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L. M. Winters
University of Minnesota

from time to time, feeding on small fruits such as those of *Sorbus,* species of *Prunus* and *Amelanchier.*

The sheltering forest and the borders of thickets are also sought by those birds which are seen there during summer. They include Ruby-throated Humming Bird, Catbird, Veery, American Redstart, Yellow Warbler, Chipping and Song Sparrows, Kingbirds, Least Flycatcher, Robin, Purple Martin, Flicker and others. A pair of Mourning Doves was seen twice, but there was no evidence that these birds nested there. A pair of European Starlings was found feeding young in a hollow of a tree on the Fourth of July.

Of the transient sparrows Slate-colored Junco, Tree, Harris and White-throated Sparrows have been common. Most of the warblers on record were observed during fall migration.

STUDIES OF PRENATAL DEVELOPMENT IN FARM ANIMALS

L. M. WINTERS
University of Minnesota

The central objective of these studies has been to gather as accurate data as possible regarding normal prenatal development in farm animals. Once this is established as a base we or other workers will be in a position to study the specific effects of unfavorable environments, such as deficiency rations, excess fat, etc. Our work has progressed far enough so that we are now incorporating some of the latter in our studies.

Our studies of prenatal development have been confined chiefly to the sheep and the bovine. The sheep series includes 200 specimens of rather definitely known ages; the bovine series includes 78 specimens of well known ages. The sheep series is complete but it will be necessary to add a few more bovine specimens. The age of each specimen is calculated from the cession of heat. In this respect our calculations differ from others in that the onset of heat has generally been used. The objections to using the onset of heat are: the duration of heat is subject to considerable individual variation and time of ovulation is more closely related to the cession of heat than heat's onset. In the ewe ovulation occurs about as heat is passing; we have found a range of about six hours either way. In the cow ovulation occurs about 24 hours after the cession of heat. This means that by our method of calculating the ages of our specimens the bovine ones are actually about one day younger than the sheep specimens given the same age. This is interesting because

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we find that thru the entire period of the ovum (to the time of implantation) development of the bovine is about 24 hours behind development of the sheep. In reality they develop thru the ovum period at approximately the same rate. Following implantation, however, the bovine develops much slower. The period of gestation in the sheep is only about 145 days, whereas in the bovine it approximates that of the human being, about 270 days. For this reason the study of prenatal development in the bovine is of added interest. Here, too, however, we cannot be too definite because actually the human is born earlier in development than the bovine.

In the sheep the sperm require about five hours from the time of copulation to reach the infundibulum where fertilization usually occurs. We have no data on the bovine.

Our two celled stage in the sheep was recovered at 39 hours; in the bovine it was 52. The sheep egg reaches the uterus about 90 hours after heat whereas the first bovine egg recovered from the uterus was 115 hours after heat. The zona pellucida is lost in the sheep at about seven days; in the bovine it is lost at about eight days.

Recovery of the bovine blastocyst stages is extremely difficult not only because of their extreme minuteness but because of the frequent presence of a slight carotinoid like pigment. In the sheep the blastocyst has a certain brilliance or lustre which aids greatly in its recognition.

Implantation in the sheep occurs at about 10½ days and in the bovine at about 12. The sheep reaches the 4-somite stage during the 15th day whereas in the bovine it is not reached until about the 20th day. The 10-somite stage and closing over of the neural folds is reached during the 16th day in the sheep and the 21st in the bovine. The allantois is fairly prominent in the sheep early in the 18th day and a similar stage in the bovine is not reached until the 23rd day. The heart is functioning quite satisfactorily as a definite organ by the 18th day in the sheep and the 23rd day in the bovine. The mesonephros is easily recognized in the sheep by the 18th day and in the bovine by the 26th day. Limb buds are present in the 21 day old sheep embryo and in the 28 day old bovine. The sheep reaches the fetal stage at about 34 days and the bovine reaches it at about 50 days.

The first hair follicles of the bovine are apparent by microscopic examination at 90 days and the horn pits at 100 days. Pigment appears in the sheep fetus at 94 days and in the bovine at 150 days. Hair makes its appearance in the bovine at about 150 days.

Studies of the Sperm Cell and Artificial Insemination

Our studies of artificial insemination have progressed to the point where we now have two lambs which resulted from use of semen kept in the laboratory six days and three from samples kept five days. Ewes were settled with one and two day samples with

about as high a degree of success as from mating with the ram. Sheep sperm have been sent from St. Paul to Grand Rapids and from Grand Rapids to St. Paul by bus and ewes settled at either end of the journey.

Artificial insemination in the bovine has not progressed quite so far. Fresh semen drawn from the bull by massage of the ampulla has been used with a high degree of success. Semen collected in this manner has not, however, been stored with success. Two cows have been settled with bull semen collected from the vagina following service and kept in the laboratory one day.

Sperm are very sensitive to sudden changes in temperature. Our method of handling is as follows: We force mate females out of heat. Sperm drawn from a dry vagina give better results than those drawn from a moist one (a female in heat). The sperm are drawn off with a large mouthed pipette transferred to a test tube and covered with mineral oil. On return to the laboratory the sheep semen is diluted with an equal quantity of saturated calcium sulphate solution carefully buffered to 6.8. This solution was developed by one of my assistants, R. E. Comstock, and has proved much superior to any of the other solutions tested in our laboratory. Bull semen is diluted with an equal quantity of three or four per cent glucose solution, a solution recommended by Dr. Fred Miller of the U.S.D.A.

The diluted samples are allowed to stand in the laboratory for about 30 minutes and then transferred to a refrigerator kept at a temperature of 40–42° F. Before use the semen is removed from the refrigerator and allowed to stand at room temperature before taking it to the barn for insemination.

The ewe is then placed in a specially made crate. A test tube is used to dilate the vagina, following which a test tube with an open bottom is used as a speculum. The cervix is located with the aid of a small speculum light; a strong flash light or even a reading light will serve the same purpose altho they are not quite so convenient. Insemination is then made with a small bored glass pipette rounded at the tip and bent at a right angle about four inches from the outer end. The tip of the pipette is inserted between the lips of the cervix for insemination.

The cow provides sufficient room to locate the cervix with the two forefingers. The pipette is inserted by allowing the point to follow the arm and hand. Care must be taken in this or it will probe and injure the mucous membrane of the vagina. With the two forefingers the pipette is placed in the lips of the cervix and the insemination then made.

Through the use of artificial insemination the use of valuable males can be multiplied many times. In certain instances it will be very advantageous to be able to inseminate females with sperm from males located some distance. This would be true in case of

some very valuable animals or in cases where certain breeds or species are in quarantine.

Artificial insemination will be perfected to the highest point possible only through a more complete understanding of the chemical and biological properties of both sperm and egg cells and of the various secretions contributing to seminal fluid. Studies of this nature are under way in our laboratory. These studies are extremely fascinating but they are rather slow in yielding results. There are a large number of fundamental studies still to be made on the mammalian reproductive tract.

THE STRUCTURE AND FUNCTION OF THE VOMERO-NASAL ORGANS (OF JACOBSON) IN THE COMMON GARTER SNAKE, *Thamnophis sirtalis sirtalis* (LINN)

(By Title Only)

WALTER S. WILDE
University of Minnesota

A STUDY WITH THE ULTRA CENTRIFUGE ON THE MECHANISM OF DEATH BY FREEZING.

(By Title Only)

SISTER MARY GRELL
College of St. Benedict