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COMPOSITION OF THE BOVINE AT BIRTH

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Composition of the Bovine at Birth[1]

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The data used in this bulletin were collected under the direction of P. F. Trowbridge during the progress of the "Use of Food" investigations of the Missouri Agricultural Experiment Station under the Adams Act. For a number of the Jersey calves the Department of Agricultural Chemistry is indebted to the Department of Dairy Husbandry. The Hereford calves were obtained from the Department of Animal Husbandry from beef cows used in a breeding experiment, sub-project of the "Use of Food" experiment.

The bulletin has been prepared for publication by L. D. Haigh in collaboration with other authors.

This report covering the composition of the bovine animal at birth is logically the first of a series of reports to be presented covering the composition of the beef animal at all stages of life and degrees of thrift. These data were obtained from time to time during the progress of the "Use of Food" experiment at this Experiment Station. The report includes the composition of the fetus, obtained before birth, from each of three Jersey dams, and of four Jersey and thirteen Hereford calves slaughtered soon after birth.

DESCRIPTION OF ANIMALS USED

A. THE JERSEY COWS AND THEIR CALVES

Cow 43 at a little more than six years of age was put upon a maintenance ration. During this time the cow was dry. This maintenance period of feeding was continued for approximately five months after which the ration was changed to a full feed. This was a fattening ration consisting of corn chop, eight parts; linseed meal, one part; and four-tenths as much alfalfa hay as grain. At the time of slaughtering the full feeding had continued for 160 days and the animal was in a fat condition. The cow was seven years and one month old when slaughtered. She was bred April 2, 1909, about 25 days before the full feeding began and was slaughtered October 4, 1909. The fetus was therefore 185 days old. It was well formed and to all appearances normal, and weighed 14.48 pounds. It was ground to make one composite sample for analysis.

[1]For preliminary report, see Proceedings of annual meeting. Amer. Soc. Animal Production, Nov. 1914, p. 100.

[2]Resigned September, 1918.

Cow 13 was in milk during the gestation period in question and was being fed the usual dairy ration for milk production. She was considered a very fat cow for the breed. She was bred May 20, 1913, and was slaughtered January 7, 1914, at which time she was five years and two months old. The fetus from this cow, which was therefore 232 days old, weighed 30.81 pounds. It was analyzed as a composite sample with the exception of the contents of the intestines or excreta, which were handled separately.

Cow 2, bred June 20, 1912, was slaughtered March 26, 1913. Beginning in May 1912, she was fed the usual dairy ration for milk production and at the time of slaughtering was in better condition of flesh than the average cow at this stage of pregnancy. This fetus was about a full term calf, having been carried 279 days. The operation of slaughtering was delayed as long as it seemed safe to do so and still be able to obtain all the fluids and other parts without loss. This calf fetus was normally developed and weighed a little over sixty-nine pounds. It was analyzed as a composite sample without any separation into parts.

Jersey Cow 11 (Missouri St. Lambert) furnished consecutively two calves at birth for this experiment, both of which were born dead. This cow was a little over eleven years old at the time of birth of the first calf, No. 11A. She had previously suffered from prolapsus which may have had something to do with the calves being still-born. She was used as a family cow and was fed a usual ration for milk production during both of these gestation periods. The first calf, No. 11A, was ground to make one composite sample. The second calf, No. 11B, was divided into a number of samples as indicated in the tables. Since the calf was dead before being handled it was not possible to obtain a complete sample of the blood, but the sample obtained was mingled with other body liquids and serum. In addition to the separate samples, a sample representing the entire calf was obtained by mixing together aliquots of the separated and weighed parts and passing the mixture thru a meat grinder a few times to insure a uniform mixture.

Cow 22 was three years and three months old at the time of the birth of the bull calf analyzed. At this time she was still immature and growing steadily. She was in milk during the twelve months preceding and was being fed as good a ration as possible for growth and milk production. The calf in question was dropped June 15, 1912, and weighed 57 pounds. This calf was weaker than the average calf altho able to stand. It was slaughtered June 20, 1912, at which time it weighed 52.2 pounds. This animal

was divided into six samples for analysis, as indicated in the tables.

Heifer 85 was used in an experiment to determine the effect of a deficiency of mineral in the feed. At six months of age she was put upon a ration of silage and grain. The latter consisted of gluten meal, three parts; and corn, two parts. When silage was not available timothy hay was fed in its place. While sufficient for growth and energy this ration was deficient in calcium, supplying approximately about ten grams a day. Up to the twelfth month on this ration body weight and growth in skeleton appeared to be normal; after this, however, symptoms of distress, such as stiffness of the joints, became apparent, probably due to the low calcium supply. One month after the first appearance of the symptoms the animal was practically unable to stand. The feed was changed to alfalfa hay with calcium carbonate and bone meal fed in addition. This change in feed was made about January 1, 1914. She recovered slowly up to the time of calving four months later when she was in a fair condition. The calf from Heifer 85 was born May 2, 1914, and weighed 30 pounds at birth. This calf was abnormal, the lower jaw was undeveloped, there were no eyes, and hair was growing from the eye sockets. Twelve hours after birth it was slaughtered. The whole animal exclusive of the blood was composited into one sample for analysis. The blood was analyzed as a separate sample.

To summarize, the weights of these embryonic and full-term calves are indicated in Table 1.

TABLE 1.—WEIGHTS OF JERSEY CALVES AS OBTAINED FOR THIS EXPERIMENT

Description	Pounds	Grams
Fetus of Cow 43 (185 days) 43X	14.48	6,568
Fetus of Cow 13 (232 days) 13X	30.81	13,975
Fetus (full term) of Cow 2 (279 days) 2X	69.81	31,665
Calf of Cow 11 (stillborn) 11A	56.00	24,040
Calf of Cow 11 (still born) 11B	70.40	31,933
Calf of Cow 22 (5 days old) 22A	52.20	23,677
Calf of Heifer 85 (abnormal) 85A	30.00	13,608

B. THE HEREFORD COWS AND THEIR CALVES

The dams of the pure-bred Hereford calves discussed in this report were kept on three different planes of nutrition, as follows: Heifers 560, 561, and 562 were kept on a high plane of nutrition; heifers 563, 564 and 565, on a medium plane of nutrition; and heifers 566, 567 and 568, on a low plane of nutrition. All of the animals were fed a grain ration of six parts of corn, three parts of

bran, and one of linseed, with roughage consisting of three parts of alfalfa hay and two parts of oat straw. The animals on the high plane of nutrition were allowed to eat enough of this ration to fatten as well as to make thrifty growth; those on the medium plane, enough to make thrifty growth without getting fat; and those on the low plane were fed scantily in order to keep them in the condition of cattle on a Southwest range under arid conditions. The feeding was so adjusted that the animals were eating all of the roughage they desired and the condition was regulated by the amount of grain fed. By this arrangement the heifers on the high plane of nutrition on the average received two parts of grain to one of roughage; those on the medium plane, one-third to one-fourth as much grain as roughage; while those on the low plane received roughage alone most of the time with occasionally a little grain. The feeding of these Hereford heifers began in August, 1912.

All of these heifers were bred after they had become established upon their respective planes of nutrition. Under the condition of scanty feeding to which the low-plane heifers were subjected these failed to come into heat promptly. The plane of feeding was therefore raised for a time so that the animals came in heat. After breeding the plane of feeding was again dropped to the original level.

The calves produced by these heifers on the three planes of nutrition were slaughtered soon after birth and analyzed. It was hoped that the data thus obtained would indicate whether the different planes of nutrition of the mother heifer had any effect upon the composition of the calf at birth, and, if so, how much.

Heifer 561 died at the time of the first calving, and this calf was not analyzed.

The calves have been given the same number as the heifer dam with an accompanying letter, A, B, etc., corresponding to the first, second, etc., calf dropped by the heifer since the beginning of the experiment.

Heifer 560 was found to have been bred before the opening of the experiment. The calf designated as 560A was dropped in November, 1912, but was not analyzed. The heifer was immediately dried up and continued in the experiment.

In handling the new-born Hereford calves it was the intention to slaughter them before they received any food from the mother. This was accomplished, with one exception, namely in case of Calf 565B.

All of these Hereford calves reported upon in this bulletin appeared to be normal in development. The calves from the heifers on the high plane of nutrition had smoother appearance according to the animal-husbandry judges. The calves from the heifers on the medium plane of nutrition appeared to be as vigorous, on the average, as calves usually are at birth. Calf 568B, the lightest of all, from the low-plane group, while normally developed, was the weakest of all the calves. This calf did not stand upon its feet before slaughtering. On the other hand, Calf 566B, also from the low-plane group, was practically as heavy as any calf obtained in this experiment, and Calf 567B of average weight and vigor appeared to have about as much internal and carcass fat as any of the calves from the better fed groups.

The mesentery from Calf 565A was covered with fat sufficient only to make it opaque.

The analysis of the excreta of Calf 565B was not made, as milk was found in the stomach of this calf.

Table 2 gives the list of Hereford calves analyzed, with their respective live weights at birth.

TABLE 2.—LIVE WEIGHT OF HEREFORD CALVES AT BIRTH

Calf No.	Plane of Feeding	Live Weight	
		Pounds	Grams
560B	High Plane	88.25	40,029
562B	High Plane	82.38	37,364
560D	High Plane	71.75	32,545
562C	High Plane	87.75	39,803
565A	Medium Plane	89.48	40,587
563A	Medium Plane	89.64	40,661
564B	Medium Plane	67.82	30,760
565B	Medium Plane	72.43	32,854
564C	Medium Plane	85.00	38,555
568B	Low Plane	39.00	17,690
567B	Low Plane	63.00	28,576
566B	Low Plane	89.00	40,370
568C	Low Plane	73.80	33,478

METHODS OF SLAUGHTERING AND SAMPLING

All of the calves at birth were slaughtered in from four to ten hours after birth with the exception of the calf of Jersey Cow 22 which was five days old when slaughtered. In the operation of slaughtering the animal was stunned and suspended by the hind legs from a hoist. The throat was then opened up in the usual manner and the animal bled as thoroly as possible, the blood be-

ing caught in a tared container and weighed. A portion of the blood was caught in a beaker and samples for analysis were poured into tared containers which were immediately closed tight, taken to the laboratory and weighed.

After bleeding, the feet were skinned out, removed from the carcass, weighed and placed in a closed container. Also the head and tail, after removal of the hide from these parts, were cut off and weighed. The body was then opened along the ventral line and the internal organs including the kidneys were removed, placed in a tight container and a little later separated from each other and then weighed. The contents of the intestinal tract were removed, weighed, and set aside in a closed container for analysis as excreta. The cleaned intestines were put with the internal organs.

After the removal of the internal organs the carcass of the calf, the hide still on, was allowed to chill out for some hours in a cooler. When completely cold the hide was skinned off carefully to avoid, as far as possible, the removal of sub-dermal tissue with it. After weighing the hide that part from the right half of

TABLE 3.—COMPARISON OF THE LIVE WEIGHT OF DIFFERENT CALVES FROM THE SAME HEIFER, IN POUNDS

	First Calf	Second Calf	Third Calf	Fourth Calf
Heifer 560	*71.50	88.25	*88.00	71.74
Heifer 562	*89.00	82.38	87.75	.....
Heifer 564	*83.00	67.82	85.00	.....
Heifer 565	89.48	72.43	.....	.....
Heifer 566	*72.50	89.00	.....	.....
Heifer 567	*69.50	63.00	.....	.....
Heifer 568	*59.00	39.00	73.80	.....

*From data of Animal Husbandry Department, Mo. Agr. Expt. Sta.

the animal was cut into strips and ground to a uniform sample in a meat chopper. The head was split into right and left halves; the brain was then removed and weighed. The carcass was also split thru the middle of the backbone, the spinal cord was removed and weighed. The brain and spinal cord were then added to the internal organs obtained as above described and all of these ground to a uniform sample for analysis as composite internal organs. The tail was split into right and left halves and the lean and fat flesh were removed as carefully as possible from the right half of the head, tail, and carcass respectively and together with the right kidney fat of the carcass weighed as composite flesh, right half.

The flesh thus obtained was ground to a uniform sample in a meat grinder. The bones thus cleaned from the right half of the head, the tail, and the right half of the body including the right fore and right hind foot constituted the skeleton, right half. This was passed thru a bone grinder to reduce the sample to a fine condition for analysis. The weights recorded in the tables for composite flesh and composite skeleton are for the entire animal obtained by taking twice the weights for the right half.

With a number of the animals, in addition to these samples, three special samples were taken for analysis from the left side

TABLE 4.—WEIGHTS OF SEPARATED PARTS OF NEW BORN JERSEY CALVES, IN GRAMS

Animal No.	11 B.	22A.	85A.[6]
Live weight of animal	31,933.0	23,677.0	13,608
Blood	1,675.0	1,015.8	555
Hair and hide	3,896.0	2,224.0	.....
Composite flesh	12,862.0	8,610.0	.....
Tongue with base	237.0	166.0	.....
Esophagus	.....[1]	20.0	.....
Thymus and thyroid	120.0	57.0	.....
Lungs and trachea	218.0	432.0	.....
Heart	256.0	123.0	.....
Pericardium and arteries	169.0[2]	90.0	.....
Diaphragm	.....	99.0	.....
Stomachs	467.0	333.0	.....
Spleen	124.0	82.0	.....
Liver	581.0[3]	543.0	.....
Gall bladder	.....	1.0	.....
Gall	.....	2.0	.....
Pancreas		21.0	.....
Small intestines		580.0	.....
Large intestines		224.0	.....
Bladder	1,215.0	20.0	.....
Urine		36.0	.....
Penis		55.0	.....
Testicles		9.0	.....
Kidneys	193.0	106.0	.....
Fat of stomach and intestines	168.0	80.0[5]	.....
Brain	257.0	200.0	.....
Spinal cord	81.0	56.0	.....
Total internal organs	4,086.0	3,299.0	.....
Composite skeleton	7,554.0	6,405.6	.....
Excreta	301.0	383.0	.....
Kidney fat	200.0	59.0	.....
Length of small intestine, cms.	1,745.0	1,602.0	.....
Length of large intestine, cms.	.....[4]	223.0	.....

