MISSOURI

Agricultural College Experiment Station.

BULLETIN NO. 25.

AN ENQUIRY
INTO THE
COMPOSITION OF THE FLESH OF CATTLE.

COLUMBIA, MISSOURI.

APRIL, 1894.

E. W. STEPHENS, Printer, Columbia, Mo.

THIS BULLETIN, not written for general circulation, is sent to Experiment Stations, the Department of Agriculture at Washington and to such chemists and scientific men as may apply for it.

The conclusions of the trial are given in Bulletin 24, which is intended for general circulation and sent to every person on our mailing list. Write for it.

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INTRODUCTORY.

In carrying out the objects of the organization of an "Agricultural Experiment Station," we cordially invite the co-operation of all persons interested in its success. Suggestions as to lines of experimental work, problems to be solved. inquiries relating to agriculture, horticulture, stock, and the dairy will be cheerfully received and answered as far as possible; but no work will be undertaken unless of public value, and the results of which we are at liberty to use for the public good.

Specimens of grains and grasses; seeds of fruit and forest trees; vegetables, plants and flowers that are true to name; varieties of beneficial and injurious insects; samples of mineral waters and ores, and whatever may illustrate any department of agriculture will be gladly received and due acknowledgments made in annual reports. Directions for collecting, packing and shipping such specimens will be furnished on application.

Bulletins will be issued at least quarterly, giving the results of experimental work as fast as completed, together with such suggestions and information as may be thought valuable to the farmers of Missouri.

The bulletins and reports of this Station are sent free to every citizen of Missouri who applies for them. Copies are sent as soon as issued to every newspaper in the State, to every Grange, Farmers' Alliance or other agricultural organization whose address can be obtained. Bulletins and reports are also sent to the leading agricultural papers of the country, and will be sent to *any* paper that may desire to exchange.

Letters relating to any special line of work should be directed to the officer in charge of that division, but all general correspondence relating to the work of the Station should be addressed to

EDWARD D. PORTER,
Director of Experiment Station.

COLUMBIA, Boone County, Mo.

AN ENQUIRY INTO THE COMPOSITION OF THE FLESH OF CATTLE.

P. SCHWEITZER, *Chemist.*

The present paper is part of an experimental investigation undertaken with a view of deciding in how far breed and feed enter into the cost of production and quality of the flesh of cattle. The history and conclusion of the trial as found in Bulletin Number 24, though designed especially to answer the practical questions of the farmer and stock raiser, are, in a measure, introductory to this Bulletin and give it completion. Considerable material, the result of faithful and diligent work in other directions, may, at a later time, be drawn upon for further illustration of the points at issue.

When the termination of the feeding tests made a systematic and uniform plan of work for the chemical part of the investigation necessary, to master the immense amount of labor which the reception and preparation of so large a number of samples of rapidly changing material demanded, the meagre provision in facilities and assistance at the command of the chemist made it not only difficult to carry out the original design in the proper manner but compelled subsequently an abandonment of part of the work originally contemplated.

Not only the flesh of the experimental animals, but also their blood, bones and fat, together with their

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Not only the flesh of the experimental animals, but also their blood, bones and fat, together with their

excrements, were intended to be investigated, and samples of each were sent to the laboratory; the analyses of the latter, that is of blood, bones, fat and excrements could, however, not be executed at the proper time, and subsequent investigation would have resulted in no satisfactory conclusion regarding their composition and meaning. They do, therefore, not appear in connection with the work here given and are, besides, of comparatively little importance in answering *the main enquiry of the trial, which was to determine the percentage and quantity of fat in the body of each of the animals under experiment.* It seems proper to give the following memoranda copied from the laboratory diary:

LABORATORY DIARY.

