



The biology of the antelope (*Antilocarpa Americana*) in Montana
by Paul D Buck

A THESIS Submitted to the Graduate Committee in Partial fulfillment of the requirements for the degree of Master of Science in Zoology of Montana State College
Montana State University
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Abstract:

The object of the present thesis is to present results of research work on the American Antelope (*Antilooapra americana*).

The American antelope belongs to a different family from those of the Old World, It is unique among all horned animals by its possession of deciduous horns with a permanent bony core. The antelope possesses a gall bladder in contrast to the deer. The eyes are exceptionally large for its size.

It has by far the keenest vision of any mammal. The teeth are used to determine the antelope's age but the horns show strong indications in the younger bucks. The average length for 69 specimens taken in Montana was 93 inches. This was normally reached at the end of the third year. The males averaged 10 per cent larger than the females. During the winter months the antelope congregate in bands but during the summer the older bucks separate from the does and their young* Twins are the general rule. In Montana the antelope appears to be exceptionally free from disease and parasites.

Stomach analysis showed that 85.9 per cent of their food was browse. The principal plant eaten is sage. Cactus was dominant in several samples. Grass was second in number of items but the quantity was extremely small. Observations would indicate that antelope give but little competition

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IN MONTANA

by

PAUL D. RUSK

A THESIS

Submitted to the Graduate Committee

in

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Montana State College

Approved:



In charge of major work



Chairman, Examining Committee



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Miss G. Graduate Committee

ABSTRACT

The object of the present thesis is to present results of research work on the American Antelope (Antilocapra americana).

The American antelope belongs to a different family from those of the Old World. It is unique among all horned animals by its possession of deciduous horns with a permanent bony core. The antelope possesses a gall bladder in contrast to the deer. The eyes are exceptionally large for its size. It has by far the keenest vision of any mammal. The teeth are used to determine the antelope's age but the horns show strong indications in the younger bucks. The average length for 65 specimens taken in Montana was 53 inches. This was normally reached at the end of the third year. The males averaged 10 per cent larger than the females. During the winter months the antelope congregate in bands but during the summer the older bucks separate from the does and their young. Twins are the general rule. In Montana the antelope appears to be exceptionally free from disease and parasites.

Stomach analysis showed that 85.9 per cent of their food was browse. The principal plant eaten is sage. Cactus was dominant in several samples. Grass was second in number of items but the quantity was extremely small. Observations would indicate that antelope give but little competition

to livestock.

The gross anatomy is similar to that of sheep. This is especially true of the reproductive system with the exception of minor details. The observation of the embryos indicates that identical twins may appear.

100%
COTTON FIBRE
ANNIVERSARY BOND
BY
FOX RIVER

INTRODUCTION

During the past forty years many American game animals have had to orient themselves to new environments. This has been primarily due to civilization which has changed the habitat of so many animals. It is one of the things that has led to the need of a better understanding of the factors that control wildlife.

There has been very little work done on the antelope in Montana. Due to this, the present study is only on the general biology of the antelope. It is hoped that this will lead to further work.

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FOX RIVER
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Classification

The antelope possesses a four chambered stomach and ruminates its food. Thus it is placed in the division of Ruminants with the deer, elk, cattle, sheep and goats. Due to its deciduous horns it has been separated into a single family, Antilocapridae and given the name Antilocapra americana. The genus name Antilocapra was compounded by Ord from the Latin word for antelope. Its hollow horns and genital organs resemble those of the true antelope or antelope gazelle of the old world. The name capra means goat. The presence of odor glands is similar to that of a goat. The lachrymal sinus is wanting in both the prong horn and the goat. It has four mammae like a deer while the goat has only two. In common with the hollow-horned ruminants, it has a gall bladder which is wanting in all Cervidae. The genus has only one species, americana. Vernacular names are prongbuck, pronghorn, antelope and loper. The family Antilocapridae is strictly North American and is peculiar in that it combines the features of several other families.

In general the antelope is smaller than the white tail deer. In contrast its horns are hollow and deciduous with a short, triangular process extending forward near its tips.

The legs are rather short but slim and straight. Hoofs are bifid, small and pointed. There are eleven cutaneous glands but none are placed on the outside of the hind leg or inside the hock as in the deer. Hair grows on the lips. The head and body of the antelope is colored with black markings on a brownish red undercoat. Its throat, belly and rump are predominately white. The bucks have distinct V markings below each ear. They differ from the does by having more black on the head. They are also larger and have longer horns.

The antelope has by far the keenest vision of all mammals, a fact associated with its unusually large eyes. The eye is intensely black so that it is impossible to distinguish the pupil from the iris or its surrounding. No white part is ever visible unless the eye is turned to one side. The eye-lashes are long, coarse and stiff but sparse.

The antelope has two coats of hair. The coarse, long outside hair is tubular in structure and thus breaks when bent and will not straighten again. They terminate in exceedingly sharp points and have no felting properties. The hair is largest a small distance above the root, thence it tapers very gradually for a short distance and then more rapidly to the sharp point. The second hair coat is a fine under fur. These hairs are not pointed but are of a uniform size the whole length and terminate abruptly. The hair is longest on

the rump and mane, varying up to four inches in length. On the legs and face the hair is short and without the fur.

The horns of the American antelope constitute one of its most remarkable characteristics, and one which strikingly distinguishes it from all other ruminants. It is the main factor that has given it a wide separation from all other horned animals. Both sexes have horns. The horns on the female rarely exceeds three or four inches in length. It has a deciduous horn which envelopes a persistent core as shown in Plate I. Thus it sheds its outer covering every year but maintains its inner core which develops a new horn covering before the outer one is lost. The growth of the horns is not completed until August and they are cast off in October or November.

The horns are made up of modified hair, particularly near the base as shown in Plate II. The new horn starts growing on the tip of the core underneath the old horn and gradually pushes the old horn off. Many record sets of horns may be the combination of the two. The horns, even when fully grown, are not securely attached to the core.

Normally the main horn shaft projects straight up from the skull. The one prong is webbed on to the main shaft and projects directly forward. These prongs play a definite part in the protection of the skull when fighting. The primary

objective during battle seems to be to use the curved, sharp prongs to gouge, hook or rip the throat of the opponent.

McLean (1944) states "that freak horns of various shapes are not uncommon among antelope. Some were widespread, some straight up and parallel, some tipped forward, some with double prongs. There was one four-horned buck from California who had an extra set, equal in size and growing between the normal set. Several were killed during the 1942 and '43 seasons with Cock's comb shaped horns on the bridges of their noses. This was attached to the skin over the base of the nasal bones."

In Montana the antelope shed their horns shortly after the rutting season. Most of the horns are shed from October through December.

Dentition

As in all ruminants, the age of the antelope can be determined by its lower incisors. Each year up to the age of four years they lose a pair of their temporary teeth starting from the center line of the lower jaw. These are replaced by permanent teeth. The first are known from the others by their smallness and particularly by their narrowness. It is easy to confuse permanent teeth with temporary teeth when the permanent ones are small. The same is the case when the temporary teeth are large. In the case of permanent



Plate I Note the deciduous horn and the bony core.



Plate II Note the long hair and the downward development of the tips.



Figure 1.

Figure 2.

Plate III Figure 1 is the jaw of a two year old buck.
Figure 2 is the jaw of a four year old doe.

incisors, the molars will show considerable wear. Plate III, figure 1 shows a two year old with two sets of large incisors along with the two smaller temporary sets to the out edge of the jaw. The upper incisors are lacking, their function being replaced by a thick cartilaginous pad which is covered by the mucous membrane of the mouth. This pad forms the gum and furnishes a bearing for the incisors of the lower jaw.

Plate III, figure 2 shows a four year old with its four sets of permanent incisors evenly formed. In this case the incisors are quite narrow and hard to determine as permanent.

The first three molars on each side of the jaw are also temporary and are replaced by permanent ones but do not give an age indication.

Horn growths are sometimes useful as an age determinant but are not as reliable as the teeth. Plate IV, figure 1 shows the horn development of a one year old, Plate IV, figure 2 a two year old and Plate IV, figure 3 a four year old. One can easily see the increase gradation from the one year old to the four year old in the length of the horn, the circumference at the base, the size of the prong and the curvature of the tip. Measurements taken on the sixty-two animals from Carter County (see Table III) show the males to have an average horn length from the base to the tip of 2.1 inches with an average base circumference of 2.2 inches for those less than one year old.