[1]Esophagus weighed with stomach.
[2]Diaphragm weighed with pericardium and arteries.
[3]Includes gall bladder and gall.
[4]Length not recorded.
[5]Mesentery only.
[6]Blood was the only part separated and weighed.

of the carcass in order that some data regarding the composition of these tissues at birth might be secured. These samples were the marrow from the femur, the left kidney fat, and lean flesh of the loin as free as possible from fatty or connective tissues.

The first calf obtained for analysis, 560B, on the high plane of nutrition, was strangled at birth and could not be bled. All of the soft parts—lean and fat flesh of body, internal organs, and the blood—were composited into one sample, the bones, teeth, and hoofs were composited for the second sample; the hair and hide constituted the third sample; and the intestinal contents or excreta, the fourth sample. On this last sample no analysis of the fresh material was made.

Calf 560D was obtained by post mortem operation on the mother, Cow 560. Some days before full term, the cow was taken sick with symptoms of labor pains and general distress. The symptoms were alleviated by the veterinarian but the cow finally died on the day the calf was due. The cause of the trouble was not found. This calf was normal and apparently alive when the mother cow died. It, of course, could not be bled, but the blood remained with the tissues, a part with the flesh, but the larger

TABLE 5.—PERCENTAGE OF LIVE WEIGHT OF SEPARATED PARTS OF NEW-BORN JERSEY CALVES

Animal No.	11B.	22A.	85A.[5]	Average
Live weight of animal	100.00	100.00	100.00	100.00
Blood	5.24	4.29	4.08	4.54
Hair and hide	12.20	9.39	.....	10.80
Composite flesh	40.28	36.36	.....	38.32
Lungs and trachea	0.68	1.82	.....	1.25
Heart	0.80	0.52	.....	0.66
Pericardium and arteries	0.53[1]	0.38	.....	0.46
Diaphragm	.....	.42	.....	.....
Stomachs	1.46	1.41	.....	1.44
Liver	1.82[2]	2.29	.....	.....
Large and small intestine	3.36[3]	3.40	.....	3.38
Kidneys	0.60	0.45	.....	0.53
Fat of stomach and intestines	0.53	0.34[4]	.....	.....
Brain and spinal cord	1.06	1.08	.....	1.07
Total internal organs	12.80	13.94	.....	13.37
Composite skeleton	23.60	27.06	.....	25.33
Excreta	0.94	1.62	.....	1.28
Kidney fat	0.63	0.25	.....	0.44

[1]Diaphragm weighed with pericardium and arteries.
[2]Gall bladder and gall included.
[3]Obtained by calculation.
[4]Messentery only.
[5]Blood was the only part separated and weighed.

part appeared to be in the internal organs. The kidney fat was not added to the flesh as usual, but remained a separate sample.

All the other calves analyzed were divided into six regular and three special samples for analysis, but not all of the special samples were taken in every case.

WEIGHTS AND PROPORTIONS OF PARTS

THE JERSEY CALVES

The weights of the separated parts are shown in Table 4, and the proportions to the total live weight of the animal are shown in Table 5. The weight of the blood varies from approxi-

TABLE 6.—WEIGHTS IN GRAMS OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A HIGH PLANE OF NUTRITION

Animal No.	560B.	562B.	560D.	562C.
Live weight of animal	40,029.0	37,364.0	32,545.0	39,803.0
Blood	90.7[1]	1,746.4	....[3]	1,777.5
Hair and hide	4,590.0	4,620.9	4,130.5	4,323.3
Composite flesh	19,180.0*	15,518.4	13,120.1	16,578.7
Tongue with base	307.0	212.7	238.1	292.0
Esophagus	91.0	56.7	45.4	48.2
Thymus and thyroid glands	135.0	141.8	184.2	192.8
Lungs	779.0[2]*	343.1[2]	910.0	360.0
Heart	343.0[4]	212.6	243.8	212.6
Pericardium and arteries	....[3]	170.1	175.8	167.3
Diaphragm	....[3]	42.5	34.0	25.5
Stomachs	427.0	377.0	377.1	320.3
Spleen	92.0	76.5	113.4	76.5
Liver	902.0	666.2	793.8[5]	788.1
Gall bladder and gall	10.0	14.2	....[3]	19.9
Pancreas	41.0	34.0	34.0	31.2
Small intestines	654.0	691.7	510.3	584.0
Large intestines	227.0	212.6	226.8	283.5
Bladder	73.0	73.7	....[3]	45.4
Urine	155.0	53.8	....[3]	158.7
Penis and testicles	....[3]	51.0	....	....
Uterus, ovaries, tubes, etc.	....	....	133.2[7]	70.9
Serum and body liquids	1,932.0	....[3]	581.2	....[3]
Kidneys	311.0*	102.1	93.6	181.4
Fat of stomach and intestines	....[3]	241.0	178.6	207.0
Brain	218.0	204.1	198.5	207.0
Spinal cord	130.0	73.7	65.2	82.2
Total internal organs	....[6]	4,051.1	5,137.0	4,354.5
Composite skeleton	9,252.0	9,854.2	8,660.7	11,682.8
Excreta	1,019.0	402.6	532.9	782.4
Kidney fat	....[3]	....[3]	218.3	232.5
Length of small intestines, cms.	1,425.0	1,242.0	1,406.0	1,232.0
Length of large intestines, cms.	242.0	228.0	246.0	220.0

*Weight doubtful.
[1]A portion of the blood.
[2]This sample includes the trachea.
[3]Not obtained separately.
[4]Includes the pericardium and arteries.
[5]Includes the gall bladder and gall.
[6]No sum—all parts were not weighed.
[7]Includes the bladder and urine.

mately 4 per cent to 5.2 per cent. A part of this variation may be due to the fact that the blood from the first Jersey calf was not obtained pure but was mixed with water and serum. The hair and hide, wind-pipe and lungs, and heart show a wide variation. The first Jersey calf, 11B, is of average development and weight, while the second calf, 22A, was undersized, underweight and of less vigor. This latter calf, therefore, may be expected to show a lower proportion of flesh and higher proportion of skeleton than the first calf. This accords with the actual results obtained.

TABLE 7.—WEIGHTS IN GRAMS OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A MEDIUM PLANE OF NUTRITION

Animal No.	565A	563A	564B	565B	564C
Live weight of animal	40,587.0	40,661.0	30,760.0	32,854.0	38,555.0
Blood	1,805.3	1,958.6	1,862.0	1,672.6	2,044.0
Hair and hide	4,990.0	5,848.0	3,720.0	4,019.9	4,031.3
Composite flesh	16,556.0	14,906.0	11,032.0	13,016.3	16,034.4
Tongue with base	240.0	349.0	235.0	235.3	255.2
Esophagus	47.0	38.0	.....[3]	28.3	59.5
Thymus and thyroid glands	150.0	100.0	49.0[4]	164.4	147.5
Lungs	534.0[1]	386.0[1]	328.0	269.3	425.2
Heart	233.0	224.0	182.0	170.1	229.6
Pericardium and arteries	222.0	287.0	242.0	136.1	161.6
Diaphragm	62.0	170.0	.....[6]	22.7	36.9
Stomachs	360.0	326.0	356.0	294.8	382.7
Spleen	64.0	58.0	46.0	51.0	70.9
Liver	682.0	642.0	634.0	595.3	686.1
Gall bladder and gall	13.0	12.0	3.0	2.8	22.7
Pancreas	17.0	26.0	23.0	28.4	34.0
Small intestines	732.0	698.0	859.0	635.0	782.4
Large intestines	284.0	216.0	274.0	241.0	255.1
Bladder	48.0	42.0	43.0	22.7	56.7
Urine	33.0[2]	25.0	250.0	76.5	311.8
Penis	65.0	.....	52.0	.....	.....
Testicles	12.0	.....	8.0	.....	.....
Uterus, ovaries, tubes, etc.	.....	236.0	.....	62.4	113.4
Kidneys	110.0	119.0	101.0	93.6	150.2
Fat of stomach and intestines	190.0	122.0	141.0	184.3	189.9
Brain	224.0	235.0	228.0	207.0	235.3
Spinal cord	99.0	61.0	63.0	65.2	85.1
Total internal organs	4,388.0	4,372.0	4,117.0	3,586.2	4,691.8
Composite skeleton	11,156.0	10,804.0	8,054.0	8,708.9	10,636.7
Excreta	709.0[2]	641.0	326.0	479.1	479.1
Kidney fat	.....[5]	120.0	.....[5]	.....[5]	93.6
Length of small intestines cms.	1,323.0	1,387.0	1,612.0	1,504.0	1,776.0
Length of large intestines, cms.	205.0	242.0	202.0	237.0	246.0

[1]This sample includes trachea.
[2]Weight of excreta includes the urine.
[3]Weighed with pericardium and arteries.
[4]Thyroid only. Thymus with pericardium and arteries.
[5]Not weighed separately.
[6]Diaphragm with pericardium and arteries.

THE HEREFORD CALVES

Tables 6, 7, and 8 give the weights of parts, and Tables 9, 10, and 11 give the percentages. The average values from Tables 5, 9, 10, and 11 are grouped together in Table 12 for ready comparison. The weights of the blood obtained from eleven of the thirteen Hereford calves range from 4.34 per cent to 6.05 per cent of the live weight, with an average value of 4.93 per cent. The weights of hair and hide vary irregularly between 10.46 and 14.38 per cent.

The composite flesh varies within wide limits from 29.54 per

TABLE 8.—WEIGHTS IN GRAMS OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A LOW PLANE OF NUTRITION

Animal No.	568B	567B	566B	568C
Live weight of animal	17,690.0	28,576.0	40,370.0	33,478.0
Blood	912.0	1,335.4	2,104.9	1,451.5
Hair and hide	2,477.0	3,415.5	4,856.2	3,657.1
Composite flesh	5,226.0	11,124.3	15,750.9	12,898.9
Tongue with base	144.0	286.3	246.6	297.7
Esophagus	47.0	42.5	53.8	48.2
Thymus and thyroid glands	29.0	110.6	45.4[1]	116.2
Lungs	210.0	249.5	297.7	408.2
Heart	110.0	172.9	232.5	189.9
Pericardium and arteries	102.0	99.2	172.9	121.9
Diaphragm	65.0	48.2	28.3	42.5
Stomachs	208.0	252.3	354.5	374.2
Spleen	27.0	53.9	62.4	56.7
Liver	240.0	504.6	646.4	493.3
Gall bladder and gall	7.0	11.3	17.0	25.5
Pancreas	12.0	.....[2]	34.0	34.0
Small intestines	346.0	516.0	785.3	756.9
Large intestines	125.0	198.4	283.5	266.5
Bladder	21.0	51.0	42.5	90.7[5]
Urine	162.0	73.7[3]	133.2	.....
Penis	52.0	45.4	45.4	.....
Testicles	4.0	14.2	17.0	.....
Uterus, ovaries, tubes, etc.	.....	.....	.....	136.1
Serum and body liquids	.....[4]	.....[4]	17.0	48.2
Kidneys	70.0	79.4	127.6	93.6
Fat of stomach and intestines	182.0	153.1	178.6	170.1
Brain	190.0	221.1	226.8	215.5
Spinal Cord	44.0	73.7	85.0	62.4
Total Internal Organs	2,397.0	3,183.6	4,133.4	4,048.3
Composite skeleton	5,148.0	8,513.3	12,224.3	9,786.2
Excreta	280.0	584.0[3]	280.7	671.9
Kidney fat	72.0	.....[4]	192.8	107.7
Length of small intestines, cms.	1,129.0	1,257.0	1,518.0	1,458.0
Length of large intestines, cms.	179.0	214.0	241.0	212.0

[1]One gland only. The other gland weighed with pericardium.
[2]With fat of intestines.
[3]Weight of excreta includes the urine.
[4]Not weighed separately.
[5]Includes weight of urine.

cent in the smallest calf to 41.59 per cent in one of the large calves. The average value for twelve Hereford calves is 38.67 per cent. The abnormally high percentage of the flesh of Calf 560B may be partly due to the fact that the blood was not drawn but remained in and was weighed with the soft parts. This high percentage,

TABLE 9.—PERCENTAGE OF LIVE WEIGHT OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A HIGH PLANE OF NUTRITION

Animal No.	560B	562B	560D	562C	Average
Live weight of animal	100.00	100.00	100.00	100.00	100.00
Blood	.....[4]	4.68	.....[4]	4.47	4.58
Hair and hide	11.47	12.37	12.69	10.86	11.85
Composite flesh	47.91[1]	41.53	40.31	41.65	41.16
Lungs	1.95[1]	0.92	2.80[1]	0.90	0.91
Heart, pericardium and arteries	0.86	1.02	1.29	0.95	1.03
Stomachs	1.07	1.01	1.16	0.80	1.01
Spleen	0.23	0.20	0.35	0.19	0.24
Liver	2.25	1.78	2.44[3]	1.98	2.00
Pancreas	0.10	0.09	0.10	0.08	0.09
Large and small intestines	2.20	2.42	2.27	2.18	2.27
Kidneys	0.77[1]	0.27	0.29	0.46	0.34
Brain and spinal cord	0.87	0.74	0.81	0.73	0.79
Total internal organs	.....[2]	10.84	15.78[1]	10.94	10.89
Composite skeleton	23.11	26.38	26.61	29.35	26.36
Excreta	2.54	1.08	1.64	1.97	1.81

[1]Omitted from average.
[2]Data on some parts missing.
[3]Includes the gall bladder and gall.
[4]Not obtained separately.