Jan. 23, 1891, 16 samples of excrements; 5 samples of feed.
Jan. 24, 1891, 20 samples of excrements.
Jan. 25, 1891, 16 samples of excrements.
Jan. 26, 1891, 24 samples of excrements.
Jan. 27, 1891, 20 samples of excrements; 5 samples feed; *3 samples blood.*
Jan. 28, 1891, 20 *samples of flesh.*
Feb. 2, 1891, 8 *samples of flesh.*
Feb. 3, 1891, 12 *samples of flesh.*
Feb. 5, 1891, 3 *samples of flesh.*
Feb. 7, 1891, 18 *samples of flesh.*
Feb. 9, 1891, 3 *samples of flesh.*
Feb. 10, 1891, 8 *samples of flesh.*
Feb. 11, 1891, 15 *samples of flesh.*
Feb. 16, 1891, 16 samples of excrements.
Feb. 17, 1891, 16 samples of excrements; 2 *samples of bones.*
Feb. 18, 1891, 16 samples of excrements; 4 samples of feed.
Feb. 19, 1891, 16 samples of excrements; 1 sample of feed.
Feb. 20, 1891, 16 samples of excrements; 1 *sample of blood.*
Feb. 21, 1891, 7 *samples of flesh.*
Feb. 23, 1891, 11 *samples of flesh.*
Feb. 24, 1891, 8 *samples of flesh.*
Feb. 25, 1891, 12 *samples of flesh.*
Feb. 26, 1891, 1 *sample of fat.*
Feb. 27, 1891, 8 *samples of flesh.*
Feb. 28, 1891, 12 *samples of flesh.*

March 2, 1891, 1 *sample of fat.*
March 3, 1891, 12 *samples of flesh.*
March 4, 1891, 12 *samples of flesh.*
March 5, 1891, 9 *samples of flesh; 6 samples of fat.*
March 6, 1891, 12 *samples of flesh.*
March 9, 1891, 12 *samples of flesh; 1 sample of fat.*
March 11, 1891, 13 *samples of flesh.*

From January 23 to March 11, 1891, there were received the following:

179 samples of excrements.
15 samples of feed.
230 samples of flesh, fat, etc.

Of these were disposed of:

180 samples of flesh, analyzed.
2 samples of flesh, lost by accident.
48 samples of flesh, fat, blood, bone not tested.

From March 11, 1891, to February 13, 1892, the analyses of the previously mentioned samples of flesh were conducted. During this time there were received, in addition, and analyzed:

82 samples of beet juice; double polarization.
146 samples of soil; water determination.

From February 13 to March 28, 1892, the analytical data reported by the assistant chemist were examined and, at the latter date, returned to him with specifications for recalculation and rearrangement.

From February 13 to December 31, 1892, the work of recalculation proceeded, interrupted by the receipt and analysis of the following:

4 samples of feed.
92 samples of milk; fat determination.
2 samples of cream; fat determination.
2 samples of skimmed milk; fat determination.
2 samples of buttermilk; fat determination.
1 sample of butter; determination of water.
89 samples of soil; water determination.
90 samples of beet juice; double polarization.
109 samples of sorghum juice; double polarization.
5 samples of potatoes; water determination.

December 15, 1892, recalculation finished and data placed in the hands of the chemist.

It was plain that under the circumstances suggested the analyses could not be made immediately on receipt of the samples, but had to be deferred till later, while the samples themselves had to undergo such a preliminary treatment, as would preserve them unaltered by air and bacterial life and, at the same time, offer a reliable basis upon which to rest the results of subsequent analytical work.

The points, then, to be reached were, first, *to obtain a sample that would represent the average composition of the whole cut or organ*, and second, *to dry it quantitatively without loss or sensible change up to the point where it could be preserved without fear of alteration.*

The first point, *to obtain an average sample*, was no easy matter. The question was not to ascertain the composition of lean meat, but of a cut of beef weighing perhaps a hundred pounds or more, and interlaced with visible layers and patches of fat that in many instances exceeded half its weight. Without dwelling longer on the attempts to overcome the difficulties incident to securing a representative sample, suffice it to say that the plan finally adopted was to put the samples of a pound each through a sausage cutter and to repeat the operation at least three times. The mass was then still further mixed with a spoon and 100 grams of it taken for drying and subsequent analysis.

A smaller quantity than 100 grams, excepting where lack of material necessitated it, did not appear safe to estimate the water on, as will be plain by comparing the percentages thus obtained with those derived from drying at the same time two grams, till no further loss was experienced. The differences, now

above and then below, are plainly due to differences in the composition of the samples, and the larger quantity of flesh taken approaches doubtlessly nearer to the real composition of the whole than does the two grams.