Plate IV Horns of three different age groups.

Those between one and two years had an average length of 6.2 with an average base circumference of 4.6 inches. The age group from two to three years had an average horn length of 8.7 with a base circumference of 5.4. The three to four year group measured 11.2 inches in length with a base circumference averaging 5.6. Those over four years averaged 11.5 inches in horn length with a base circumference of 5.9. Indications show that they nearly reach their maximum length and size in their third or fourth year.

Table III also shows that the antelope reaches its average length of 52 to 53 inches at the end of the second year. This is also true for its average shoulder height of 33 to 34 inches. The leg length varied very little after the end of the second year. However, they continue to gain weight even after the fourth year. The average weight of the males four years and over was 81 pounds hog dressed and the female was somewhat less, averaging 70 pounds.

Foot

The foot of the antelope is considerably smaller than that of a deer. It is strongly convex on top, slim and sharply pointed.

The rudiment of the posterior accessory toes (dew claws) found on nearly all other ruminants above the useful hoofs is entirely wanting. Even the fetlocks found in horses are wanting.

TABLE I

Measurements of Antelope taken from Carter County, 1946.

Age less than one year

Wt.	T.L.	S.H.	Leg	Ear	Tail	Horn L.	Horn C.
Males							
36	45	31	13.5	5.5	4.5	1.5	1.5
--	42	32	14	6.5	5.5	2.8	3.
34	43.5	28	12.5	5.	5.		
Females							
40	42	29.5	13	5	5.8		
28	38	30	12.8	5.3	4		
46	42	27	13	5.5	4.5		
28	36	28	12	4.8	4		
44	48	30	13	6	4.5		

One year plus

Males							
70	52	32	13.5	5.8	4	6	4.5
52	49	32	13.3	5.5	5	2	
67	50	35	14.5	6.3	6	7.5	4.5
68	53	35	15	6	6	9	4.5
72	55	33.5	14.5	6	5.5	6.8	5
60	51	31	14	5.5	4	6	4.5

Two years plus

Males							
78	55	33	15	6	4.8	7.5	5
75	53	33	15	5	4.5	9.5	6.5
75	52	32	14	5.5	5	7	5
74	52.5	34.5	15.5	5.8	4	10.5	6
78	55	33	15	6	4.6	7.5	5
68	52	33.5	14	5.5	4	10.5	5

Three years plus

Males							
72	54	35	14.5	5.8	4.5	12.5	5.8
87	52	35	15	6	5.5	7.5	4.5
74	52	32	14	5	5	10	5
74	49	33.5	14.5	5.5	5.5	11.5	5.8
81	55	34	14.5	5.8	5.5	13.5	6.5
72	54	33	14.5	5.8	4.5	12.5	5.8

TABLE II

Measurements of Antelope taken from Carter County, 1946

Age four years and over

Wt. T.L. S.H. Leg Ear Tail Horn L. Horn C.

Males

80	53	36	16	7.5	6.5	15	6
82	54	40	16.5	6.5	6	15	6.8
85	53	35	16	5	4.5	11.5	6
65	51.5	36	16	5	6	8.5	5.8
74	52	34	14.5	6.5	5.5	12	5.8
84	55	36	14.8	6	6.5	13	6
86	55.5	36	15	6	4.6	12	6
78	52	33	14.8	5.8	5.8	11	4.5
84	53	34	14	6	6	13	7
80	50	35	15	6	5	11.5	6
--	--	32	14	6.3	4.8	14	7
84	53	38	14.5	6	5.5	12	6.5
93	54	35	13.5	6	5.5	12.5	6
82	61.5	34.5	14	5.5	4.8	13.3	5.8
65	50	35	13.5	6	5.8	6.7	4
78	53	34	15	7	6	12	6.8
75	53	35.5	15	6.2	5.5	6.5	4.5
82	52	34	14	6.5	4.8	10	5
95	53	32.5	15	6	5	12.6	6.5
86	53	35.5	14.6	6.3	5.3	11.8	5.8
84	50	37	15.5	5.3	5.3	12.5	6.5
84	54	35	15	5.3	6	10	5.5
83	53	35	14.5	5.8	5.5	7.8	4.3
75	53	34.5	16	5.8	5.8	12.8	7.5

Females

61	56	32.5	14	5.5	4.5	.8	1
61	56	32.5	14	5.5	4.5	.8	--
74	52	32	14	6	4.5	2.5	--
76	49	32	14	6	--	2	--
76	53.5	33.5	15	6.5	4.8		
61	52	32	14	5.5	4.5		
65	52	31	15	6	5.5		
70	54-	32	15	6	5.5		
73	53	33	14	5.8	5		
61	56	32.5	14	5.5	4.5	1	.8
82	56	37	14.8	6	5.5	2	--
80	53	32	15	6.5	6	2.5	--

TABLE III

Average measurements of Antelope taken from Carter County, 1946

Wt.	T.L.	S.H.	Leg	Ear	Tail	Horn L.	Horn C.
Age less than one year							
Males and Females							
36.6	42.1	29.6	13.1	5.4	4.7	2.1	2.2
One year plus							
Males							
65.	51.3	35.1	14.1	5.8	5.1	6.2	4.6
Two years plus							
Males							
74.7	53.2	33.2	14.7	5.6	4.5	8.7	5.4
Three years plus							
Males							
76.6	52.7	33.4	14.5	5.6	5.0	11.2	5.6
Four years plus							
Males							
81	52.7	35	14.9	6	5.5	11.5	5.9
Females							
70	53.5	32.6	14.3	5.9	4.9	1.6	1.2

Gait

Much has been said and recorded on the high speed of an antelope. Just how reliable such data are, is yet to be known. Most of the records have been recorded from the speedometers of automobiles while in the pursuit of antelope.

Edmund Heller (1930) states that the only authentic accurate record rates their speed to be thirty-two miles per hour and that the pronghorn is only exceeded in speed by a trained race horse which exceeds it by two miles per hour. The greyhound is almost equal to the pronghorn in speed. The pronghorn is a long distance runner and can keep up a high rate of speed for ten miles, which will distance almost any greyhound. The average speed recorded by other observers is approximately forty-five miles per hour. (Seton, 1929; O'Connor, 1939; McLean, 1944) The average speed in Montana was thirty-five miles per hour.

In their running antelope do not bounce up and down like a deer but keep their bodies on a horizontal plane with a very smooth gait. They do not make long leaps but rather short, even leaps. They do not throw any dust, dirt or mud in their running. The roughness of the terrain has very little effect on their smoothness of gait. They do prefer solid ground however.

Vision

The antelope has by far the keenest vision of all mammals

except possibly mountain sheep.

Antelope can spot hunters several miles away as indicated by the flaring of their rump patches in the bright sunlight. A band of thirty spotted me from about a mile away. At the same time a lone buck was lying down on top of a knoll near the band. He stood up when he spotted my movements and flared his rump.

Habits

Primarily due to their excessive speeds, antelope seem to enjoy racing fast moving objects. They invariably will cross in front of their object. On various occasions they raced the car, cutting in front of it and then stopping to feed as if nothing had happened. Several cases have been reported where antelope have attempted to race moving trains on the prairies. Many times they will race each other back and forth in front of the band.

Antelope seek treeless plains, ravines, and rolling foothills or wherever they can see for long distances. They primarily depend upon their keen sight and fast speeds for protection. Particular bands seldom leave the locality where they are born. From November through March they meet in bands, the bucks, does and fawns all together. In March the bands start to break up. The does go off one by one to prepare for the birth of their young. The old bucks go

off alone or in groups of two or three leaving the young bucks and young does together in small bands. During the winter the bands are quite tame but when they start to break up in the spring they are very shy and hard to approach. The entire band tends to move away from local ranch houses and civilization. While in the band, an old buck generally takes the lead. The band will follow him when disturbed by natural causes. It was observed that when a band was badly frightened they would split into small bands. Each smaller band would tend to go toward its local feeding area. This would indicate that small local bands unite to form large ones.

