-ovariectomy, showing fetal capillaries (F), maternal blood (M), and area of breakdown of maternal-fetal blood barrier (arrow). Papanicolaou stain. $\times 165$.

100% of the rat conceptuses occurred as a result of ovariectomy on day 11. The degree of resorption observed on day 12 was sufficiently varied to allow for reconstruction of tissue changes associated with death and resorption of the fetus and placenta.

The breakdown of the maternal-fetal blood barrier of the placental labyrinth was the first indication of resorption (Fig. 1). Maternal blood appeared in the fetal blood vessels (Fig. 2) and fetal blood cells and trophoblast cells in the maternal blood vessels of the decidua basalis. Stasis of the maternal blood in the sinuses of the labyrinth including a pronounced accumulation of maternal blood in and a swelling of the marginal sinuses of the placenta occurred (Fig. 3). Subsequently, pycnosis of the nuclei and a loss of intercellular cohesion, both indicative of degenera-

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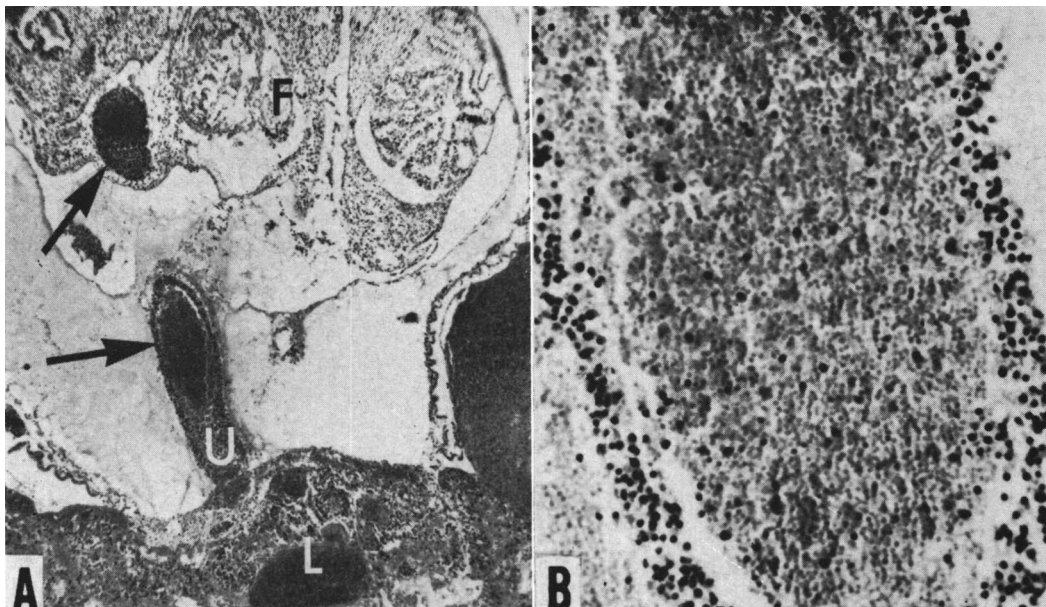


FIG. 2. Section of 12-day conceptus, 24 hours post-ovariectomy. A. Note degenerating fetus (F), hemorrhagic placental labyrinth (L), umbilical cord (U), and maternal blood in fetal blood vessels (arrows). Papanicolaou stain. $\times 30$. B. Higher power of umbilical cord showing mixture of maternal and fetal blood cells. Papanicolaou stain. $\times 165$.

tion, occurred in the fetus, yolk sac, and placental labyrinth. The entire area became hemorrhagic with maternal blood appearing in the yolk sac cavity but not in the amniotic cavity. Gradually the dead cells of the fetus, yolk sac, and placental labyrinth disappeared and the area became filled with maternal blood, including a large number of polymorphonuclear and eosinophilic leucocytes. Forty-eight hours after ovariectomy, only the giant cells and the decidua basalis persisted.

Although the later stages of resorption induced by ovariectomy resemble resorption induced by other methods(1,2), the initial stages of the breakdown of the maternal-fetal blood barrier in the labyrinth, resulting in mixing of the maternal and fetal blood, appear to differ from resorption induced by the administration of ethionine(1) or of Triton WR-1339(2). Control morphology and histochemistry have been previously presented(1,2, 6).