The point, *to dry partially without alteration or loss*, was complicated by the fact of the samples reaching the laboratory in such large numbers and containing each so large a quantity of fat. The drying had to be done quickly and at low temperatures; quickly, to get the samples out of the way and to reduce the chances of alteration, and at low temperatures to prevent the fat from separating from the meat by melting and thereby complicate all subsequent operations. The method finally adopted consisted in drying by hot air, beginning with a temperature of 30 degrees C. and increasing it gradually to 60 degrees C.; this required from twelve to twenty-four hours, depending upon the number of samples in the oven, and was fairly satisfactory. A difficulty arising from sudden alterations of the gas pressure and beyond the control of the station, by which the temperature of the oven might rise unnoticed 10 and 15 degrees above the points fixed upon, made, after the first batch of samples, a deviation necessary; it consisted in cutting off all visible fat from the samples received and, after weighing it and the lean meat separately, operate only with the latter; the work became thereby more simple and satisfactory and the results more reliable.

To determine practically, however, the manner of operation as well as the degree of accuracy attainable by it, an analysis along the lines suggested was undertaken in December, 1890, in triplicate, and the results submitted to the association of Official Agricultural Chemists at their eighth annual meeting for criticism and suggestion; none were offered and the main points,

as necessary to properly estimate the character of the work here given, are copied from the report of the proceedings.(*)

Meat Analysis; Testing of Apparatus and Method.

The oven was a simple sheet iron affair, forty-four inches high and six inches square, furnished with ten removable, heavily galvanized, wire-gauze trays. It was heated by a supply of hot air conducted through two copper tubes, one on each side, into a shallow chamber at the bottom, from which the heated air passed successively through the perforated trays into the chimney at the top, which could be lengthened to two feet or more to increase the draft. The apparatus worked very satisfactorily, the temperatures indicated below being respectively those of the top and of the bottom shelf.

The lean meat of a beefsteak was put several times through a sausage cutter, well mixed, and three portions weighed off—two on watch glasses, the third on the screen of the drying oven direct—and carefully dried at low temperatures, and weighed from time to time. The results were as follows:

(*) U. S. Department of Agriculture, Division of Chemistry, Bulletin No. 31, 1891.

(The loss by drying is indicated in grams (gr.) and per cent.)

		Temperat'e. Deg. C.	1 Watch Glass.	2 Watch Glass.	3 Screen.
Original weight of support and meat		..	129.8 gr.	81.2 gr.	111.4 gr.
Weight of support		..	29.8 gr.	31.2 gr.	61.4 gr.
Weight of meat		..	100.0 gr.	50.0 gr.	50.0 gr.
First hour—	Top shelf	38	4.6 gr.	2.6 gr.	5.3 gr.
	Bottom shelf	53	4.6 p.c.	5.2 p.c.	10.6 p.c.
Second hour—	Top shelf	38	3.0 gr.	1.8 gr.	6.1 gr.
	Bottom shelf	53	3.0 p.c.	3.6 p.c.	12.2 p.c.
			7.6 p.c.	8.8 p.c.	22.8 p.c.
Third hour—	Top shelf	38	2 4 gr.	1.5 gr.	3.8 gr.
	Bottom shelf	50	2.4 p.c.	3.0 p.c.	7.6 p.c.
			10.0 p.c.	11.8 p.c.	30.4 p.c.
Fifteenth hour—	Top shelf (over n't)	39	15.5 gr.	8.2 gr.	14.4 gr.
	Bottom shelf	52	15.5 p.c.	16.4 p.c.	28.8 p.c.
			25.5 p.c.	28.2 p.c.	59.2 p.c.
Sixteenth hour—	Top shelf	42	2.5 gr.	1.3 gr.	1.1 gr.
	Bottom shelf	55	2.5 p.c.	2.6 p.c.	2.2 p.c.
			28.0 p.c.	30.8 p.c.	61.4 p.c.
Seventeenth hour—	Top shelf	47	2.3 gr.	1.5 gr.	0.8 gr.
	Bottom shelf	59	2.3 p.c.	3.0 p.c.	1.6 p.c.
			30.3 p.c.	33.8 p.c.	63.0 p.c.
Eighteenth hour—	Top shelf	42	1.9 gr.	1.2 gr.	0.8 gr.
	Bottom shelf	51	1.9 p.c.	2.4 p.c.	1.6 p.c.
			32.2 p.c.	36.2 p.c.	64.6 p.c.
Nineteenth hour—	Top shelf	39	2.1 gr.	1.1 gr.	0.5 gr.
	Bottom shelf	51	2.1 p.c.	2.2 p.c.	1.0 p.c.
			34.3 p.c.	38.4 p.c.	65.6 p.c.
Twentieth hour—	Top shelf	42	1.8 gr.	0.9 gr.	0.3 gr.
	Bottom shelf	53	1.8 p.c.	1.8 p.c.	0.6 p.c.
			36.1 p.c.	40.2 p.c.	66.2 p.c.
Thirty-second hour—	Top shelf (over n't)	35	15.2 gr.	7.0 gr.	1.3 gr.
	Bottom shelf	51	15.2 p.c.	14.0 p.c.	2.6 p.c.
			51.3 p.c.	54.2 p.c.	68.8 p.c.
Thirty-third hour—	Top shelf	44	2.9 gr.	1.5 gr.	0.3 gr.
	Bottom shelf	64	2.9 p.c.	3.0 p.c.	0.6 p.c.
			54.2 p.c.	57.2 p.c.	69.4 p.c.
Thirty-fourth hour—	Top shelf	43	1.8 gr.	0.6 gr.	.....
	Bottom shelf	63	1.8 p.c.	1.2 p.c.	.....
			56.0 p.c.	58.4 p.c	69.4 p.c.