TABLE 10.—PERCENTAGES OF LIVE WEIGHT OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A MEDIUM PLANE OF NUTRITION

Animal No.	565A	563A	564B	565B	564C	Average
Live weight of animal	100.00	100.00	100.00	100.00	100.00	100.00
Blood	4.45	4.82	6.05	5.09	5.30	5.14
Hair and hide	12.29	14.38	12.09	12.24	10.46	12.29
Composite flesh	40.79	36.66	35.86	39.62	41.59	38.90
Lungs	1.32	0.95	1.07	0.82	1.10	1.03
Heart, pericardium and arteries	1.12	1.26	0.59	0.93	1.07	1.10
Stomachs	0.89	0.80	1.16	0.89	0.99	0.95
Spleen	0.16	0.14	0.15	0.15	0.18	0.16
Liver	1.68	1.58	2.06	1.81	1.78	1.78
Pancreas	0.04	0.06	0.08	0.08	0.08	0.07
Large and small intestines	2.50	2.25	3.68	2.66	2.69	2.76
Kidneys	0.27	0.29	0.33	0.28	0.39	0.31
Fat of stomach and intestines	0.47	0.30	0.46	0.56	0.49	0.45
Brain and spinal cord	0.80	0.73	0.95	0.83	0.83	0.83
Total internal organs	10.81	10.75	13.38	10.92	12.17	11.61
Composite skeleton	27.49	26.57	26.18	26.51	27.59	26.87
Excreta	1.75	1.57	1.06	1.46	1.24	1.42

however, does not show with Calf 560D which was handled in the same manner.

The weight of the total internal organs varies from 10.24 per cent to 13.55 per cent of the live weight. The high value, 15.78 per cent, for calf 560D which is not included in the average is of

TABLE 11.—PERCENTAGE OF LIVE WEIGHT OF SEPARATED PARTS OF NEW-BORN HEREFORD CALVES FROM DAMS ON A LOW PLANE OF NUTRITION

Animal No.	568B	567B	566B	568C	Average
Live weight of animal	100.00	100.00	100.00	100.00	100.00
Blood	5.16	4.67	5.21	4.34	4.85
Hair and hide	14.00	11.95	12.03	10.92	12.23
Composite flesh	29.54	38.93	39.02	38.53	36.51
Lungs	1.19	0.87	0.74	1.22	1.01
Heart, pericardium and arteries	1.20	0.95	1.00	0.93	1.02
Stomachs	1.18	0.88	0.88	1.12	1.02
Spleen	0.15	0.19	0.15	0.17	0.17
Liver	1.36	1.76	1.60	1.47	1.55
Pancreas	0.07	.....[1]	0.08	0.10	0.08
Large and small intestines	2.66	2.49	2.64	3.06	2.71
Kidneys	0.39	0.28	0.32	0.28	0.32
Fat of stomach and intestines	1.03	0.54	0.44	0.51	0.63
Brain and spinal cord	1.32	1.03	0.77	0.83	0.99
Total internal organs	13.55	11.14	10.24	12.09	11.76
Composite skeleton	29.10	29.79	30.28	29.23	29.60
Excreta	1.58	2.04	0.70	2.01	1.58

[1]With fat of intestine.

TABLE 12.—AVERAGE PERCENTAGE VALUES FOR THE SEPARATED PARTS OF THE JERSEY AND HEREFORD CALVES

	Jersey Calves	Hereford Calves			
	All calves	High plane	Medium plane	Low plane	All calves
Live weight	100.00	100.00	100.00	100.00	100.00
Blood	4.54	4.58	5.14	4.85	4.93
Hair and hide	10.80	11.85	12.29	12.23	12.13
Composite flesh	38.32	41.16	38.90	36.51	38.67
Lungs	1.25	.91	1.03	1.01	1.01
Heart, pericardium and arteries	1.12	1.03	1.10	1.02	1.05
Stomachs	1.44	1.01	.95	1.02	.99
Spleen	.....[1]	.24	.16	.17	.19
Liver	.....[1]	2.00	1.78	1.55	1.76
Pancreas	.....[1]	.09	.07	.08	.08
Large and small intestines	3.38	2.27	2.76	2.71	2.60
Kidneys	0.53	.34	.31	.32	.32
Fat of stomach and intestines	.....[1]	.....[1]	.45	.63	.....[1]
Brain and spinal cord	1.07	.79	.83	.99	.86
Total internal organs	13.37	10.89	11.61	11.76	11.53
Composite skeleton	25.33	26.36	26.87	29.60	27.55
Excreta	1.28	1.81	1.42	1.58	1.59

[1]Not calculated.

course explained by the fact that a large part of the blood is with this sample. The composite sheleton varies from 26.18 per cent to 30.28 per cent of the live weight. These calves represent different degrees of development and vigor about in proportion to their live weight. The heavier calves show a lower proportion of internal organs and of skeleton and a higher proportion of flesh to the live weight than do the lighter calves. The variations in the other parts are due probably to difficulties in making a uniform separation of the parts or to individuality.

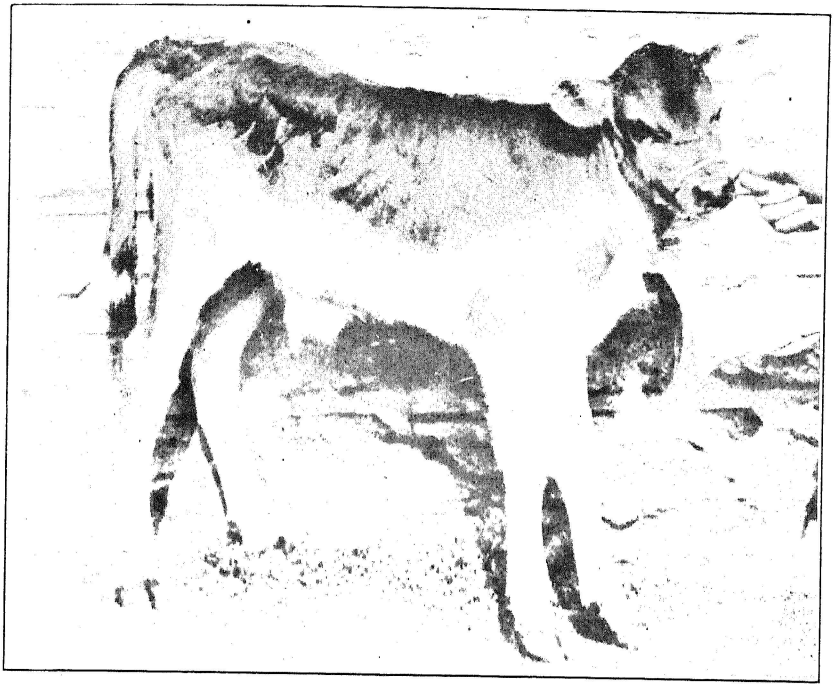
THE JERSEY AND HEREFORD CALVES COMPARED

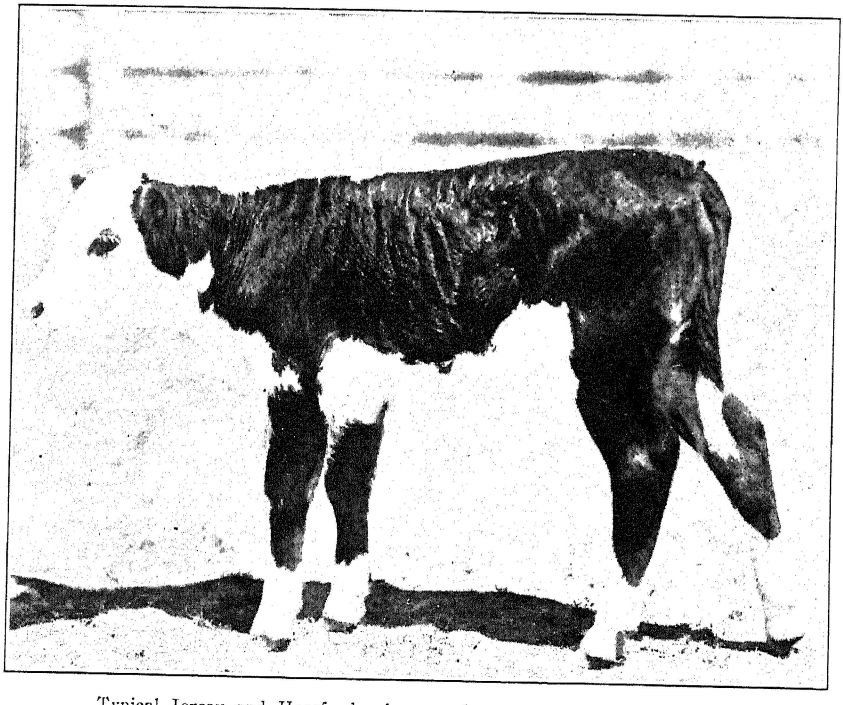
The proportion of blood to live weight of animal seems to be the same for both breeds. However, two Jersey calves show the lowest percentage, 4.08* and 4.29 per cent, and two Hereford calves the highest values, 6.05 and 5.30 per cent. The other nine Hereford calves all show a lower proportion of blood to live weight than the other Jersey calf, 11B. It is evident that these variations in the proportion of blood have nothing to do with the breed of the animal.

The percentage of the hair and hide of the Jersey calves show one high and one low value. Seven of the Hereford calves give values which are lower or about equal to the higher value of the Jersey calf, while all the rest exceed it. For all the Hereford calves the average percentage of the weight of the hair and hide is 12.13 per cent, which is higher than the highest value of the Jersey calf. It thus appears that in general the hide and hair from the Jersey calves is a lower proportionate part of the live weight than is the hair and hide of the Hereford calves. Data on mature animals give the same results. It is evident that the Jersey is a thinner skinned animal than the Hereford.

The weight of composite flesh in the Jersey calves shows intermediate values as compared with the highest and lowest of the Hereford calves. Six of the Hereford calves show higher proportionate value than the highest value for Jersey calves, and two other Hereford calves, 564B and 568B, show lower proportionate values than the lowest value of the Jersey calves. Doubtless the same number of Jersey calves representing the same variations in condition that we have in the Hereford calves would show the same variations in the percentage of weight of flesh to live

*This value is from Calf 85A for which only the weights of animal and blood were obtained. See Table 15.





Typical Jersey and Hereford calves as they appear shortly after birth

weight as are shown with the Hereford calves. The average percentage value for composite flesh for all the Herefords is in close agreement with the average value for the two Jerseys.

For the total internal organs, omitting Hereford Calf 560D for reasons stated above, one Jersey calf shows the highest proportionate value, or 13.94 per cent. Nine Hereford calves show a lower value than the lowest Jersey value—12.80 per cent. Two Hereford calves show values intermediate between the values of the two Jersey calves. From the data it would appear that the internal organs of the Jerseys show a higher value in proportion to the live weight than do the internal organs of the Herefords. More data on Jersey calves should be forthcoming for positive proof.

Among the proportions of the separated organs the fairly uniform values for heart and kidneys of all the animals may be noted. The most striking variation as regards organs between the two breeds is the higher proportionate weight of the stomach and intestines of the Jerseys as compared to the Herefords. The two values for the stomachs of the Jerseys were 1.46 and 1.41 per cent as compared with values for the stomachs of the Herefords which range from 0.80 to 1.18 per cent, or an average value for all the Herefords of 0.99 per cent. The weight for intestines of Calf 11B, 1215 grams, includes the weight of the pancreas, bladder, penis and testicles. If we deduct from this weight the proportional weight of these organs as found in Calf 22A we obtain a calculated weight of intestines for Calf 11B amounting to 3.36 per cent of the live weight of 11B. Both this value and the value 3.40 per cent for Calf 22A are appreciably above the values for twelve of the Hereford calves which range from 2.18 to 3.06 per cent with an average of all values of 2.60 per cent. Calf 564B is a notable exception in the proportionate weight of the intestines to the live weight. The value found, 3.68 per cent, is in close agreement with the corresponding values found for the Jerseys.

The size of the intestines may be judged by their length, especially the small intestines. The length of the large intestine seems to show but little variation in the different animals. The lengths of the small intestine of the Jersey calves were 1745 and 1602 centimeters, or an average value of 1674 centimeters. The length of the small intestines of eleven Hereford calves ranges from 1129 to 1518 centimeters, while the other two Herefords calves, 564B and 564C, give values for length of 1612 and 1776 centimeters respectively. The average value for the eleven Herefords is 1353 centimeters. It seems quite reasonable that the dairy type

of bovine should be provided with a digestive apparatus of larger capacity than the beef type because of the large amount of roughage consumed by the dairy animal. The new born calf shows, therefore, the effect of this high amount of roughage fed thru succeeding generations in the size of the digestive tract with which it is provided. It is significant that Hereford Cow 564, the mother of the two calves, 564B and 564C, proved to be an unusually good milker for her breed. She therefore seems to approach the dairy type of animals and her calves show the high capacity of the alimentary tract of the dairy calf.