The rutting occurs in September and October when the horns of the adult have been fully developed and before they have been loosened by the new undergrowth. During the early part of the rutting season the old bucks drive the younger bucks from the bands and build themselves small harems of from four to ten does along with their yearling kids. The old bucks will try to cut does from other harems to build up their own. They tend to chase the does for long periods of time during the rut.

The pronghorn is not a high jumper like the deer but will invariably crawl under its object rather than jump it. When confronted by a fence they strive to crawl under the lower strand. When driven, this is done so rapidly that large masses of hair are cut from their backs.

Curiosity is the main weakness of the antelope. Any strange object will attract them and cause them to approach and investigate. Hunters have lured them to within range of their guns by hanging bright colored cloth or garments on trees, bushes, sagebrush or other objects.

Numbers & Distribution

Nelson (1925) states in the early days the great plains of Montana contained countless thousands of antelope. The 1924 census records surviving herds in 44 districts, mainly in the eastern and central parts of the state, with a total of approximately 3,000 animals. The United States Fish and Wildlife Service has estimated the 1937 census to be 10,602 with an increase up to 23,537 for 1941 in the State of Montana. The present population is not known but is definitely on the increase. As against the many millions of pronghorns once inhabiting this continent, a 1924 census, taken through the Biological Survey and detailed elsewhere, shows approximately 30,000 survivors. Through the occupation of its territory by man, the pronghorn has become extinct in many of its former haunts. See Plate V.

Enemies

Seton (1929) says the worst enemies of the wild antelope today are, first, repeating rifles; next, sheep, which destroy their winter range; and, finally, deep snow. However, coyotes



Plate V Nelson (1924) heavy line marks limits of pronghorn before European settlements in America. Shaded portion indicates 1924 distribution.

wolves and eagles kill many, especially kids. Epidemic diseases occasionally appear.

Diseases

Dr. J. A. Allen (1874) states "During the summer of 1873, a fatal epidemic raged among the pronghorns over nearly the whole area between the Yellowstone and Missouri Rivers, destroying apparently three-fourths to nine-tenths of them."

Except for the epidemic of 1873 there is very little to report on the diseases of antelope. Confinement animals in parks are very subject to fatal enteritis, and tuberculosis, probably from improper food or an unbalanced diet.

Four digestive tracts were examined. The only internal parasites found were whip worms in the caecum. These are normally found in the large colon and caecum. Centrifugal flotation tests of fecal material from one animal showed a complete absence of eggs or egg cases. Careful examinations were made for ecto-parasites but none were found. However, in Montana respiratory infections, gastro-intestinal parasites and tick infestations have been reported from antelope by the State Fish and Game Commission.

One antelope examined had a small hair ball about the size of a hen egg in the reticulum. Another antelope possessed a small obstruction in its fourth stomach, the center of which was composed of hair. It was black in color indicating the antelope had carried it for quite a period of time. Although

it was only the size of a large egg, it was too large to enter the small intestinal orifice. There was no indication of it doing any harm to the animal.

Foods

Stomach samples were first collected on September 15, 1946 in Carter County where an antelope checking station was established during the hunting season. Data was obtained from hunters checked in and out of the area. Sixty-five antelope of all age classes and sex were measured and weighed during that time. Pint jars were given to the hunters for collection of food samples from the paunches of freshly killed antelope. Later, other food samples and embryos were obtained from Musselshell County and the Gardiner area in Yellowstone Park.

By permission from the Montana Fish and Game Commission four antelope were collected during December, January, February and March from the antelope band in Broadwater County. Besides stomach samples, these were used for study of the reproductive systems and embryonic development.

Whether it is more correct to classify food content by weight or by volume is still undecided. In these studies little difference was found between them. Both methods were used. Since most experimental work is done on the dry weight

basis, this will be used in the following discussion. The food was separated in a water bath for ease of identification. It was then placed between blotters and dried. All weights were made in grams and percentages calculated on that basis. The volumetric measurements were made by measuring the amount of water displaced by placing the food samples in a 100 cc graduate.

Cactus was the only plant that varied to any great extent. Its volume was high but it weighed very little upon drying. This in turn would raise the percentages of other plants when calculated on a weight basis.

Taken collectively, foods of wild game can best be divided into three major classifications; grass, forbs and browse.

Contrary to general belief, the antelope is not a great grass eater. Of the forty-five stomach contents examined, grass had a total average of only 7.4 per cent. Forbs, including alfalfa, was only 6.7 per cent. The bulk of the food was browse, totaling an average of 85.9 per cent. There was much grass and forbs present in the area but the antelope has chosen browse as its principle food. Table IV.

Sage was the plant preferred above any other and made up 39.7 per cent of the total foods eaten. It was found in 34 of the 45 samples, twice the occurrence of any other browse plant, (Table V). Sage averaged 52.5 per cent in the 34 samples.

Artemisia tridentata was the most common species but other sage species were present. Leaves and twigs were eaten along with much of the flowering parts. Sage is the dominant browse plant in the area although other browse species are available. The antelope's preference for it was shown in one case where the entire food sample was sage. Indications are that it is the principle food in other counties such as Broadwater, Park and Musselshell, (Table XIII). It is probable that in the Gardiner area the sage is being killed out through over grazing by antelope.

Snowberry (Symphoricarpos) was utilized to a great extent by antelope considering that it is not as prevalent as sage. It is found only in the moister areas along creek bottoms and gullies. Snowberry was second in preference, making up 16.9 per cent of total average. It occurred 12 times but had an average of 63.7 per cent in these occurrences. In one case it made up 97.0 per cent of the sample. (Plate VIII) Twigs, leaves and berries were eaten. Snowberry is a good succulent food in dry weather and may be one reason why antelope desire it.

Saltbrush (Atriplex) composed 5.3 per cent of the total weight and occurred 13 times. Although its occurrence was high, the greatest amount found in any one stomach was 33.3

TABLE V

Average per cent by Volume and by Weight of each food as it occurred in aggregate sample.

	<u>Wt.</u>	<u>Vol.</u>
Sage (Artemisia)	52.5	51.7
Snowberry (Symphoricarpos)	63.7	61.4
Saltbush (Atriplex)	17.7	14.6
Greasewood (Sarcobatus)	40.5	44.4
Cutierrezia & Chrysothamnus	55.3	54.4
Rose (Rosa)	12.5	11.2
Cactus (Opuntia)	25.5	32.0
Grass	13.6	14.8
Forbs	10.2	11.2
Alfalfa	33.5	33.5

per cent. Its average in the 13 occurrences was 17.7 per cent. Saltbrush isn't very abundant in the Carter County area in comparison to sage. The tips of the twigs were utilized most. However, parts of the main branches were present.

Greasewood (Sarcobatus) had a total average of 4.6 per cent which is slightly lower than saltbrush. (Table VI) It was found in 5 samples and had an average weight of 40.5 per cent in these 5 samples. This is considerably higher than that found in saltsage. In one sample greasewood made up 86.2 per cent of the weight. When available, it was readily consumed by the antelope. The stems were eaten mostly with very few leaves present in any of the samples.

Due to the extreme similarity of the leaves of Gutierrezia and Chrysothamnus, I have placed these two genera together to avoid error of classification. Their flower parts can easily be separated but not their leaves. Gutierrezia is more common than Chrysothamnus in Carter County but this would not indicate food preference in case of the antelope. These two genera made up 8.9 per cent of the total weight which is about the same as saltbrush and greasewood combined. They were found present in 11 samples, making up 35.3 per cent of their average. They are an important browse plant as they

made up 83.4 per cent of one sample. They were about equal to that of greasewood. Twigs, leaves and stems were eaten.

Rose (Rosa) was the least utilized browse plant found present. It made up only 0.9 per cent of the total weight and occurred only 3 times. In the 3 samples it had an average of 12.5 per cent and was 25 per cent of the composition in one particular case. Leaves were mostly eaten but twigs and spiny stems were also found. The spines or stickers evidently were of no harm to the antelope's mouth nor were there any signs of sores on the stomach walls.