		Temp'r.. Deg. C.	1 Watch Glass.	2 Watch Glass.	3 Screen.
Thirty-fifth hour—	Top shelf.....	45	2.0 gr.	0.9 gr.	0.1 gr.
	Bottom shelf.....	64	2.0 p.c.	1.8 p.c.	0.2 p.c.
			58.0 p.c.	60.2 p.c.	69.6 p.c.
Thirty-sixth hour—	Top shelf.....	41	1.4 gr.	0.5 gr.	0.1 gr.
	Bottom shelf.....	57	1.4 p.c.	1.0 p.c.	0.2 p.c.
			59.4 p.c.	61.2 p.c.	69.8 p.c.
Thirty-seventh hour—	Top shelf.....	43	0.8 gr.	0.4 gr.	0.1 gr.
	Bottom shelf.....	63	0.8 p.c.	0.8 p.c.	0.2 p.c.
			60.2 p.c.	62.0 p.c.	70.0 p.c.
Thirty-eighth hour—	Top shelf.....	47	1.0 gr.	0.3 gr.	.....
	Bottom shelf.....	52	1.0 p.c.	0.6 p.c.	.....
			61.2 p.c.	62.2 p.c.	70.0 p.c.
Forty-sixth hour—	Top shelf (over n't)	39	6.0 gr.	1.7 gr.	0.2 gr.
	Bottom shelf.....	60	6.0 p.c.	3.4 p.c.	0.4 p.c.
			67.2 p.c.	66.0 p.c.	70.4 p.c.
Weight of dried meat (a)			32.8 gr.	17.0 gr.	14.8 gr.
Weight of powdered meat (b)			31.5 gr.	16.2 gr.	14.6 gr.
Loss by transfer and powdering			1.3 gr.	0.8 gr.	0.2 gr.
Weight of water in 2 grs. of b at 110 deg. C.			0.2001	0.1782	0.0410
Per cent. of water in b			10 00	8.91	2 05
Weight of water for total weight of a...			3.28	1.50	0.30
Total per cent. of water in fresh meat....			70.48	69.00	71.00
Weight of fat in 2 grs. of b.....			0.4022	0.4166	0.4182
Weight of fat for total weight of a.			6.5960	3.5411	3.0946
Per cent. of fat in fresh meat.....			6.60	7.08	6.19
Weight of nitrogen in 2 grs. of b.....			0.2045	0.2087	0.2291
Weight of nitrogen for total weight of a..			3.3538	1.7739	1.6953
Total weight of albuminoids from this val'e			20.9612	11.0869	10.5956
Per cent. of albuminoids in fresh meat...			20.96	22.17	21.19
Per cent. composition of meat—					
Fat.....			6.60	7.08	6.19
Albuminoids.....			20.96	22.17	21.19
Water.....			70.48	69.00	71.00
Loss (ash, etc.)			1.96	1.75	1 62
			100.	100.	100.
P. c. composition of meat fibre (lean m't)—					
Albuminoids			22.93	24.32	22.99
Water.....			77.07	75.68	77.01
			100.	100.	100.