The Hereford calves show all ranges from the lowest to the highest in proportionate weight of skeleton. The results for the two Jersey calves are one low and one average result. This does not seem to indicate that the skeleton of the Jersey is necessarily lighter in proportion to the live weight than is the skeleton of the Hereford. A larger number of Jerseys might show the same range of values as is shown by the Herefords here reported.

THE EFFECT OF THE PLANE OF NUTRITION UPON THE WEIGHTS OF THE PARTS OF THE ANIMALS

Of the Herefords, four are from mothers on high planes of nutrition, five are from mothers on medium planes of nutrition, and four are from mothers on low planes of nutrition. The mothers of the two Jersey calves were on planes of nutrition which for our purposes may be considered a medium plane.

The weight of blood obtained from the various calves shows no relation whatever to the plane of feeding upon which the mother was kept. This is shown by the average percentages for the three groups, 4.58, 5.14, and 4.85 per cent. Calf 564B, medium plane, furnished the highest result, 6.05 per cent, while Jersey Calf 22A, also a medium plane, gave the lowest result, 4.28 per cent. Jersey Calf 85A, fed abnormally, furnished a low result, 4.08 per cent. It is hardly fair, however, to compare this with other medium-plane calves. Of the low results for the Hereford calves, 4.47 per cent, 4.45 per cent, and 4.34 per cent, one comes from each plane of nutrition.

Comparing the average percentage for each group no relation appears between the plane of nutrition and the percentage of the hair and hide. Both the highest and the lowest percentages, 14.38 per cent for Hereford Calf 563A, and 9.39 per cent for Jersey Calf 22A, are from the medium-plane group, while two of the low-plane Hereford calves, 568B and 568C, give also a high and a low result,

14.00 per cent and 10.92 per cent, respectively. The high-plane calf, 562B, gives the result 12.37 per cent, which compares very closely with three other medium-plane animals, 12.20, 12.09 and 12.24 per cent.

The proportion of flesh shows a tendency at least to follow the plane of feeding, the high plane giving a high proportion, 41.16 per cent, and the low plane a low proportion of flesh, 36.51, with an intermediate value of 38.90 for the medium-plane calves. One calf from the low plane group, 568B, gave the lowest proportion, 29.54 per cent, while the three other low-plane calves gave results which compare very closely with the medium-fed calves. The foregoing data also shows that the more thrifty the calf—generally shown by his weight at birth—the higher the proportion of flesh obtained. Calf 568B, the weakest calf and also lowest in weight, gave the lowest proportion of flesh to live weight, 29.54 per cent. Calves 562B, 562C, and 564C, three of the heaviest calves, gave the highest proportion of flesh, or 41.53, 41.65 and 41.59 per cent, respectively. The heaviest calf, 563A, was an exception, giving but 36.66 per cent of flesh. Of the two Jersey calves, the most vigorous one, 11B, gave 40.28 per cent, while the weaker and lighter calf, 22A, gave but 36.36 per cent.

By studying the average percentage for each group we find no definite variation in the weights of the separated internal organs due to the plane of feeding of the mother. It may be noted that the weight of the nervous system (brain and spinal cord) of the two lighter calves, 568B and 567B, is rather higher in proportion to the live weight than for the heavier calves. It would thus appear that the development of the nervous system proceeds normally under all the conditions present in this experiment, regardless of how other parts of the animal may be affected by these conditions.

For the total of internal organs, Calf 566B of the low-plane group has the lowest proportion, 10.24 per cent, and Calf 568B of the same group has the highest proportion, 13.55 per cent. The other calves show intermediate values in the proportion of internal organs. The heavier and more thrifty animals, calves 562B, 562C, 565A, 563A and 566B, show low proportionate weights of internal organs, 10.84, 10.94, 10.81, 10.75, and 10.24 per cent respectively; while 568B, the lightest of the Herefords, give the largest proportion of internal organs, or 13.55 per cent. It will also be noticed that the heaviest Jersey calf, 11B, gives the lowest proportion of internal organs. As we pass from high plane to low plane the proportion of total internal organs to live weight increases—

10.89, 11.61, and 11.76 per cent. It thus appears that the internal organs tend to develop to normal weight under all the conditions of this experiment, and that other parts such as flesh respond directly to these conditions, causing the variation in the live weight at birth and the change in the percentage of the internal organs.

The percentage of composite skeleton to live weight does not show much variation between the high-plane and the medium-plane calves. The tendency, however, seems to be the same as shown by the total internal organs, the same explanation applying. All these values vary from 23.11 per cent to 29.35 per cent. For the four low-plane calves the proportion of skeleton is rather higher, none being below 29.10, and averaging 29.60 per cent for the group. It will also be observed that the more thrifty Jersey calf, 11B, shows a lower proportion of skeleton than the weaker Jersey calf, 22A.

It thus appears that the plane of nutrition to which the mother cow is subjected during pregnancy does not influence the proportionate weight of all parts of the animal in any regular way. It does appear, however, that the proportionate weight of some parts is influenced by the degree of thriftiness of the calf itself which in a general way is indicated by the live weight at birth. The degree of thriftiness of the calf may or may not be influenced by the plane of feeding of the mother. The plane of nutrition will certainly influence the condition of the mother, but may not affect the developing calf. However, it is evident from our data of live weights and proportion of composite flesh that a higher proportion of thriftiness is found in the better-fed than in the scant-fed group.

	High Plane	Medium Plane	Low Plane
Average live weight.....	82.53 pounds	80.87 pounds	66.20 pounds
Average percentage of flesh....	41.16	38.90	36.51

Considering now the individual calves, the most thrifty as judged from the live weight was Calf 563A, the mother being on a medium plane of nutrition. The weakest calf, 568B, was from the low-plane group of heifers, but the other calves of the same group compare very favorably in thriftiness with those of the medium-fed group. This is especially true for calf 566B whose live weight is practically equal to that of the heaviest calf produced in the experiment. The calves from the high-plane group have a live weight intermediate in value between the heavist and lightest of the medium-plane calves. As shown above, the difference in thriftiness between the high-plane and medium-plane calves is not as

great as between the medium-and low-plane calves. The principal difference will be found to exist in the proportion of flesh and particularly of the fat in the animal.

CHEMICAL COMPOSITION

The chemical composition of the parts and of the total animal for each calf is shown in Tables 13 to 29, inclusive.

COMPOSITION OF ENTIRE ANIMAL

The figures for the composition of the entire animal are gathered together in Table 29. Some significant differences are seen on studying an average composition of the different groups.

The young organism shows a high percentage of moisture, which value decreases as growth proceeds. The Jersey fetus at 185 days showed 84.80 per cent moisture; at 232 days, 78.70 per cent; and just before birth, 74.19 per cent. The two normal Jersey

TABLE 13.—COMPOSITION OF THE SEPARATED PARTS OF THE JERSEY CALF 11B, STRANGLED AT BIRTH

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood, serum and water	1,675.0	90.847	0.190	1.424	0.427	0.094
Liver	581.0	83.877	1.074	2.245	0.957	0.135
Nervous system	338.0	79.915	7.333	1.668	1.234	0.278
Internal organs	3,167.0	79.571	5.790	2.199	0.902	0.144
Hair and hide	3,896.0	69.121	0.765	5.070	0.787	0.068
Skeleton (includes teeth and hoofs)	7,554.0	62.858	2.920	3.020	14.639	2.564
Flesh (includes right kidney fat)	12,862.0	77.818	4.416	2.702	0.904	0.163
Left kidney fat (special	100.0	25.644	69.166	0.775	.....[1]	.....[1]
Excreta	301.0	61.158	8.417	2.779	1.426	0.025
Total animal as analyzed	30,374.0	73.857	3.494	2.942	4.288	0.738

[1]Not determined.

TABLE 14.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW BORN JERSEY CALF 22A FROM IMMATURE DAM

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,015.8	84.432	.....[1]	2.364	0.535	0.038
Hair and hide	2,224.0	63.284	0.673	5.238	1.020	0.087
Internal organs	3,299.0	78.324	4.729	2.304	1.069	0.237
Flesh	8,610.0	77.046	1.824	3.675	1.043	0.200
Skeleton	6,406.0	63.118	1.444	3.408	13.016	2.294
Kidney fat (special)	59.0	33.950	58.588	1.090	.....[1]	.....[1]
Total animal as analyzed	21,554.8	72.030	1.951	3.485	4.579	0.809

[1]Not determined.

calves killed soon after birth showed 72.27 per cent and 73.85 per cent moisture, or an average value of 73.44 per cent moisture, if we include the calf just before birth. In the calves of low weight and vigor the percentage of moisture is higher, this condition being analogous to the under-development of the calf before birth. This is shown by Jersey Calf 85A, weighing 13.6 kilos, and giving a moisture content of 75.06 per cent, and by Hereford Calf 568B, weighing 17.7 kilos and giving a moisture content of 75.81 per cent.

TABLE 15.—COMPOSITION OF SEPARATED PARTS OF THE NEW BORN JERSEY CALF 85A FROM DAM ON A DEFICIENT MINERAL RATION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Composite of calf after bleeding	12,105.2	74.608	4.190	2.566	4.430	0.795
Blood of calf	555.0	84.937	.....[1]	2.291	0.782	0.025
Total calf as analyzed	12,660.2	75.061	4.006	2.554	4.270	0.761

[1]Not determined.

TABLE 16.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 560B (STRANGLED AT BIRTH) FROM DAM ON HIGH PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Composite of blood, organs, and flesh	25,943.0	77.549	4.791	2.826	0.898	0.149
Composite of bones, teeth, hoofs	9,252.0	62.028	2.743	.....[1]	14.297	2.457
Composite of hair and hide	4,590.0	65.519	0.585	5.064	0.807	0.065
Excreta	1,019.0	.....[1]	.....[1]	.....[1]	0.370	.....[1]
Total animal as analyzed	39,785.0	72.552	3.829	.....[1]	4.003	0.676

[1]Not determined.

TABLE 17.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 562B FROM DAM ON A HIGH PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,746.4	81.065	.....[2]	2.878	0.684	0.031
Hair and hide	4,620.9	66.452	1.186	5.252	2.178	0.067
Composite flesh	15,518.4	75.513	4.544	2.976	1.060	0.167
Composite internal organs	4,051.1	76.225	7.668	2.158	1.227	0.203
Composite skeleton	9,854.2	66.422	3.731	2.798	12.365	2.137
Excreta	402.6	69.871	4.539	2.070	1.411	0.032
Kidney fat (special)	.....[1]	37.642	53.736	1.251	0.699	0.087
Lean (special)	.....[1]	75.976	1.091	3.232	1.200	0.186
Total animal as analyzed	36,193.6	72.166	4.024	3.112	4.285	0.686

[1]Weight included in other samples.
[2]Not determined.

The percentage of moisture in the other calves, which may be considered of about average weight and vigor, is much the same for all. The values range from 71.56 per cent to 74.05 per cent and in-

TABLE 18.—COMPOSITION OF SEPARATED PARTS OF FULL TERM HEREFORD CALF 560D, OBTAINED BY POST MORTEM FROM DAM ON HIGH PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Hair and hide	4,130.5	65.833	1.240	5.426	0.946	0.090
Composite flesh (contains some blood)	13,120.1	76.608	4.073	2.799	0.910	0.163
Composite internal organs (contains most of the blood)	5,137.0	80.911	5.132	2.056	0.997	0.161
Composite skeleton	8,660.7	61.925	4.691	3.115	13.745	3.215
Excreta	532.9	72.218	4.712	2.166	1.180	0.130
Kidney fat (both sides)	218.3	38.561	54.676	1.091	0.505	0.091
Total animal as analyzed	31,799.5	71.569	4.402	3.084	4.426	0.983

TABLE 19.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 562C FROM DAM ON A HIGH PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,777.5	82.351	.....[2]	2.587	0.839	0.028
Hair and hide	4,323.3	67.297	1.737	5.106	0.973	0.065
Composite flesh	16,578.7	76.813	4.626	2.598	0.983	0.172
Composite internal organs	4,354.5	77.026	7.449	2.055	1.090	0.210
Composite skeleton	11,682.8	66.953	4.724	2.731	10.823	2.607
Excreta	782.4	91.480	0.701	0.654	0.848	0.028
Marrow (special)	.....[1]	64.709	27.402	1.081	0.986	0.122
Kidney fat (special)	232.5	33.088	59.859	0.922	0.479	0.078
Lean special	.....[1]	78.473	1.285	2.762	1.071	0.203
Total animal as analyzed	39,499.2	73.419	4.364	2 813	3.895	0.875

[1]Weight included in other samples.
[2]Not determined.

TABLE 20.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 565A FROM DAM ON A MEDIUM PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,805.3	83.202	0.019	2.593	0.474	0.035
Hair and hide	4,990.0	69.770	1.395	4.850	1.467	0.065
Composite flesh	16,556.0	77.283	3.779	2.656	0.915	0.169
Composite internal organs	4,388.0	77.915	6.781	2.035	1.069	0.208
Composite skeleton	11,156.0	65.311	2.299	2.589	13.755	2.452
Excreta	709.0	77.989	3.136	1.542	0.974	0.018
Marrow (special)	.....[1]	76.713	15.037	0.949	.....[2]	.....[2]
Total animal as analyzed	39,604.3	73.317	3.212	2.822	4.599	0.794

[1]Weight included in other samples.
[2]Not determined.

clude four Herefords from the high plane, five Herefords from the medium plane, and three Herefords from the low plane, and three Jersey calves the mothers of which may be considered to have been upon a medium plane of nutrition. The average value for all the Herefords is 72.80 per cent and for the three normal Jerseys is 73.44 per cent. While the relation between moisture content and the plane of nutrition of the animal is not exact, consideration of the average result for each group shows the tendency of the moisture content to rise as we pass from high to low plane of nutrition.