Cactus (Opuntia) was second to sage in occurrence. It was found in 16 samples and made up 9.6 per cent of the total weight of all foods. Cactus averaged 25.5 per cent in the 16 samples indicating the inclination for antelope to desire it. In one case it composed 84.0 per cent of the sample. Cactus is quite prevalent on the open range and may be one way antelope obtain water as the plant is very succulent. The entire plant is eaten but the seed pods were found most commonly. Many of the samples contained long cactus spines. Evidently the spines are of no detriment to the mouth, throat or stomach. The cactus was utilized most in Musselshell County.

Grass was fifth in weight of foods taken and had an average of 7.4 per cent. It was second in occurrence, being

found in 25 of the 45 samples. In the 25 samples it averaged 13.6 per cent which was eighth in position of the ten plants classified. I was unable to determine the species of grass utilized because the leaves and stems were all that were found. The three grasses common to the area are Agropyron, Boutelua and Bromus with local areas of Foa.

Forbs were identified by the structure of the stems and leaves and were separated from alfalfa because of the economic importance of alfalfa in the antelope-livestock conflict. Forbs were very low, making up only 2.3 of the total weight. They occurred 9 times and had an average percentage of 10.2 in the 9 samples. The greatest amount in any one sample was 43.7 per cent. The forbs most common were knotweed, wild wheat, lambs quarter, thistle, ragweed and dock. Similar plants were reported by Couey (1946).

In the Carter County area alfalfa made up 4.4 per cent of the total food weight. (Table VII) This is nearly equal to some of the browse plants. It was found in 7 samples which isn't very serious from the livestock point of view. However, alfalfa composed 95.6 per cent of the weight in one sample. The average for the 7 samples was 33.5 per cent. (Table V)

Considering the availability of alfalfa to other plants, it cannot be said that antelope are giving very much

TABLE VII

Average per cent of all foods eaten by Antelope, 1946

	<u>Wt.</u>	<u>Vol.</u>
Sage (Artemisia)	39.7	39.0
Snowberry (Symphoricarpos)	16.9	16.6
Saltbush (Atriplex)	5.3	4.4
Greasewood (Sarcobatus)	4.6	4.2
Cutierrezia & Chrysothamnus	8.9	8.9
Rose (Rosa)	0.9	0.9
Cactus (Opuntia)	9.6	11.7
Grass	7.4	7.4
Forbs	2.3	2.5
Alfalfa	4.4	4.4

TABLE VIII

Largest amount of each food found in any one case

	<u>Wt.</u>	<u>Vol.</u>
Sage (Artemisia)	100. ██████████	100. ██████████
Snowberry (Symphoricarpos)	97.0 ██████████	94.6 ██████████
Saltbush (Atriplex)	33.3 ████████	31.5 ████████
Greasewood (Sarcobatus)	86.2 ██████████	90.0 ██████████
Gutierrezia & Chrysothamnus	83.4 ██████████	85.7 ██████████
Rose (Rosa)	26.0 ████████	16.6 ████████
Cactus (Opuntia)	84.0 ██████████	87.0 ██████████
Grass	41.0 ████████	42.3 ████████
Forbs	43.7 ████████	44.4 ████████
Alfalfa	95.6 ██████████	98.0 ██████████

TABLE IX

Per cent by weight of plants eaten by Antelope in Carter County, 1946

Sample No.	1	2	3	4	5	6	7	8	9	10	11
Sage (Artemisia)	28.3		45.1		38.4	86.1	97.0	73.1		72.3	1.4
Snowberry (Symphoricarpos)	62.3										
Saltbush (Atriplex)	9.4	18.5		21.6							1.0
Greasewood (Sarcobatus)											
Gutierrezia & Chrysothamnus		57.6	23.5	54.1	38.4						
Rose (Rosa)									25.0		
Cactus (Opuntia)				18.8	23.1		1.0			27.7	
Grass		23.8	30.7	5.4		2.6	1.0	17.0	31.2		1.0
Forbs						1.3		10.9	43.7		
Alfalfa							1.0				95.6

TABLE X

Per cent by weight of plants eaten by Antelope in Carter County, 1946

Sample No.	12	13	14	15	16	17	18	19	20	21	22
Sage (<i>Artemisia</i>)			4.4	100.	40.0	12.0	77.7	4.0	18.1	90.0	95.0
Snowberry (<i>Symphoricarpos</i>)			73.3		57.0	63.0					
Saltbush (<i>Atriplex</i>)	10.3	7.5	15.5						18.1		
Greasewood (<i>Sarcobatus</i>)	66.2	75.0									
Gutierrezia & <i>Chrysothamnus</i>								60.0	35.6		
Rose (<i>Rosa</i>)	3.4										
Cactus (<i>Opuntia</i>)										6.0	5.0
Grass		5.8	6.6				22.3		27.5	1.0	
Forbs		11.6				5.0				3.0	
Alfalfa					3.0						

TABLE XI

Per cent by weight of plants eaten by Antelope in Carter County, 1946

Sample No.	23	24	25	26	27	28	29	30	31	32	33
Sage (Artemisia)		18.2	9.0	14.8		35.4	5.0		16.8	33.0	
Snowberry (Symphoricarpos)	77.4	72.7	45.4	43.1			90.0	97.0	41.5		16.6
Saltbush (Atriplex)	22.6		27.0	33.3							
Greasewood (Sarcobatus)											
Gutierrezia & Chrysothamnus		9.1			14.2					7.0	83.4
Rose (Rosa)			9.0								
Cactus (Opuntia)					40.8	47.0					
Grass				3.9	8.1	5.3				41.0	
Forbs			9.0			11.8	5.0				
Alfalfa					36.7			3.0	41.6	19.0	

1
63
1

TABLE XII

Per cent by volume of plants eaten by Antelope in Carter County, 1946

Sample No.	1	2	3	4	5	6	7	8	9	10	11
Sage (Artemisia)	39.0		50.0		38.8	77.0	96.0	80.8		74.6	1.0
Snowberry (Symphoricarpos)	53.6										
Saltbush (Atriplex)	7.3	18.2		35.8							0.5
Greasewood (Sarcobatus)											
Gutierrezia & Chrysothamnus		54.4	16.6	8.9	26.3						
Rose (Rosa)									16.6		
Cactus (Opuntia)				44.6	38.8		1.5			25.3	
Grass		27.5	33.3	10.7		15.3	1.0	14.1	38.8		0.5
Forbs						7.7		5.6	44.4		
Alfalfa							1.5				98.0

TABLE XIII

Per cent by volume of plants eaten by Antelope in Carter County, 1946

Sample No.	12	13	14	15	16	17	18	19	20	21	22
Sage (Artemisia)			12.3	100.	38.0	11.0	83.3	38.0	17.0	83.0	87.0
Snowberry (Symphoricarpos)			73.7		55.0	78.0					
Saltbush (Atriplex)	6.4	13.3	1.6						17.0		
Greasewood (Sarcobatus)	90.0	77.0									
Gutierrezia & Chrysothamnus								62.0	40.5		
Rose (Rosa)	3.6										
Cactus (Opuntia)										12.0	13.0
Grass		4.8	12.3				16.7		25.5	1.0	
Forbs		4.9				11.0				4.1	
Alfalfa					7.0						

TABLE XIV

Per cent by volume of plants eaten by Antelope in Carter County, 1946

Sample No.	23	24	25	26	27	28	29	30	31	32	33
Sage (Artemisia)		20.0	4.0	15.7		31.8	7.0		14.6	28.0	
Snowberry (Symphoricarpos)	78.2	70.0	40.0	47.4			89.0	94.6	42.7		14.3
Saltbush (Atriplex)	21.8		26.6	31.5							
Greasewood (Sarcobatus)											
Gutierrezia & Chrysothamnus		10.0			16.1					6.4	85.7
Rose (Rosa)			13.3								
Cactus (Opuntia)					48.3	33.2					
Grass				5.2	3.2	4.2				42.2	
Forbs			16.0			10.6	4.0				
Alfalfa					32.2			5.4	42.7	23.4	