Acid phosphatase in the resorbing conceptus. The Barka-Anderson and Gomori methods for acid phosphatase determination produced similar distribution patterns. These patterns resemble those observed with other

methods of producing resorption(1,2). Fetal lysosomes are found in all epithelial tissues and are especially prominent in the neural

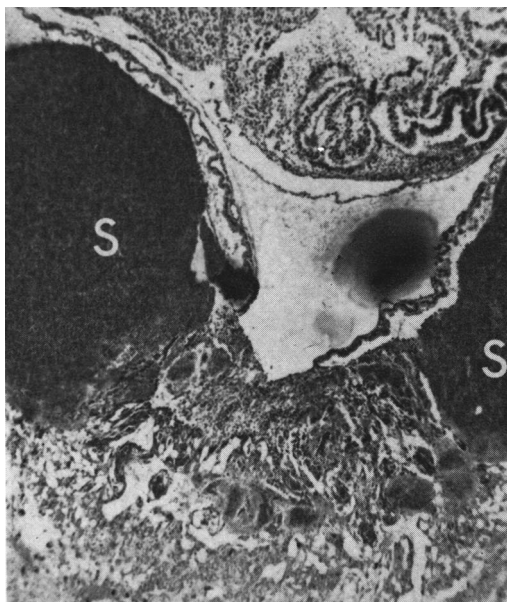


FIG. 3. Section of 12-day conceptus, 24 hours post-ovariectomy. Note marginal sinuses of the placenta (S) engorged with maternal blood. Papanicolaou stain. $\times 30$.

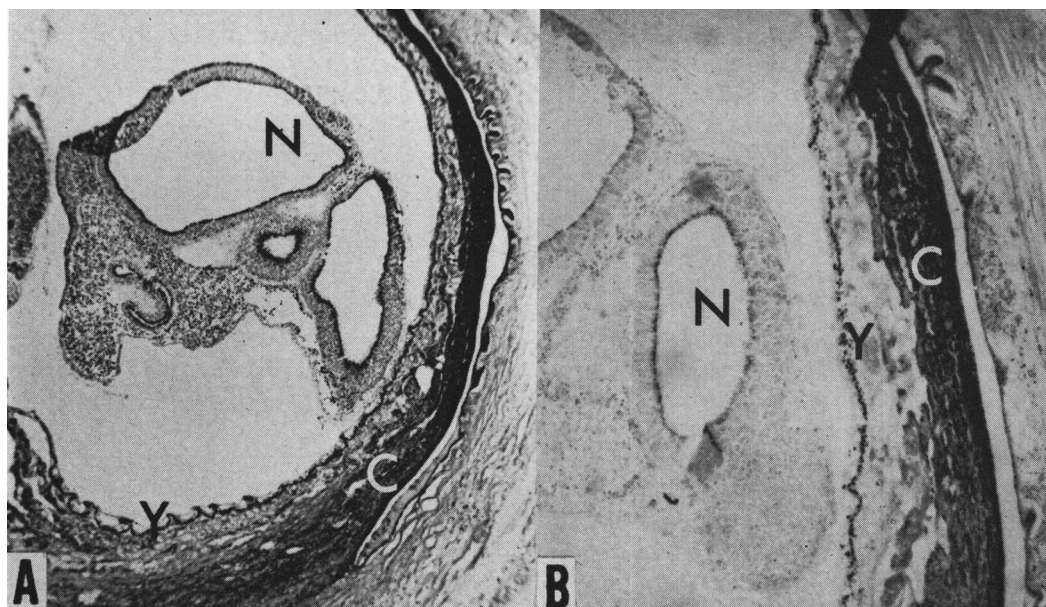


FIG. 4. Sections of 12-day conceptus, 24 hours post-ovariectomy, reacted for acid phosphatase. Note enzyme reaction in the ependymal layer of the fetal neural tube (N), in the yolk sac epithelial cells (Y), and in the decidua capsularis (C). A. Baraka-Anderson reaction. $\times 30$. Gomori reaction. $\times 50$.

tube, lining of the gut, kidney tubules, notochord and dermatomes. In the resorbing fetus, the lysosomes of all of these tissues and of the mesenchymal cells appeared larger than in control fetuses of the same stage of development. In the later stages of degeneration, the lysosomes of the neural tube become concentrated in cells adjacent to the lumen (ependyma) rather than in the more superficial layers (mantle and marginal) (Fig. 4). The lysosomes of the visceral yolk sac epithelium and those of the trophoblast cells of the labyrinth remain conspicuous as long as the tissues persist (Fig. 4).

In the later stages of resorption, macrophages invade the decidua basalis; these highly reactive cells become concentrated in the area of the basalis adjacent to the labyrinth and in the hemorrhagic areas of the placenta. The decidua capsularis thickens and is notable for the heavy concentration of acid phosphatase activity (Fig. 4). When almost all fetal tissue is gone, the decidua capsularis and the cells of the endometrium about the basalis form a "ring of activity" around the entire conceptus.

Summary. The distribution of lysosomal

enzymes in conceptuses during resorption induced by ovariectomy was studied by histochemical methods. The histologic changes associated with ovariectomy-induced resorption were, in sequence, disruption of the maternal-fetal blood barrier (with mixing of fetal and maternal blood), simultaneous degeneration of the cells of the fetus, yolk sac, and placental labyrinth, and invasion of the fetal area with maternal blood. Histochemical study of acid phosphatase in the resorbing tissues showed a persistence of the lysosomes in the fetus, yolk sac, and placental labyrinth during tissue degeneration. There was a change in the distribution of the lysosomes in the fetal neural tube during the process of resorption.

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