The percentage of fat shows the lowest value, 2.36, in the youngest Jersey fetus of 185 days and increases as the time of birth approaches. For the new-born Jersey calves the values range from 3.49 to 4.59 per cent. Jersey Calf 22A is a notable exception, giving a percentage value of fat in the entire animal of a little

TABLE 21.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 563A FROM DAM ON A MEDIUM PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,958.6	79.790	0.053	3.096	0.474	0.021
Hair and hide	5,848.0	72.179	0.550	3.920	3.269	0.062
Composite flesh	14,906.0	76.020	4.258	2.797	1.002	0.156
Composite internal organs	4,372.0	76.105	8.157	2.083	1.123	0.177
Composite skeleton	10,804.0	66.316	4.345	2.776	11.632	2.119
Excreta	641.0	73.793	5.075	1.762	1.179	0.034
Marrow (special)	.....[1]	70.732	21.836	1.003	.....[2]	.....[2]
Kidney fat (special)	.....[1]	29.546	64.293	0.873	0.425	0.076
Total animal as analyzed	38,529.6	72.880	3.959	2.878	4.317	0.685

[1]Weight included in other samples.
[2]Not determined.

TABLE 22.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 564B FROM DAM ON A MEDIUM PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,862.0	82.024	.....[2]	2.725	0.598	0.029
Hair and hide	3,720.0	65.876	0.787	5.161	1.116	0.060
Composite flesh	11,032.0	76.730	3.998	2.809	0.949	0.171
Composite internal organs	4,117.0	77.925	5.864	2.141	1.057	0.206
Composite skeleton	8,054.0	63.856	3.106	3.037	13.919	2.528
Excreta	326.0	75.524	3.508	2.241	0.991	0.062
Kidney fat (special)	.....[1]	53.526	39.645	1.179	0.616	0.091
Total animal as analyzed	29,111.0	72.275	3.344	3.066	4.552	0.804

[1]Weight included in other samples.
[2]Not determined.

less than 2 per cent. This result appears abnormal and may best be disregarded in seeking the normal tendency. The percentage of fat in the Hereford calves shows some relation to the plane of nutrition considered as a whole, especially if average results are considered. One high-plane calf gives the highest results, 4.40 per cent, the average result for fat for all four calves of the high-plane group being 4.15 per cent. Two calves in the medium-fed group, 563A and 565B, give respectively 3.96 and 3.94, which closely follow the average for the high-plane group. One calf of the medium-fed group shows the lowest result for all of the Herefords, or 3.21 per cent. The average result for the five medium-plane Herefords is 3.56 per cent. Calf 566B, the heaviest calf of the low-plane group, gives a lower per cent of fat than Calf 568B,

TABLE 23.—COMPOSITION OF SEPARATED PARTS OF NEW-BORN HEREFORD CALF 565B FROM DAM ON A MEDIUM PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,672.6	81.961	.....[3]	2.830	0.687	0.035
Hair and hide	4,019.9	63.822	0.874	5.403	2.228	0.093
Composite flesh	13,016.3	76.133	4.684	2.773	1.040	0.178
Composite internal organs	3,586.2	76.981	6.885	2.188	1.159	0.223
Composite skeleton	8,708.9	65.122	3.786	2.804	13.046	2.414
Excreta[1]	479.1	.....	.....	.....	.....	.....
Kidney fat (special)	.....[2]	28.864	61.917	1.362	0.605	0.121
Lean (special)	.....[2]	78.067	1.352	2.924	1.108	0.222
Total animal as analyzed	31,003.9	71.864	3.940	3.058	4.561	0.793

[1]Not analyzed.
[2]Weight included in other samples.
[3]Not determined.

TABLE 24.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW-BORN HEREFORD CALF 564C FROM DAM ON A MEDIUM PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	2,044.0	79.394	.....[2]	3.150	0.740	0.029
Hair and hide	4,031.3	66.684	0.930	5.245	0.914	0.059
Composite flesh	16,034.4	76.418	3.637	2.792	1.032	0.184
Composite internal organs	4,691.8	77.591	6.215	2.184	1.120	0.218
Composite skeleton	10,636.7	64.183	3.243	3.022	13.569	3.045
Excreta	479.1	71.727	5.587	1.801	1.194	0.068
Marrow (special)	.....[1]	72.508	1.775	1.446	.....[2]	.....[2]
Kidney fat (special)	.....[1]	30.992	62.067	1.037	0.599	0.088
Lean special	.....[1]	77.802	0.820	2.963	1.153	0.222
Total animal as analyzed	37,917.3	72.197	3.386	3.049	4.534	0.967

[1]Weight included in other samples.
[2]Not determined.

the lightest and least vigorous calf of the same group. If we average all four of the low-plane values for fat we obtain 3.24 per cent. Thus we see that the tendency of the results for fat in the Hereford calves is to increase from the low plane to the higher planes of nutrition.

The per cents of nitrogen, ash, and phosphorus are all lowest in the youngest fetus (185 days) and increase in value as the time of birth approaches. Of the Jersey calves at birth the results for nitrogen vary from 2.55 to 2.95 per cent, with the exception of Jersey Calf 22A which has an unusually high value, 3.48 per cent. The ash percentage varies from 4.09 to 4.57 per cent, while the phosphorus percentage varies from 0.617 to 0.809 per cent, the extreme values for ash associating with the extreme values for phosphorus.

With the Hereford calves the percentage of nitrogen in most

TABLE 25.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW-BORN HEREFORD CALF 568B FROM DAM ON A LOW PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	912.0	86.842	.....[2]	1.950	0.419	0.026
Hair and hide	2,477.0	74.622	0.895	3.832	1.333	0.073
Composite flesh	5,226.0	79.413	4.242	2.176	0.858	0.140
Composite internal organs	2,397.0	78.327	8.294	1.868	0.951	0.164
Composite skeleton	5,148.0	69.636	2.293	2.736	10.861	1.937
Excreta	280.0	75.279	2.408	1.866	1.020	0.040
Kidney fat (special)	.....[1]	31.659	64.260	0.809	0.386	0.091
Total animal as analyzed	16,440.0	75.813	3.452	2.538	4.054	0.688

[1]Weight included in other samples.
[2]Not determined.

TABLE 26.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW-BORN HEREFORD CALF 567B FROM DAM ON A LOW PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,335.4	83.016	.....[2]	2.558	0.782	0.027
Hair and hide	3,415.5	66.707	0.442	5.115	2.623	0.077
Composite flesh	11,124.3	77.197	3.903	2.639	1.075	0.173
Composite internal organs	3,183.6	77.522	6.433	2.180	1.236	0.230
Composite skeleton	8,513.3	65.738	2.834	2.770	13.339	2.403
Excreta	584.0	78.089	3.055	1.619	1.025	0.019
Marrow (special)	.....[1]	79.786	1.129	1.183	0.939	0.115
Kidney fat (special)	.....[1]	25.392	67.572	0.935	0.541	0.089
Lean (special)	.....[1]	79.165	0.745	2.693	1.069	0.205
Total animal as analyzed	28,156.1	72.792	3.243	2.902	4.974	0.832

[1]Weight included in other samples.
[2]Not determined.

cases vary but little from the average value which is 2.92 per cent. But in some few cases the variation from the average is 7 to 14 per cent of the average. Calf 568B shows the greatest variation in this value, which is 0.4 per cent less. Considered by groups the high plane shows the highest per cent, 3.00; followed by the medium-plane result, 2.97, and lastly by the low-plane result, or 2.80. Thus it appears that the nitrogen shows a decreasing value the lower the plane of feeding to which the mother of the calf had been subjected, and in spite of a lower proportion of fat.

The ash and the phosphorus show a slight tendency to increase in percentage value as we pass from the high to the low plane of feeding. The values for ash are: high plane, 4.15 per

TABLE 27.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW-BORN HEREFORD CALF 566B FROM DAM ON A LOW PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	2,104.9	82.948	.....[2]	2.517	0.684	0.032
Hair and hide	4,856.2	70.114	0.772	4.540	1.063	0.061
Composite flesh	15,750.9	80.110	2.351	2.740	1.024	0.146
Composite internal organs	4,133.4	79.248	5.463	2.111	1.060	0.213
Composite skeleton	12,224.3	64.468	2.934	2.602	15,469	3.081
Excreta	280.7	77.092	2.960	1.656	1.058	0.121
Marrow (special)	.....[1]	62.280	29.641	0.967	.....[2]	.....[2]
Kidney fat (special)	.....[1]	45.295	47.180	0.975	0.602	0.095
Lean (special)	.....[1]	79.933	0.704	2.677	1.062	0.178
Total animal as analyzed	39,350.4	74.057	2.543	2.834	5.502	1.048

[1]Weight included in other samples.
[2]Not determined.

TABLE 28.—COMPOSITION OF THE SEPARATED PARTS OF THE NEW-BORN HEREFORD CALF 568C FROM DAM ON A LOW PLANE OF NUTRITION

	Fresh weight of sample	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Blood	1,451.5	83.547	.....[2]	2.552	0.813	0.024
Hair and hide	3,657.1	67.455	1.027	5.190	0.888	0.060
Composite flesh	12,898.9	76.134	3.984	2.728	1.015	0.179
Composite internal organs	4,048.3	78.866	5.847	1.959	1.041	0.198
Composite skeleton	9,786.2	61.874	4.049	3.001	14.621	3.277
Excreta	671.9	78.721	4.193	1.386	1.027	0.077
Marrow (special)	.....[1]	71.343	21.441	0.945	2.940	0.113
Kidney fat (special)	.....[1]	20.866	74.029	0.553	0.387	0.086
Lean (special)	.....[1]	78.419	0.657	2.758	1.101	0.207
Total animal as analyzed	32,513.9	71.590	3.729	2.956	5.090	1.091

[1]Weight included in other samples.
[2]Not determined.

cent; medium plane, 4.51 per cent; and for low plane, 4.90 per cent. In general the values for phosphorus follow directly the per cent of ash.

COMPOSITION OF THE SEPARATED PARTS.

Tables 13 to 28, inclusive, show the composition of each individual calf analyzed; as a whole and by parts. For convenience of study these data are regrouped under the divisions of the animal in tables 30 to 36, inclusive. Inspection of the data under each division shows that these parts vary in composition in much the same manner as does the composition of the entire animal.

Blood.—In the blood (Table 30) we find the highest percentage of moisture in Calf 568B and Calf 22A, which were the calves of

TABLE 29.—THE COMPOSITION OF ENTIRE BOVINE FETUS AND CALVES

	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey fetus (185 days) 43X	84.801	2.363	1.673	1.776	0.283
Jersey fetus (232 days) 13X	78.700	2.573	2.011	3.180	0.370
Jersey fetus (279 days) 2X	74.192	3.384	2.735	4.062	0.688
Jersey Calf 11A	72.276	4.591	2.956	4.096	0.617
Jersey Calf 11B	73.857	3.494	2.942	4.288	0.738
Jersey Calf 22A[1] subnormal	72.030	1.951	3.485	4.579	0.809
Jersey Calf 85A[1] abnormal	75.061	4.006	2.554	4.270	0.761
Average for Jersey Calves at birth (2X, 11B, 11A)	73.442	3.823	2.878	4.149	0.681
Hereford Calf 560B	72.552	3.829	....[2]	4.003	0.676
Hereford Calf 562B	72.166	4.024	3.112	4.285	0.686
Hereford Calf 560D	71.569	4.402	3.084	4.426	0.983
Hereford Calf 562C	73.419	4.364	2.813	3.895	0.875
Average for Herefords (high plane)	72.427	4.155	3.003	4.152	0.805
Hereford Calf 565A	73.317	3.212	2.822	4.599	0.794
Hereford Calf 563A	72.880	3.959	2.878	4.317	0.685
Hereford Calf 564B	72.275	3.344	3.066	4.552	0.804
Hereford Calf 565B	71.864	3.940	3.058	4.561	0.793
Hereford Calf 564C	72.197	3.386	3.049	4.534	0.967
Average for Herefords (medium plane)	72.507	3.568	2.975	4.513	0.809
Hereford Calf 568B	75.813	3.452	2.538	4.054	0.688
Hereford Calf 567B	72.792	3.243	2.902	4.974	0.832
Hereford Calf 566B	74.057	2.543	2.834	5.502	1.048
Hereford Calf 568C	71.590	3.729	2.956	5.090	1.091
Average for Herefords (low plane)	73.563	3.242	2.808	4.905	0.915
Average for all Herefords	72.807	3.648	2.926	4.523	0.841

[1]Omitted from averages.
[2]Not determined.

lowest weight and vigor. The heaviest calf, 563A, shows, with one exception, the lowest percentage of moisture in the blood. The animals from the low plane of nutrition show a higher percentage of moisture in the blood than those from the higher plane of nutrition A difference between the high and medium-plane groups is not apparent from our data. The true percentage of moisture in the blood of Jersey Calf 11B is not shown by the result, 90.84, as this blood sample had been mingled with water and other body liquids before it was obtained for analysis. The nitrogen, ash, and phosphorus in the blood vary inversely as the percentage of moisture.