TABLE XV

Per cent by weight of plants eaten by Antelope in three other counties, 1946

County	Broadwater			Park			Musselshell						
	1	2		1	2	3	1	2	3	4	5	6	7
Sample No.													
Sage (Artemisia)		57.1		77.7	65.0	61.8		56.3	63.4	95.2	46.0	74.0	66.0
Saltbush (Atriplex)							16.0				10.0		
Greasewood (Sarcobatus)				7.0	25.0	9.1							
Gutierrezia & Chrysothamnus	60.0												
Cactus (Opuntia)	23.6	7.2					64.0	31.2		2.4	44.0	26.0	14.0
Grass	10.7	35.7		14.8	10.0	9.1		12.5	16.6	2.4			

Per cent by volume of plants eaten by Antelope in three other counties, 1946

County	Broadwater			Park			Musselshell						
	1	2		1	2	3	1	2	3	4	5	6	7
Sample No.													
Sage (Artemisia)		50.1		75.0	52.6	61.0		40.4	71.5	90.0	42.9	70.0	60.0
Saltbush (Atriplex)							13.0				7.0		
Greasewood (Sarcobatus)				10.0	36.9	8.2							
Gutierrezia & Chrysothamnus	57.6												
Cactus (Opuntia)	37.7	13.5					67.0	54.5		7.0	50.0	30.0	20.0
Grass	4.7	37.4		15.0	10.5	10.8		5.0	23.5	3.0			

competition to the livestock. It must be kept in mind that the majority of the food samples analyzed were taken in the fall of the year. More samples during other seasons of the year are needed to provide more reliable data for comparison. The time of day the antelope were killed would also tend to change the picture of their food habits. Observations in Broadwater County showed the antelope to do light pawing in the effort to obtain the green leaves of Artemisia frigida.

Gross Anatomy

In the antelope the heart is of average size for the size of the animal in comparison with other wild animals. The lungs are somewhat small for the size and endurance the antelope possesses. One would expect it to have a large lung capacity when we think of its great speed and endurance.

Plate VI shows the abdominal muscle removed and the viscera held in place by the gastrohepatic omentum. The paunch and intestinal tract has the same position and proportions as those found in the sheep and goats. Removing the gastrohepatic omentum and pulling the stomach to one side, the small intestines are seen held by the great mesentery (Plate VII). This mesentery is quite transparent and delicate. In most ruminants it possesses a great deal of fat.



Plate VI Note the size and position of the stomach.

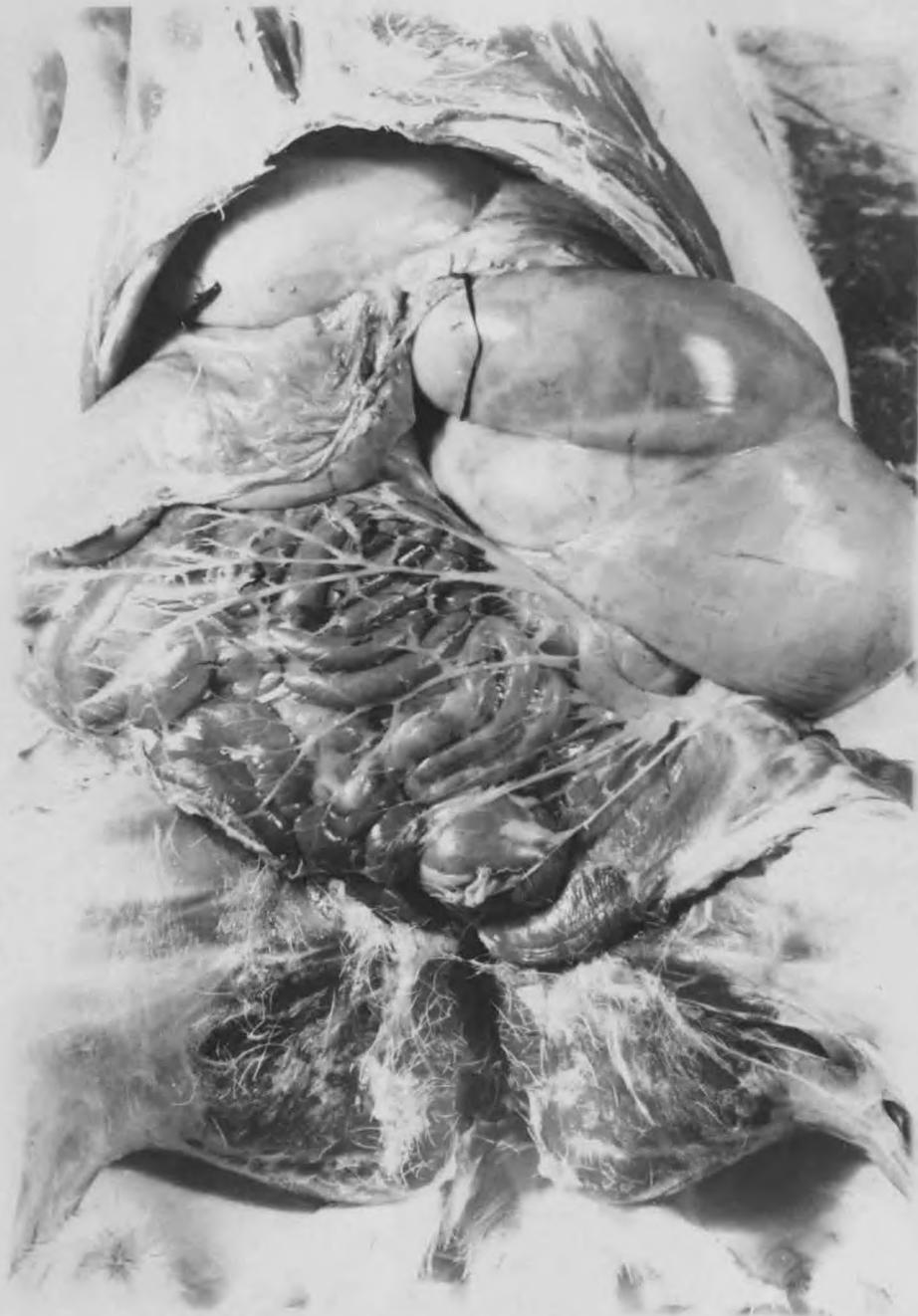


Plate VII The small intestines are held in place by the great mesentery.

The spleen is broad, flattened and semilunar in most ruminants. It lies flat on the rumen. In the antelope it is considerably broader than that of a cow. It is similar in size to that of a sheep (Plate VIII-A).

The antelope is similar to other ruminants in that it possesses a four chambered stomach and chews its food twice. The first of the series is the rumen or the first stomach into which the oesophagus opens (Plate VIII). It constitutes about nine-tenths of the total mass. The other three, the reticulum, omasum and abomasum, form a short chain and are continuous with the small intestine.

Food enters the rumen by way of the oesophagus (Plate VIII-B). Here the food is stored until time for rechewing. The internal surface is similar to that of domestic animals.

The second cavity or reticulum is less distinctly separated from the rumen than usual. It participates in the same functions as the rumen, to which it is only a kind of diverticulum. It is particularly with regard to liquids that it plays the part of a reservoir while the rumen stores the solid particles. The reticulum is often referred to as the water bag. Its interior surface is divided by ridges of mucous membrane into polyhedral cells which gives it the appearance of honeycomb covered with minute blunt papillae.

Foreign bodies swallowed by Ruminants are usually lodged in the reticulum (Plate VIII-C). The reticulum also possesses an oesophageal groove which leads from the oesophagus orifice in the rumen to the fourth cavity or abomasum. The function is similar to that of a sheep.

The junction (Plate VIII-D) between the omasum and reticulum is quite constricted, allowing only the well chewed food particles to enter. The omasum (Plate VIII-E) is smaller than the reticulum and characterized by its many leaves of mucous membrane which follow the full length of the cavity. Their sides are covered by very hard papillae.

The abomasum or fourth cavity (Plate VIII-F) is joined with the omasum by a thick walled, constricted orifice at one end and a similar orifice at the other end in connection with the small intestine. The abomasum has the usual structure of the true digestive stomach. It is smooth to touch and provided with numerous glands for the secretion of the gastric juice. It has numerous lamellar folds.

The small intestine of the antelope floats from a broad mesentery in the abdominal cavity. It is folded into a multitude of festoons at its anterior and becomes larger and separate at its posterior end (Plate IX). The small intestine joins the large intestine where a large caecum

is attached (Plate X). The small intestine is about twenty-five feet in length.