Hair and Hide.—The percentage of moisture in the hair and hide (Table 31) varies for the individual without regard to the plane of nutrition. The heaviest and lightest calves, 563A and

TABLE 30.—COMPOSITION OF THE BLOOD OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	90.847[1]	0.190	1.424	0.427	0.024
Jersey Calf 22A	84.432	.....[3]	2.364	0.535	0.038
Average for Jersey calves	.....	.....	1.894	0.481	0.031
Hereford Calf 560B[2]	.....	.....	.....	.....	.....
Hereford Calf 562B	81.065	.....[3]	2.878	0.684	0.031
Hereford Calf 560D[2]	.....	.....	.....	.....	.....
Hereford Calf 562C	82.351	.....[3]	2.587	0.839	0.028
Average for Herefords (high plane)	81.708	.....	2.733	0.762	0.030
Hereford Calf 565A	83.202	0.019	2.593	0.474	0.035
Hereford Calf 563A	79.790	0.053	3.096	0.474	0.021
Hereford Calf 564B	82.024	.....[3]	2.725	0.598	0.029
Hereford Calf 565B	81.961	.....[3]	2.830	0.687	0.035
Hereford Calf 564C	79.394	.....[3]	3.150	0.740	0.029
Average for Herefords (medium plane)	81.274	.....	2.879	0.595	0.030
Hereford Calf 568B	86.842	.....[3]	1.950	0.419	0.026
Hereford Calf 567B	83.016	.....[3]	2.558	0.782	0.027
Hereford Calf 566B	82.948	.....[3]	2.517	0.684	0.032
Hereford Calf 568C	83.547	.....[3]	2.552	0.813	0.024
Average for Herefords (low plane)	84.088	.....	2.394	0.675	0.027
Average for all Herefords	82.376	.....	2.676	0.654	0.029

[1]Omitted from averages. Sample mixed with water.
[2]Blood not obtained as separate sample.
[3]No determination of ether extract made.

568B, show the highest percentage of moisture, while other calves, both Jerseys and Herefords, of average weight and vigor show values ranging from 63 to 69 per cent. However, if average results for each group be considered, the tendency to increase in moisture content as we pass from high to low plane becomes apparent.

The percentage of fat in the hair and hide vary within rather wide limits even within the same group. The value found depends largely upon the care with which the hide is separated from sub-dermal tissue. There is generally more or less fat lying between this sub-dermal tissue and the hide, and unless great care is taken considerable quantities of this will cling to the hide on removal. The group averages show a decrease with a lower plane of nutrition.

The most striking fact in the composition of the hair and hide

TABLE 31.—COMPOSITION OF THE HAIR AND HIDE OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	69.121	0.765	5.070	0.787	0.068
Jersey Calf 22A	63.284	0.673	5.238	1.020	0.087
Average for Jersey calves	66.202	0.719	5.154	0.903	0.078
Hereford Calf 560B	65.519	0.585	5.064	0.807	0.065
Hereford Calf 562B	66.452	1.186	5.252	2.178[1]	0.067
Hereford Calf 560D	65.833	1.240	5.426	0.946	0.090
Hereford Calf 562C	67.297	1.737	5.106	0.973	0.065
Average for Herefords (high plane)	66.275	1.583	5.212	0.909	0.072
Hereford Calf 565A	69.770	1.395	4.850	1.467	0.065
Hereford Calf 563A	72.179	0.550	3.920	3.269[1]	0.062
Hereford Calf 564B	65.876	0.787	5.161	1.116	0.060
Hereford Calf 565B	63.822	0.874	5.403	2.228[1]	0.093
Hereford Calf 564C	66.684	0.930	5.245	0.914	0.059
Average for Herefords (medium plane)	67.666	0.907	4.916	1.166	0.068
Hereford Calf 568B	74.622	0.895	3.832	1.333	0.073
Hereford Calf 567B	66.707	0.442	5.115	2.623[1]	0.077
Hereford Calf 566B	70.114	0.772	4.540	1.063	0.061
Hereford Calf 568C	67.455	1.027	5.190	0.888	0.060
Average for Herefords (low plane)	69.725	0.784	4.669	1.095	0.068
Average for all Herefords	67.871	0.955	4.931	1.056	0.069

[1]Omitted from averages. Samples contaminated by some dirt.

is the high percentage of nitrogen it contains. This seems to vary in the way we have observed in the entire animal, that is, falling in percentage value as we pass from the high-plane to the low-plane animals. It will be noticed that the percentage of ash in the hair and hide is very high in four cases. This is due to the fact that the hide was contaminated with dirt which could not be removed by washing. It will be noted that the per cent of phosphorus is not higher in those cases where the ash is high, which would indicate that the additional ash is extraneous dirt. The true ash percentages are probably 0.7 per cent to 1.2 per cent. The four high results were omitted in the calculation of averages.

Flesh.—The percentage of moisture in the flesh (Table 32) does not show wide variation but shows the same trend as the moisture in the entire animal. Calf 562B from the high-plane group

TABLE 32.—COMPOSITION OF THE COMPOSITE FLESH OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	77.818	4.416	2.702	0.904	0.163
Jersey Calf 22A	77.046	1.824	3.675	1.043	0.200
Average for Jersey calves	77.432	3.120	3.189	0.974	0.182
Hereford Calf 560B[1]	.....	.....	.....	.....	.....
Hereford Calf 562B	75.513	4.544	2.976	1.060	0.167
Hereford Calf 560D	76.608	4.073	2.799	0.910	0.163
Hereford Calf 562C	76.813	4.626	2.598	0.983	0.172
Average for Herefords (high plane)	76.311	4.414	2.791	0.984	0.167
Hereford Calf 565A	77,283	3.779	2.656	0.915	0.169
Hereford Calf 563A	76.020	4.258	2.797	1.002	0.156
Hereford Calf 564B	76.730	3.998	2.809	0.949	0.171
Hereford Calf 565B	76,133	4.684	2.773	1.040	0.178
Hereford Calf 564C	76.418	3.637	2.792	1.032	0.184
Average for Herefords (medium plane)	76.517	4.071	2.765	0.988	0.172
Hereford Calf 568B	79.413	4.242	2.176	0.858	0.140
Hereford Calf 567B	77.197	3.903	2.639	1.075	0.173
Hereford Calf 566B	80.110	2.351	2.740	1.024	0.146
Hereford Calf 568C	76.134	3.984	2.728	1.015	0.179
Average for Herefords (low plane)	78.214	3.620	2.571	0.993	0.160
Average for all Herefords	77.031	4.007	2.707	0.989	0.167

[1]Flesh not obtained as a separate sample.

shows the lowest percentage of moisture and Calf 566B in the low-plane group, the highest percentage of moisture. The average value for moisture in the flesh of the five medium-plane calves is 76.51 per cent, and for the four low-plane calves, 78.21 per cent.

The percentage of fat in the flesh of the Hereford varies from 2.35 to 4.68 per cent without regard to the plane of nutrition. The heaviest and lightest of these calves had the same percentage of fat in the flesh, 4.25 per cent and 4.24 per cent. Jersey Calf 22A has an exceptionally low value, 1.82 per cent. If we consider the average value for each group of Herefords we see at once the tendency of the value for fat to fall as we pass from high to low plane. The tendency of nitrogen is to decrease in percentage value

TABLE 33.—COMPOSITION OF THE COMPOSITE INTERNAL ORGANS OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	80.212[1]	5.247	2.162	0.937	0.154
Jersey Calf 22A	78.324	4.729	2.304	1.069	0.237
Average for Jersey calves	78.324	4.988[3]	2.233	1.003	0.196
Hereford Calf 560B[2]	.....	.....	.....	.....	.....
Hereford Calf 562B	76,225	7.668	2.158	1.227	0.203
Hereford Calf 560D	80.911[1]	5.132[1]	2.056	0.997	0.161
Hereford Calf 562C	77.026	7.449	2.055	1.090	0.210
Average for Herefords (high plane)	76.625	7.559	2.090	1.105	0.191
Hereford Calf 565A	77.915	6.781	2.035	1.069	0.208
Hereford Calf 563A	76.105	8.157	2.083	1.123	0.177
Hereford Calf 564B	77.925	5.864	2.141	1.057	0.206
Hereford Calf 565B	76.981	6.885	2.188	1.159	0.223
Hereford Calf 564C	77.591	6.215	2.184	1.120	0.218
Average for Herefords (medium plane)	77.303	6.780	2.126	1.106	0.206
Hereford Calf 568B	78.327	8.294	1.868	0.951	0.164
Hereford Calf 567B	77.522	6.433	2.180	1.236	0.230
Hereford Calf 566B	79.248	5.463	2.111	1.060	0.213
Hereford Calf 568C	78.866	5.847	1.959	1.041	0.198
Average for Herefords (low plane)	78.491	6.509	2.029	1.072	0.201
Average for all Herefords	77.887	6.682	2.085	1.094	0.201

[1]Omitted from averages. Samples contained much blood.

[2]Internal organs not obtained as a separate sample.

[3]Result not of value as an average. Neither calf gives a typical per cent for fat in internal organs.

from high to low plane of nutrition. The ash and the phosphorus in the same interval, tend to remain quite constant. The results on composite flesh of Jersey Calf 22A are all more or less abnormal. Jersey Calf 11B gives results in close agreement with the Hereford calves.

Internal Organs.—The moisture in the internal organs (Table 33) tends to a higher percentage value in low-plane calves than in the others. The average value for the four low-plane calves is 78.49 per cent; for the five medium-plane calves, 77.30 per cent; and for two high-plane calves, 76.62 per cent. Calf 560D, obtained by post mortem, was not bled, therefore most of the blood was with the internal organs.. This explains the abnormally high result for moisture and low result for fat in the internal organs of this calf. These results are not included in the calculated averages. Jersey

TABLE 34.—COMPOSITION OF THE COMPOSITE SKELETON OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	62,858	2.920	3.020	14.639	2.564
Jersey Calf 22A	63.118	1.444	3.408	13.016	2.294
Average for Jersey calves	62.988	2.182	3.214	13.828	2.429
Hereford Calf 560B	62.028	2.743	.....[1]	14.297	2.457
Hereford Calf 562B	66.422	3.731	2.798	12.365	2.137
Hereford Calf 560D	61.925	4.691	3.115	13.745	3.215
Hereford Calf 562C	66.953	4.724	2.731	10.823	2.607
Average for Herefords (high plane)	64.332	3.972	2.881	12.808	2.604
Hereford Calf 565A	65.311	2.299	2.589	13.755	2.452
Hereford Calf 563A	66.316	4.345	2.776	11.632	2.119
Hereford Calf 564B	63.856	3.106	3.037	13.919	2.528
Hereford Calf 565B	65.122	3.786	2.804	13.046	2.414
Hereford Calf 564C	64.183	3.243	3.022	13.569	3.045
Average for Herefords (medium plane)	64.958	3.356	2.846	13.184	2.511
Hereford Calf 568B	69.636	2.293	2.736	10.861	1.937
Hereford Calf 567B	65.738	2.834	2.770	13.339	2.403
Hereford Calf 566B	64.468	2.934	2.602	15.469	3.081
Hereford Calf 568C	61.874	4.049	3.001	14.621	3.277
Average for Herefords (low plane)	65.429	3.028	2.777	13.570	2.675
Average for all Herefords	64.918	3.445	2.832	13.188	2.590

[1]Not determined.

Calf 22A shows a low plane result, 78.32 per cent, while the high result for Jersey Calf 11B is due to the fact that this animal was not bled, therefore the internal organs contained considerable blood. The fat of the new born calves is mostly internal, which is demonstrated by the high percentage of fat found in the samples of internal organs. Again, Jersey Calf 22A shows an emaciated condition, having the lowest percentage of fat in the internal organs. The percentage of nitrogen in the internal organs is slightly but distinctly lower than in the flesh. The average of all results for per cent of nitrogen in the flesh of the Herefords is 2.71 per cent, while the average value for per cent of nitrogen in internal organs is 2.08 per cent. The per cent of ash and phosphorus in the internal organs tends to a higher value than in the flesh. The average per cents of ash and of phosphorus in the flesh are 0.989 and 0.167,

TABLE 35.—COMPOSITION OF THE EXCRETA OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	61.158	8.417	2.779	1.426	0.025
Jersey Calf 22A[1]	.....	.....	.....	.....	.....
Average for Jersey calves	.....	.....	.....	.....	.....
Hereford Calf 560B[1]	.....	.....	.....	.....	.....
Hereford Calf 562B	69.871	4.539	2.070	1.411	0.032
Hereford Calf 560D	72.218	4.712	2.166	1.180	0.130
Hereford Calf 562C	91.480	0.701	0.654	0.848	0.028
Average for Herefords (high plane)	77.856	3.317	1.630	1.146	0.063
Hereford Calf 565A	77.989	3.136	1.542	0.974	0.018
Hereford Calf 563A	73.793	5.075	1.762	1.179	0.034
Hereford Calf 564B	75.524	3.508	2.241	0.991	0.062
Hereford Calf 565B[1]	.....	.....	.....	.....	.....
Hereford Calf 564C	71.727	5.587	1.801	1.194	0.068
Average for Herefords (medium plane)	74.758	4.326	1.836	1.085	0.046
Hereford Calf 568B	75.279	2.408	1.866	1.020	0.040
Hereford Calf 567B	78.089	3.055	1.619	1.025	0.019
Hereford Calf 566B	77.092	2.960	1.656	1.058	0.121
Hereford Calf 568C	78.721	4.193	1.386	1.027	0.077
Average for Herefords (low plane)	77.295	3.154	1.632	1.033	0.064
Average for all Herefords	76.526	3.625	1.706	1.083	0.057

[1]Excreta not analyzed.

respectively; in the internal organs the values are 1.094 and 0.201 per cent, respectively. The plane of nutrition does not affect the values for nitrogen, ash and phosphorus in the internal organs with any regularity.