The caecum is roughly eighteen inches in length and four inches in diameter, which is large for the size of the animal. It serves the same purpose as the large intestine in food absorption.

Reproductive system of the male antelope

In the male the testes are suspended in the scrotal sac by the spermatic cord (Plate XI). The spermatozoa are developed in the testes and travel by the epididymis and vas deferens to the vesiculae seminales where they may be stored. The testes are very small compared to those of a sheep. The average length of the eight adults was 5 centimeters and a width of 3 centimeters. These were taken during the rutting season.

The prostatic glands in the antelope are two symmetrical, globular glands located across the neck of the bladder and joined on the base of the vesiculae seminales by means of the ejaculatory duct (Plate XI). They are similar to those found in the goat. There is a similar set of glands, called Cowper's glands, further down the urethra and at the base of the bulb of the urethra. These are granular in construction. On most animals these glands are nodular and enclosed in strong muscle tissue.

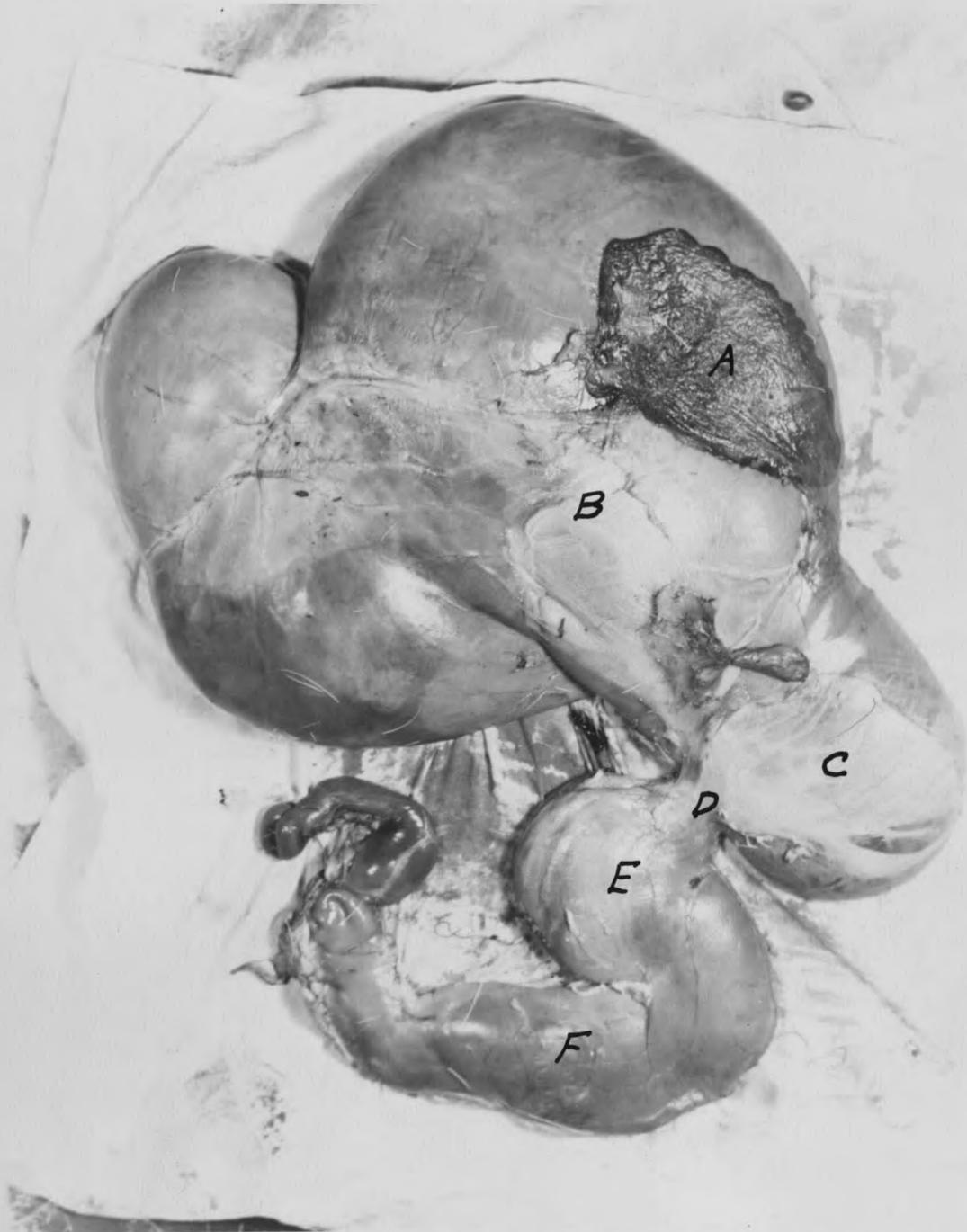


Plate VIII Note the spleen and the four-chambered stomach.

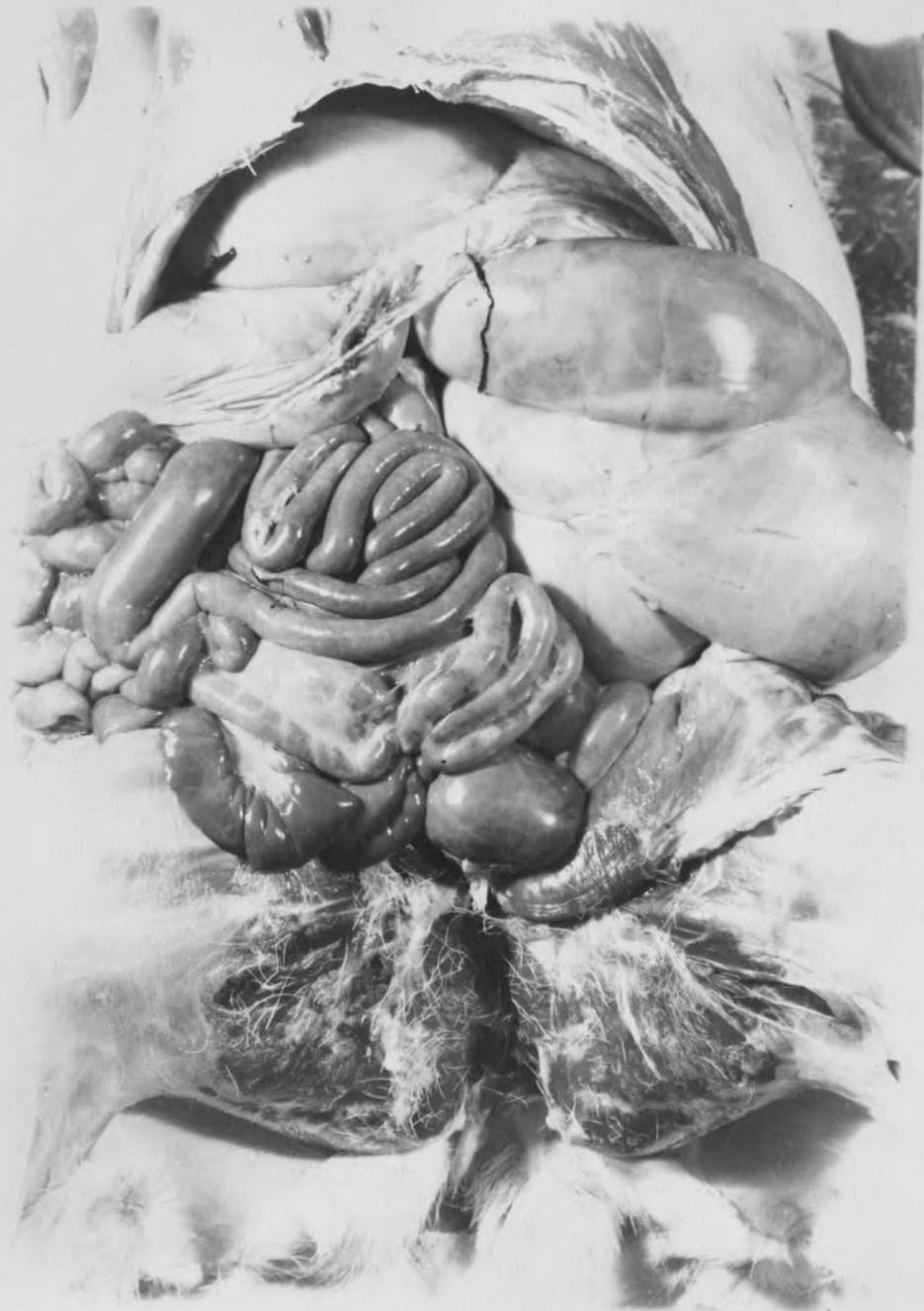


Plate IX Intestines of the abdominal cavity.



Plate X Junction of the small and large intestines. Note the large caecum.

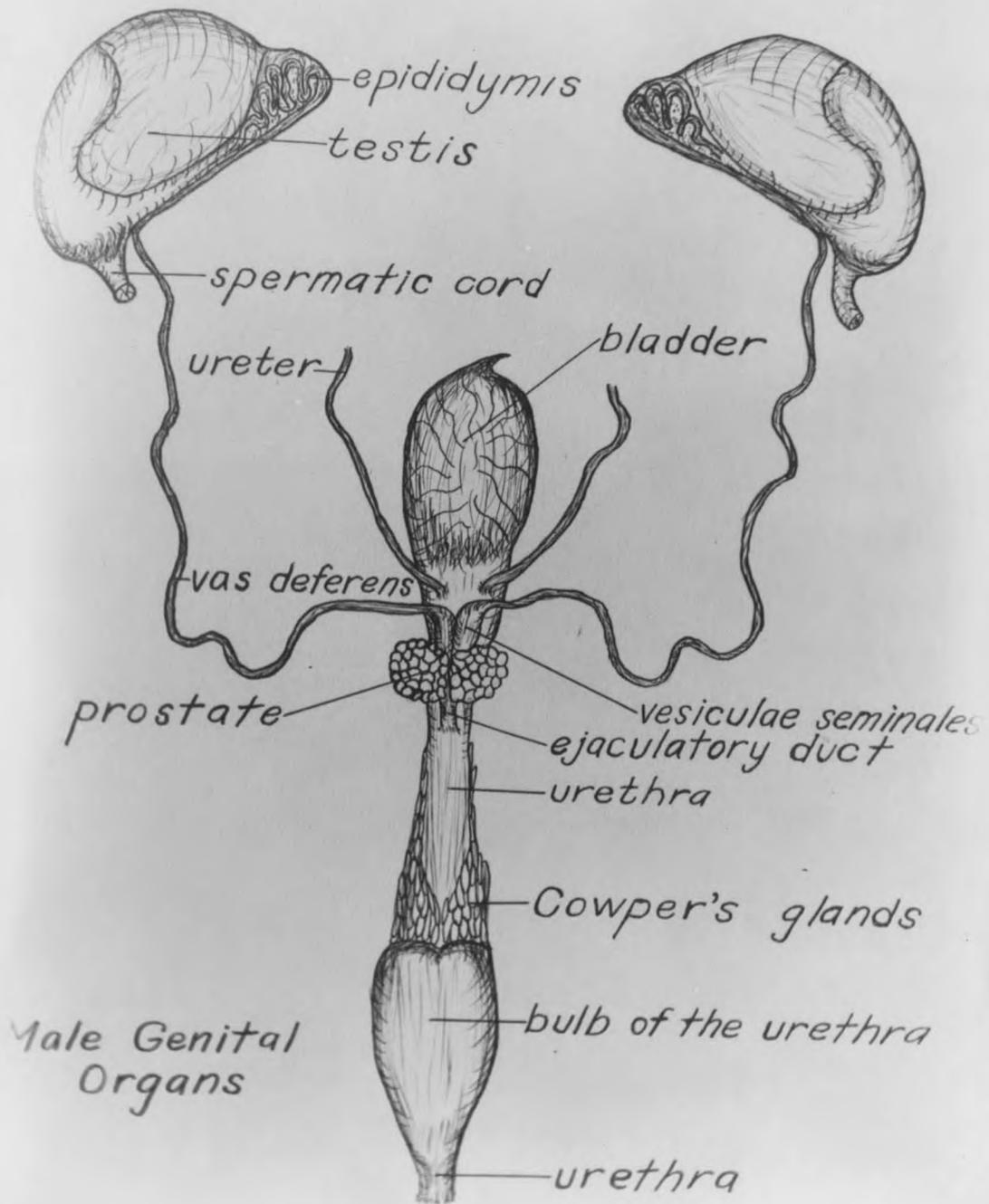
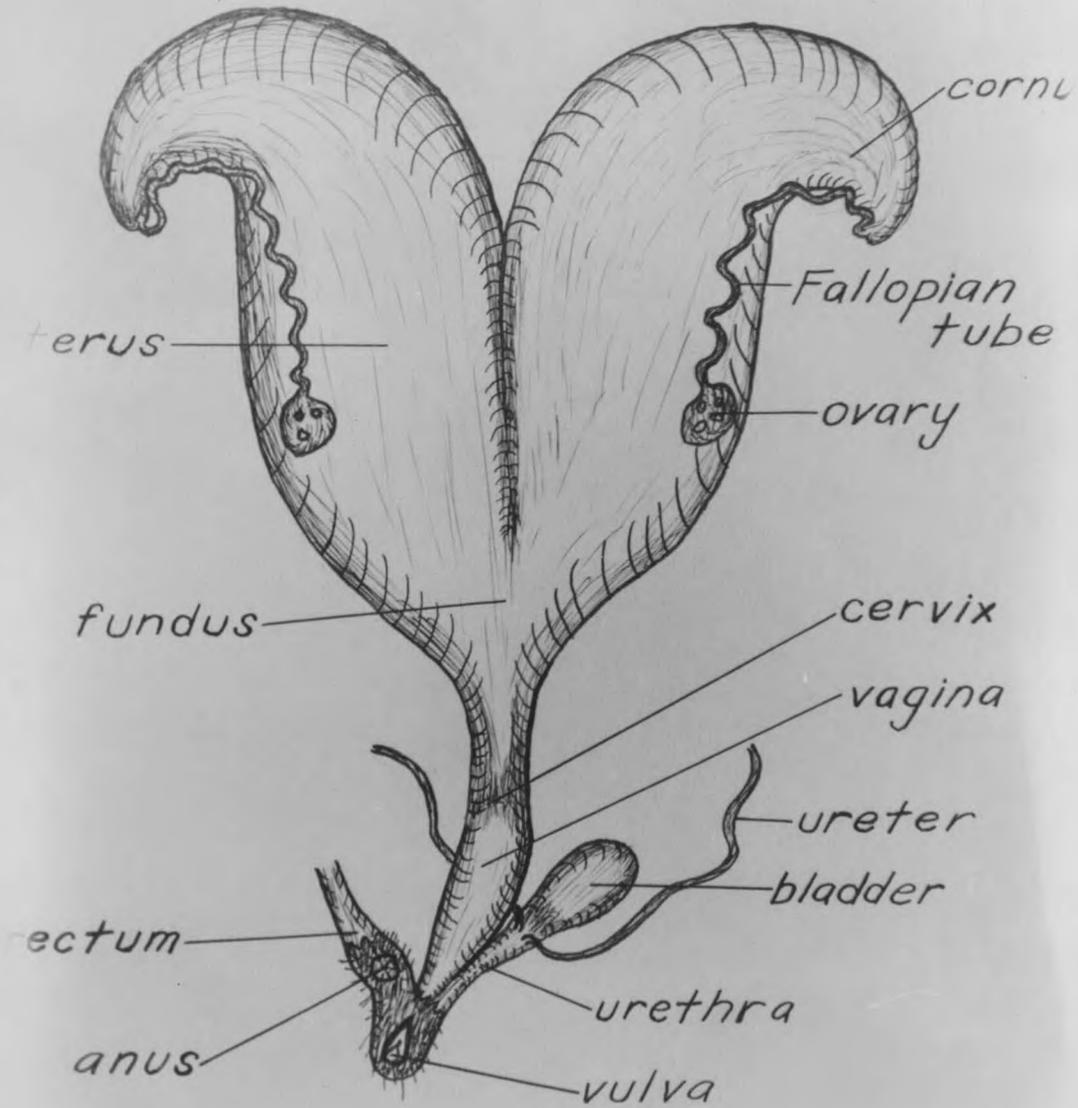