Skeleton.—For the composite skeleton (Table 34) we obtain no striking results for moisture, with the exception of Calf 568B, the lightest of all, which shows a high percentage of moisture, 69.63, as compared with values for the others which range from 62 to 66 per cent. Calf 22A shows an under-nourished condition as indicated in the comparatively low per cent of fat in the skeleton, 1.44. Of the Herefords the highest two results for fat are found in the high-plane group while the heaviest calf, 563A, of the medium-plane group also furnished a high result. The lowest re-

TABLE 36.—COMPOSITION OF THE KIDNEY FAT OF THE JERSEY AND HEREFORD CALVES AT BIRTH

Calves Analyzed	Moisture %	Fat %	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	25.644	69.166	0.775	.....[3]	.....[3]
Jersey Calf 22A	33.950	58.588	1.090	.....[3]	.....[3]
Average for Jersey calves	29.797	63.877	0.933	.....	.....
Hereford Calf 560B[1]	.....	.....	.....	.....	.....
Hereford Calf 562B	37.642	53.736	1.251	0.699	0.087
Hereford Calf 560D	38.561	54.676	1.091	0.505	0.091
Hereford Calf 562C	33.088	59.859	0.922	0.479	0.078
Average for Herefords (high plane)	36.430	56.090	1.088	0.561	0.085
Hereford Calf 565A[1]	.....	.....	.....	.....	.....
Hereford Calf 563A	29.546	64.293	0.873	0.425	0.076
Hereford Calf 564B	53.526[2]	39.645[2]	1.179	0.616	0.091
Hereford Calf 565B	28.864	61.917	1.362	0.605	0.121
Hereford Calf 564C	30.992	62.067	1.037	0.599	0.088
Average for Herefords (medium plane)	29.801	62.759	1.113	0.561	0.094
Hereford Calf 568B	31.659	64.260	0.809	0.386	0.091
Hereford Calf 567B	25.392	67.572	0.935	0.541	0.089
Hereford Calf 566B	45.295	47.180	0.975	0.602	0.095
Hereford Calf 568C	20.866	74.029	0.553	0.387	0.086
Average for Herefords (low plane)	30.803	63.260	0.818	0.479	0.090
Average for all Herefords	32.191	60.959	0.998	0.531	0.090

[1]Kidney fat not analyzed.
[2]Omitted from averages.
[3]Not determined.

TABLE 37.—SUM OF THE PERCENTAGES OF MOISTURE AND FAT IN THE ENTIRE ANIMALS AND IN THE SEVERAL PARTS ANALYZED

	Entire animal	Blood	Hair and hide	Composite flesh	Composinternal organs	Composite skeleton	Excreta	Kidney fat	Marrow	Lean flesh
Jersey fetus, 185 days 43X	87.164	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey fetus, 232 days 13X	81.273	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey fetus, 279 days 2X	77.576	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey Calf 11A	76.867	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jersey Calf 11B	77.351	90.847[1]	69.886	82.234	85.459	65.778	69.575	.....	.....	.....
Jersey Calf 22A, subnormal	73.981	84.432	63.957	78.870	83.053	64.562	.....	.....	.....	.....
Jersey Calf 85A, abnormal	79.067	84.937	.....	.....	.....	.....	.....	.....	.....	.....
Average for Jersey calves 2X, 11A, 11B	77.265	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hereford Calf 560B	76.381	.....	66.104	.....	.....	64.771	.....	.....	.....	.....
Hereford Calf 562B	76.190	81.065	67.638	80.057	83.893	70.153	74.410	91.378	.....	77.067
Hereford Calf 560D	75.971	.....[2]	67.073	80.681	86.043[3]	66.616	76.930	93.237	.....	.....
Hereford Calf 562C	77.783	82.351	69.034	81.439	84.475	71.677	92.181	92.947	92.111	79.758
Average for Hereford calves, high plane	76.582	81.708	67.858	80.725	84.184	68.304	81.273	92.521	.....	78.413
Hereford Calf 565A	76.529	83.202	71.165	81.062	84.696	67.610	81.125	.....	91.750	.....
Hereford Calf 563A	76.839	79.790	72.729	80.278	84.262	70.661	78.878	93.839	92.568	.....
Hereford Calf 564B	75.619	82.024	66.663	80.728	83.789	66.962	79.032	93.171	.....	.....
Hereford Calf 565B	75.804	81.961	64.696	80.817	83.866	68.908	.....	90.781	.....	79.419
Hereford Calf 564C	75.583	79.394	67.614	80.055	83.806	67.426	77.314	93.059	74.283	78.622
Average for Hereford calves, medium plane	76.075	81.274	68.573	80.588	84.083	68.314	79.084	92.713	.....	79.020
Hereford Calf 568B[4]	79.265[3]	86.842[3]	75.517[3]	83.655[3]	86.621[3]	71.929[3]	77.687[3]	95.919[3]	.....	.....
Hereford Calf 567B	76.035	83.016	67.149	81.100	83.955	68.572	81.144	92.964	80.915	79.910
Hereford Calf 566B	76.600	82.948	70.886	82.461	84.711	67.402	80.052	92.475	91.921	80.637
Hereford Calf 568C	75.319	83.547	68.482	80.118	84.713	65.923	82.914	94.895	92.784	79.076
Average for Hereford calves, low plane	75.985	83.170	68.839	81.226	84.460	67.302	80.454	93.445	.....	79.874
Average for all Hereford calves	76.221	81.930	68.269	80.800	84.217	68.057	80.398	92.875	88.047	79.213

[1]Blood sample mixed with some water. [2]Blood of this animal with the internal organs. [3]Result not included in averages. [4]Calf underdeveloped and weak.

sult for fat is furnished by the lightest calf, 568B, but this result is practically duplicated by the result from one of the heaviest calves, 565A. By considering averages of each group we see the relation of decreasing fat content with a descending plane of nutrition. Considering the average result of the groups the nitrogen percentage decreases and the ash increases as we pass from the high-plane to the low-plane groups.

Excreta.—The contents of small and large intestines, called excreta, do not show any significant results, but do indicate that the composition may vary widely from average results, as for example in the case of Calf 562C.

TABLE 38.—THE COMPOSITION OF ENTIRE BOVINE FETUS AND CALVES ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey fetus (185 days) 43X	13.034	13.837	2.205
Jersey fetus (232 days) 13X	10.739	16.981	1.976
Jersey fetus (279 days) 2X	12.198	18.117	3.068
Jersey Calf at birth 11A	12.779	17.707	2.667
Jersey Calf at birth 11B	12.989	18.932	3.258
Jersey Calf at birth 22A,[1] subnormal	13.393	17.597	3.109
Jersey Calf at birth 85A,[1] abnormal	12.200	20.398	3.635
Average for Jersey calves 2X, 11A, 11B	12.655	18.252	2.998
Hereford Calf 560B	.....[2]	16.949	2.862
Hereford Calf 562B	13.070	17.997	2.881
Hereford Calf 560D	12.836	18.421	4.091
Hereford Calf 562C	12.661	17.531	3.938
Average for Herefords (high plane)	12.856	17.725	3.443
Hereford Calf 565A	12.022	19.592	3.382
Hereford Calf 563A	12.427	18.641	2.958
Hereford Calf 564B	12.577	18.672	3.290
Hereford Calf 565B	12.639	18.851	3.277
Hereford Calf 564C	12.501	18.589	3.965
Average for Herefords (medium plane)	12.433	18.869	3.376
Hereford Calf 568B	12.241	19.552	3.318
Hereford Calf 567B	12.110	20.757	3.472
Hereford Calf 566B	12.113	23.516	4.479
Hereford Calf 568C	11.978	20.625	4.421
Average for Herefords (low plane)	12.111	21.113	3.923
Average for all Herefords	12.431	19.207	3.565

[1]Omitted from averages.
[2]Nitrogen in skeleton not determined.

Kidney Fat.—No relation seems to exist between the composition of the kidney fat (Table 36) and the plane of nutrition of the animal. The results for moisture and fat vary widely even within the same groups. Calf 564B shows a most unusual result of 53.52 per cent moisture and 39.64 per cent fat. This kidney fat was not firm but was flabby and had a slimy feel.

Moisture and Fat-Free Substance.— Consideration of the moisture and fat percentage shows that as the proportion of moisture increases the proportion of fat tends to decrease. In view of the theory that water may displace fat, or fat displace water in the tissues, this relation seems interesting. This constant value of the sum of the moisture and fat percentage appears in the data from calves of all planes of nutrition. Table 37 gives the sum of moisture and fat percentage for all the animals, for each separated part and for the animal as a whole. Each separated part has a certain value toward which the sum of the percentage of moisture

TABLE 39.—COMPOSITION OF THE BLOOD OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	15.887	4.764	0.268
Jersey Calf 22A	15.185	3.436	0.244
Average for Jersey calves	15.536	4.100	0.256
Hereford Calf 560B[1]	.....	.....	.....
Hereford Calf 562B	15.200	3.612	0.164
Hereford Calf 560D[1]	.....	.....	.....
Hereford Calf 562C	14.658	4.754	0.159
Average for Herefords (high plane)	14.929	4.183	0.161
Hereford Calf 565A	15.454	2.825	0.208
Hereford Calf 563A	15.359	2.352	0.104
Hereford Calf 564B	15.159	3.326	0.161
Hereford Calf 565B	15.688	3.808	0.194
Hereford Calf 564C	15.287	3.591	0.141
Average for Herefords (medium plane)	15.389	3.180	0.161
Hereford Calf 568B	14.820	3.184	0.197
Hereford Calf 567B	15.061	4.604	0.159
Hereford Calf 566B	14.761	4.011	0.188
Hereford Calf 568C	15.511	4.941	0.146
Average for Herefords (low plane)	15.038	4.185	0.173
Average for all Herefords	15.178	3.728	0.165

[1]Blood not obtained as a separate sample.

and fat seems to approximate for all the animals. This would accordingly indicate a corresponding constant value for the moisture and fat-free substances consisting of the nitrogen and mineral bearing part of the tissue. The values for blood in table 37 are the moisture percentages only, there being no ether extract from blood. They do not, therefore, correspond to the values for the other separated parts, which show this constant value for all conditions, more consistently than the blood. If the bodies in the blood, corresponding to the ether soluble bodies in the other tissues, had been estimated and added to the moisture percentages, the results might have been a more constant quantity. One of the interesting facts brought out by this study of the chemical composition concerns Calf 568B. All the results for moisture plus fat vary markedly from that of the other calves. Evidently the development of this calf was distinctly retarded by the low plane of nutrition to which the mother was subjected. As before stated,

TABLE 40.—COMPOSITION OF THE HAIR AND HIDE OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	16.836	2.613	0.225
Jersey Calf 22A	14.533	2.829	0.241
Average for Jersey calves	15.685	2.721	0.233
Hereford Calf 560B	14.939	2.381	0.192
Hereford Calf 562B	16.229	6.730[1]	0.207
Hereford Calf 560D	16.479	2.873	0.273
Hereford Calf 562C	16.489	3.142	0.209
Average for Herefords (high plane)	16.034	2.799	0.220
Hereford Calf 565A	16.820	5.087	0.225
Hereford Calf 563A	14.322	11.943[1]	0.226
Hereford Calf 564B	15.481	3.347	0.180
Hereford Calf 565B	15.304	6.311[1]	0.263
Hereford Calf 564C	16.195	2.822	0.182
Average for Herefords (medium plane)	15.624	3.752	0.215
Hereford Calf 568B	15.652	5.444	0.298
Hereford Calf 567B	15.570	7.984[1]	0.234
Hereford Calf 566B	15.593	3.651	0.210
Hereford Calf 568C	16.467	2.817	0.190
Average for Herefords (low plane)	15.821	3.971	0.233
Average for all Herefords	15.703	3.507	0.222

[1]Omitted from averages. Samples contaminated with some dirt.

this calf was the weakest of all those born in this experiment. Consideration of the data would seem to indicate that this calf had the composition of the fetus at less than full term, but probably farther advanced than 232 days.

Jersey Calf 22A was also a weak calf at birth. The mother was immature, and was growing steadily at the time of the birth of this calf. She had also been in milk for twelve months previously. It is not to be expected under these circumstances that she would have much of a reserve supply. The composition of this calf also shows abnormality in the departure of the moisture plus fat percentage from the values shown by normal animals.

By reducing the percentages of nitrogen, ash and phosphorus to the moisture and fat-free basis as in Tables 38 to 45, the variations in these constituents are magnified as compared with the variations on the fresh basis. No new variations are brought out by these tables which has not already been discussed from Tables 30 to 37.