Plate XI

Reproductive organs of the female

In the female antelope as in the deer, the ovary is attached to the face of the uterus midway between the cervix and the cornua. The ovaries are small, about 15 mm in diameter. The egg is carried from the ovary to the uterus by means of the fallopian tube (Plates XII and XIII). The two horns of the uterus are connected for half their length from the cervix upward. The cornua in the goat and sheep are relatively longer. The cervix of the uterus leads to the vagina which in turn is continuous with the vulva (Plate XIV). The placenta is of the cotyledonous type which is found in all Ruminants. The cotyledons are relatively smaller and more oblong than in a cow. There are about eighty cotyledons developed from the chorion of the cow while only about sixty develop in the antelope. They are arranged in two rows about the placenta. This is similar to that of a sheep. The placenta is non-deciduate. In Plate XV is shown the separation of the uterine wall from the chorion in one horn of the uterus. Plate XVI shows the entire chorion and embryos removed from both uteri. It has been noted that the fetal membranes between the embryos were fused. According to Hamlett and Wislocki (1934) this is common in fraternal twins in cattle and may be the case in antelope. It is also well known in sheep where the twins



Female Genital Organs

Plate XII



Plate XIII Female reproductive organs and rectum.

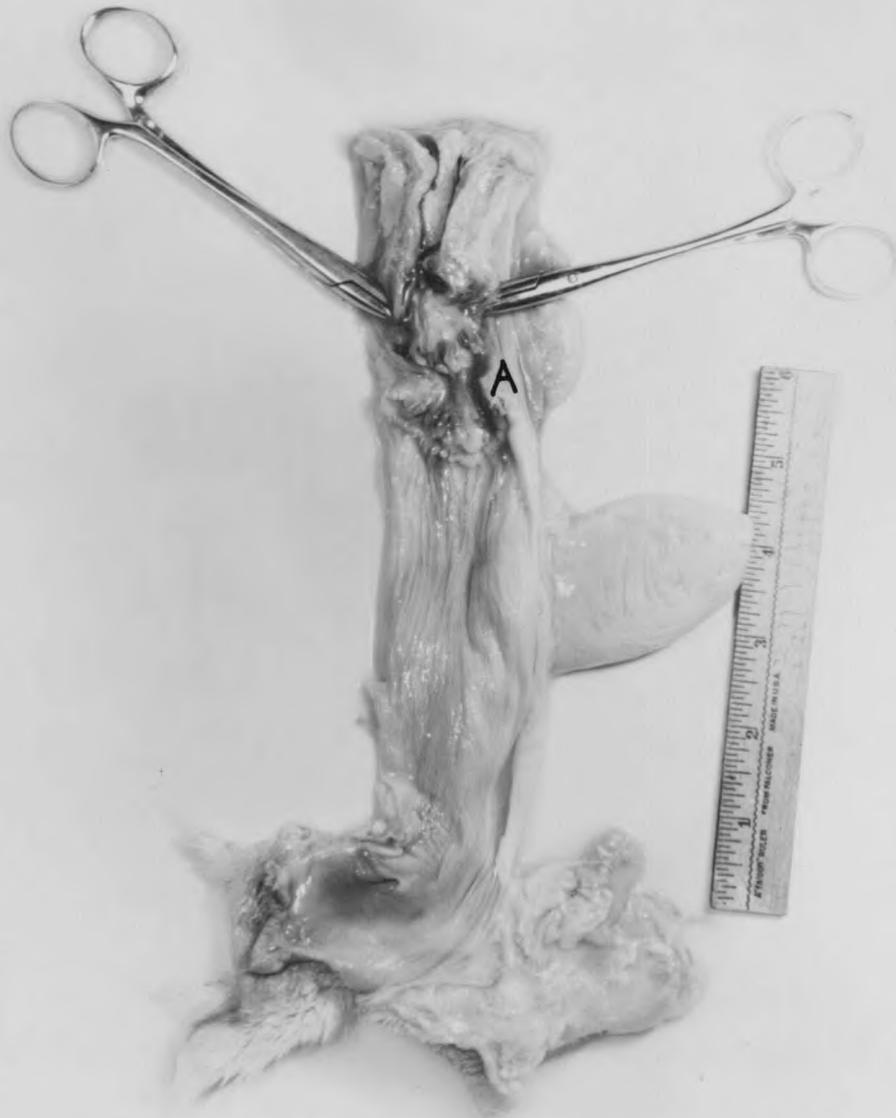


Plate XIV Note the strong cervix muscle (Point A) between the uterus and vagina.



Plate XV Separation of the uterine wall and chorion.



Plate XVI Embryonic sac with embryos.

are fraternal. The fused portion has a wall that separates the amnionic fluid of the two embryos. In Plate XVII we have the uterine wall cut open to show the position of the embryo in the sac. Also is shown the rest of the reproductive system in relation to the rectum and urinary bladder.

Plates XVIII through XXIII show the relative sizes and development of six sets of embryos obtained at various dates. Table XIV gives the sex and measurements of the six sets of embryos. As the embryos did not all come from the same county and were collected by more than one person, only approximate ages can be given, based on the approximate rutting season for the area. However, we can make comparisons between the different sizes and their development.

Antelope normally have twins. This is upheld by field observations of young as well as dissection. However, there have been reports from Montana Fish and Game Department stating that singles were found in the younger does. In the small Roe deer, which usually bring forth twins, it has been found that sometimes both embryos come from one ovary but more often one from each ovary. This gives rise to the possibility of the development of identical twins.

In the six specimens examined the twins were always of the same sex. This is suggestive of identical twins but,



Plate XVII Position of embryo in uterus.



1-A



1-B

Plate XVIII Embryos at approximately 50 days.



2-A



2-B

Plate XIX Embryos at approximately 70 days.



Plate XX Embryos at approximately 80 days.



Plate XXI Embryos at approximately 110 days.



5-A

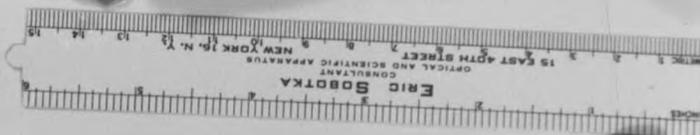


5-B

Plate XXII Embryos at approximately 120 days.



6-A



6-B

67

Plate XXIII Embryos at approximately 150 days.

of course, not proof. Identical twins must develop from the same ovum. Where there are two functional ovaries present, the possibility of identical twins is rare. However, there is always that possibility.

H. H. Newman (1917) states that size is not a reliable indication of identical twins due to the possible unbalanced food absorption in the uterus. However, I find that in the six sets of embryos examined the leg length and ear length were identical in all cases (Table XIV). In 6-A and 6-B they both possessed a papillary structure on the side of each jaw in identical places.

Another fact observed is the early development of the external features of the antelope. In all cases the stages of development were the same in both. The youngest embryos obtained were approximately fifty days old. All external features were developed even to fine hair on the lip.

In the two sets of male embryos the development was as rapid as the female sets. This is shown both in weight and size in Table XIV.

Due to the small number of embryos, the above statements may be varied upon further examinations of other embryos.

TABLE XIV

Measurements of Antelope embryos obtained from Montana

No.	Approx. Age	Sex	Wt. In Gr.	T.L.	S.H.	Leg L.	Ear L.
1-A	50	Female	36.5	10.0	5.5	2.5	0.4
1-B		Female	36.7	11.5	5.5	2.5	0.4
2-A	70	Female	55.0	12.0	7.0	3.0	0.7
2-B		Female	57.8	11.5	7.0	3.0	0.7
3-A	80	Male	60.5	11.5	6.5	3.0	0.7
3-B		Male	53.0	12.0	7.0	3.0	0.7
4-A	110	Female	158.0	15.0	10.0	4.0	1.3
4-B		Female	153.0	15.0	9.5	4.5	1.3
5-A	120	Male	160.0	15.7	8.5	4.2	1.1
5-B		Male	133.0	15.7	8.5	4.2	1.1
6-A	150	Female	268.5	20.0	11.5	6.0	1.7
6-B		Female	260.0	20.0	12.5	6.0	1.7

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