TABLE 41.—COMPOSITION OF THE COMPOSITE FLESH OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	15.209	5.088	0.918
Jersey Calf 22A	17.392	4.936	0.947
Average for Jersey calves	16.300	5.012	0.933
Hereford Calf 560B[1]	.....	.....	.....
Hereford Calf 562B	14.922	5.315	0.837
Hereford Calf 560D	14.488	4.710	0.844
Hereford Calf 562C	13.997	5.296	0.927
Average for Herefords (high plane)	14.469	5.107	0.869
Hereford Calf 565A	14.025	4.832	0.892
Hereford Calf 563A	14.185	5.081	0.791
Hereford Calf 564B	14.575	4.924	0.887
Hereford Calf 565B	14.455	5.422	0.928
Hereford Calf 564C	14.000	5.174	0.923
Average for Herefords (medium plane)	14.248	5.087	0.884
Hereford Calf 568B	13.313	5.249	0.857
Hereford Calf 567B	13.963	5.687	0.915
Hereford Calf 566B	15.622	5.838	0.832
Hereford Calf 568C	13.721	5.105	0.900
Average for Herefords (low plane)	14.155	5.470	0.876
Average for all Herefords	14.272	5.219	0.878

[1]Composite flesh not obtained as a separate sample.

Table 3 is presented in order to compare successive calves from the same mother. The live weight at birth is the only figure available for this purpose. The live weights of the first calves of 560, 562, 564, 566, 567, and 568 and of the third calf of No. 560 were obtained by the courtesy of Mr. H. O. Allison formerly of the Department of Animal Husbandry of the University of Missouri. In nearly every case the first and third calf are of about the same weight and more or less heavier than the second calf. Heifer 560 and 566 show an exception—the first calf being lighter than the second.

It does appear probable that the variation between the different calves from the same mother of the high-plane group is not as great as that shown in the medium and low-plane groups. The greatest variation is shown by the calves of No. 568, the second calf weighing about one-half as much as the third calf.

While it appears from this data that the second calf is gener-

TABLE 42.—COMPOSITION OF THE COMPOSITE INTERNAL ORGANS OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	14.868	6.444	1.059
Jersey Calf 22A	13.595	6.308	1.399
Average for Jersey calves	14.231	6.376	1.229
Hereford Calf 560B[1]	.....	.....	.....
Hereford Calf 562B	13.398	7.618	1.260
Hereford Calf 560D	14.731	7.143	1.153
Hereford Calf 562C	13.237	7.021	1.353
Average for Herefords (high plane)	13.789	7.261	1.255
Hereford Calf 565A	13.297	6.985	1.359
Hereford Calf 563A	13.235	7.135	1.124
Hereford Calf 564B	13.207	6.520	1.270
Hereford Calf 565B	13.561	7.183	1.382
Hereford Calf 564C	13.486	6.916	1.346
Average for Herefords (medium plane)	13.357	6.948	1.296
Hereford Calf 568B	13.962	7.108	1.225
Hereford Calf 567B	13.586	7.703	1.433
Hereford Calf 566B	13.807	6.933	1.393
Hereford Calf 568C	12.815	6.810	1.295
Average for Herefords (low plane)	13.542	7.138	1.336
Average for all Herefords	13.527	7.090	1.299

[1]Internal Organs not obtained as a separate sample.

ally the smaller of the first three calves, there are enough exceptions to forbid calling this a rule.

SUMMARIZED DISCUSSION OF THE INDIVIDUAL CALVES

THE JERSEY CALVES

Jersey Calf 22A five days old does not show any conclusive difference in composition compared with the Jersey calves 11A and 11B obtained at birth. All of these may be considered normal calves. The first calf, 11A, was the heaviest and in conformity with the prevailing tendency shows less moisture and higher fat percentage in the entire animal than does the lighter calf, 11B. Jersey Calf 22A seems to show from the chemical analyses many indications of being a poorly nourished calf. The proportion of skeleton and internal organs to live weight is higher than for the normal Jersey calf 11B. The hide of this calf was also lighter in

TABLE 43.—COMPOSITION OF THE COMPOSITE SKELETON OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	8.825	42.777	7.492
Jersey Calf 22A	9.617	36.729	6.473
Average for Jersey calves	9.221	39.753	6.983
Hereford Calf 560B	.....[1]	40.583	6.974
Hereford Calf 562B	9.374	41.428	7.160
Hereford Calf 560D	9.331	41.172	9.630
Hereford Calf 562C	9.642	38.212	9.204
Average for Herefords (high plane)	9.449	40.349	8.242
Hereford Calf 565A	7.993	42.467	7.570
Hereford Calf 563A	9.462	39.646	7.222
Hereford Calf 564B	9.192	42.130	7.651
Hereford Calf 565B	9.018	41.959	7.764
Hereford Calf 564C	9.277	41.658	9.347
Average for Herefords (medium plane)	8.988	41.572	7.911
Hereford Calf 568B	9.746	38.691	6.900
Hereford Calf 567B	8.813	42.443	7.646
Hereford Calf 566B	7.982	47.453	9.451
Hereford Calf 568C	8.806	42.905....	9.616
Average for Herefords (low plane)	8.837	42.873	8.403
Average for all Herefords	9.053	41.596	8.164

[1]Nitrogen in skeleton not determined.

proportion to the live weight than any other calf handled in the investigation. The amount of moisture found, however, is not as high as we ought to expect from other indications. The percentage of water is high in the blood and internal organs, but about normal in the hair and hide, flesh, and skeleton. The fat in the animal, however, is very low or about one-half as much in the dry substance as in other calves of about the same plane of nutrition. The fat appears to be deficient in all parts of the animal.

The low mineral calf, 85A, shows in the percentage of constitutents but one indication of low nutrition or under development. This is the high percentage of water. The effect of low mineral diet fed to the mother resulted in the calf being defective, but the percentage of mineral found in the calf is about normal.

TABLE 44.—COMPOSITION OF THE EXCRETA OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	9.134	4.687	0.082
Jersey Calf 22A[1]	.....	.....	.....
Average for Jersey calves	.....	.....	.....
Hereford Calf 560B[1]	.....	.....	.....
Hereford Calf 562B	8.089	5.514	0.125
Hereford Calf 560D	9.389	5.115	0.563
Hereford Calf 562C	8.364	10.845	0.358
Average for Herefords (high plane)	8.614	7.158	0.349
Hereford Calf 565A	8.169	5.160	0.095
Hereford Calf 563A	8.338	5.579	0.161
Hereford Calf 564B	10.688	4.726	0.296
Hereford Calf 565B[1]	.....	.....	.....
Hereford Calf 564C	7.939	5.263	0.299
Average for Herefords (medium plane)	8.783	5.182	0.213
Hereford Calf 568B	8.362	4.571	0.179
Hereford Calf 567B	8.586	5.436	0.100
Hereford Calf 566B	8.301	5.303	0.606
Hereford Calf 568C	8.112	6.011	0.451
Average for Herefords (low plane)	8.340	5.330	0.334
Average for all Herefords	8.576	5.775	0.294

[1]Excreta not analyzed.

THE HERFORD CALVES

The live weight of the Hereford calves is not necessarily determined by the plane of nutrition of the mother. Each group shows all degrees of variation in live weight. Of the five heaviest calves, 562B and 562C are from the high plane, 565A and 563A are from the medium plane, and 566B from the low plane. The four calves of the high-plane group all show a well-nourished condition in having a high percentage of flesh to live weight of animal and relatively high percentage of fat in the entire animal.

The data on Calf 560B cannot be considered altogether reliable. The weights of the penis, testicles, and diaphragm are missing, yet the sum of all the parts as given is greater than the live weight of the calf before slaughter. The data marked with the asterisk in Table 6 may be considered unreliable, especially the

TABLE 45.—COMPOSITION OF THE KIDNEY FAT OF THE JERSEY AND HEREFORD CALVES AT BIRTH ON MOISTURE AND FAT FREE BASIS

	Nitrogen %	Ash %	Phosphorus %
Jersey Calf 11B	14.932	.....[1]	.....[1]
Jersey Calf 22A	14.607	.....[1]	.....[1]
Average for Jersey calves	14.769	.....	.....
Hereford Calf 560B[2]	.....	.....	.....
Hereford Calf 562B	14.509	8.107	1.009
Hereford Calf 560D	16.131	7.467	1.345
Hereford Calf 562C	13.072	6.791	1.106
Average for Herefords (high plane)	14.571	7.455	1.153
Hereford Calf 565A[2]	.....	.....	.....
Hereford Calf 563A	14.169	6.898	1.233
Hereford Calf 564B	17.264	9.020	1.333
Hereford Calf 565B	14.774	6.562	1.313
Hereford Calf 564C	14.940	8.630	1.268
Average for Herefords (medium plane)	15.287	7.778	1.287
Hereford Calf 568B	19.823	9.458	2.229
Hereford Calf 567B	13.288	7.688	1.264
Hereford Calf 566B	12.957	8.000	1.262
Hereford Calf 568C	10.832	7.581	1.684
Average for Herefords (low plane)	14.225	8.182	1.610
Average for all Herefords	14.705	7.836	1.368

[1]Not determined.
[2]Kidney Fat not analyzed.

data on the composite flesh. The rest of the data may be considered dependable. The experimenter who handled this calf was new to the work and did not record his data under the eye of the more experienced chemists, and it was not checked carefully as he proceeded. It is for the sake of completeness that these data are included with the others.

Of the other three high-plane calves all stand on about a level as regards proportionate amount of flesh and fat. Calf 562C shows a rather lighter hide, and heavier skeleton, than the other two calves. The high value for the internal organs of Calf 560D is due to the fact that the blood of the animal was weighed with these parts, since the animal was not bled.

Hereford Calf 563A is the heaviest calf shown in this report. This calf shows the highest proportion of hair and hide to live weight of all the Hereford calves. In flesh, organs, and skeleton, the proportion is much the same as for the other heavy calves. The chemical composition shows that this calf leads slightly in condition of fatness as compared with other calves in the medium-fed group, altho intermediate in fatness with the other four heavy calves.

Hereford Calf 564B is the lightest of the medium-fed calves and the results in many cases seem erratic and unexplainable as compared with the others in the group. The blood and the internal organs are high in weight as compared to the live weight, while the weight of flesh is proportionately rather low. The stomach and intestines of this calf weigh much more in proportion to the live weight than do the same parts of the other Hereford calves. The great length of the small intestines is one of the striking facts in the results for this calf. The most erratic result is the composition of the kidney fat which contained about 14 per cent less fat and about 16 per cent more water than the kidney fat nearest to it in composition.

All things considered, Calf 565B appears to be about the best nourished of the medium-plane group. The percentage of flesh to live weight is higher than the average value for the group. The analysis of the parts shows a high percentage of fat content especially in the flesh and skeleton. Calf 565A from the same mother is also well nourished, showing a high percentage of flesh but not as much fat as Calf 565B. Calf 564C from the same mother as 564B shows, like the latter, the great length and therefore capacity of intestinal tract. This calf was better nourished than calf 564B as is shown by the live weight and the percentage

of flesh. The flesh and skeleton, however, did not contain as much fat proportionately as Calf 565B.

All calves of the low-plane group show a high proportion of bone to live weight of animal.

Calf 568B is the lightest of all the Hereford calves and was quite weak at birth. The blood, hair and hide, internal organs, and skeleton are high in proportion to the live weight while the flesh is proportionally low. The per cent of moisture in the entire animal is high, which is the usual result found with under-developed animals. This high per cent of moisture is found to occur in every part of the animal. As has already been pointed out, the sum of the moisture plus fat percentage also indicates the normal composition of a calf some weeks before birth rather than of a calf at birth.

Hereford Calf 567B from a low plane of feeding gives about the same proportion of blood, hair and hide, flesh, and internal organs as was shown by the medium-fed calves. The effect of the low plane of feeding on this calf is seen, however, in the high proportional weight of skeleton to live weight; also in the low percentage of fat in the composition of the animal taken as a whole.

Hereford Calf 566B tho also from the low-plane group is one of the heaviest calves obtained in the experiment. His thriftiness is also indicated by his high proportion of flesh to his live weight. He does not show, however, the presence of much fat in any part. He was a large-boned calf as is evident by the high proportion of skeleton to live weight and the high percentage of mineral matter in the animal taken as a whole.

GENERAL SUMMARY

DIFFERENCES DUE TO BREED

Jersey and Hereford calves at birth show some differences in weights of parts into which the animals were divided for analysis. The weights of the stomachs and intestines and consequently of the internal organs as a whole, of the Jersey calves, are a higher percentage of the live weight of the animal than in the case of the Hereford calves. The weight of the hair and hide and possibly of the skeleton of the Hereford calves is higher in proportion to the live weight than in the case of the Jersey calves. There is no apparent difference in chemical composition due to breed.

DIFFERENCES DUE TO PLANES OF FEEDING

This could be studied only with the Hereford calves. The thriftiness of the calves born in this experiment seem to depend upon the condition of the mother, and the condition of the mother may or may not have been affected by her feeding when the calf was produced. Calves of full weight at birth were produced from all three groups representing the three planes of feeding. From the high plane of feeding, there were three calves of full live weight and one of medium weight; from the medium plane of feeding were obtained three calves of full live weight and two of medium weight; from the low plane, one calf of full live weight, two of medium weight and one of low weight. The average of these results show that the live weight of calves at birth from the high and medium planes of nutrition were practically the same, the high plane being slightly heavier. The low-plane calves average appreciably lower than the medium-plan calves.

As regards the separated parts, the proportion of flesh decreases and the proportion of skeleton and internal organs increases as we pass from the high plane to the low plane of nutrition.

Considering the average composition of the calves, the proportion of fat and nitrogen decreases and the proportion of moisture, ash, and phosphorus increases as we pass from the high plane to the low plane of nutrition. Most of the fat of the new-born calf is found with the internal organs; the flesh and the skeleton contain some also but in small proportions. The sum of the percentages of moisture and fat, and consequently the percentage of moisture and fat-free substance, tends to a constant value, in new-born calves of normal thrift, regardless of the plane of feeding of the mother.