The results are satisfactory and agree very well, excepting in No. 2, where the deviation is explainable. Intending to use three times 100 grams of meat the supply, after cutting, was found to be insufficient; 50 grams was then taken for No. 2 and 3, but even this amount fell short in No. 2, which was weighed last, so that the portions remaining in the sausage cutter and containing some lumpy and cartilaginous matter had to be used to make up the 50 grams. (So far the report.)

This, then, was the plan to be pursued, excepting that it was extended as the study of results made it desirable.

1. The Mode of Drying.

It is plain that drying on watch glasses was impracticable on account of the length of time it would take, even if only 50 grams were taken for experiment; the open screen was, therefore, adopted and proved convenient and expeditious. The weighed meat was spread with a pair of pincers and a glass rod loosely over its surface, so as neither to be in large lumps nor to close up the meshes and impair the draught, and placed on the top shelf in the oven; at the end of an hour all screens were lowered one notch and a fresh sample put on top, so as to have the drying finished in about 10 hours. During this hourly change inspection of the samples indicated the proper time for deftly and carefully lifting every particle of meat from the screen and redepositing it again lightly to prevent adherence to the wires of the screen of the meat fibers whose brittleness, when fully dried, would render removal difficult and occasion loss of material, which would affect the composition of the meat as derived from that of the sample.

The preparation of the samples, involving in nu-

merous instances the removal of fat and weighing it and the lean meat separately, putting the latter a number of times through the sausage cutter, mixing it and weighing out 100 grams and 2 grams for immediate and direct water determination, getting rid of the surplus and weighing, removing and bottling the dry sample from the lowest screen, took often more than one hour and, with the unreliable gas supply already mentioned, made the execution of the plan, so far as strict division of time was concerned, dependent upon circumstances. All screens being numbered, error from interchange of samples was avoided and the weights of the dried meats, marked (a) in the tables, may be accepted as exact. In bottling them, portions adhered in a few instances so firmly to the wires that they were not removed, which appears in the tables and will be readily understood.

The dried meats were placed quickly and carefully into light flasks of known weight and weighed immediately after bottling, as again later on just before pulverizing; the differences between these two weights, though apart in time from two to nine months, were inconsiderable in every case and the tables record only the latter. The pulverizing of the meats was a comparatively easy matter. When of the proper degree of dryness, the mass was brittle and, excepting in the few cases in which no fat had been previously cut off, a fairly fine and uniform powder was easily obtained. The operation was performed rapidly and thoroughly in a dry and warm, but not hot, mortar and, neglecting the few particles that had jumped out and upon the floor, the pulverized material was returned to the bottles and weighed again; it is marked (b) and all details, worth recording here, appear in the tables

Certain explanations and discussions in the execution of the plan are deemed necessary.

2. The Determination of Water.

Two independent water determinations were made, the one immediate and continuous, with two grams of fresh meat, the other interrupted or in two stages with 100 grams of meat, in which to estimate subsequently fat and nitrogen. The 2 grams of meat were heated in a watch glass at low temperatures till nearly dry and then at 105 degrees C., to constant weights; an increase at this period was taken to indicate attainment of dryness with beginning oxidation, and occurred a number of times; in these cases the lowest weight was judged to be the correct one and is always recorded.

The two values thus obtained disagree considerably; those from the smaller quantity of meat (2 grams) at times exceed, and then again fall below, the values from the 100 gram sample, and the differences might well be suspected to be systematic irregularities and amenable to explanation; for reasons, however, which it is not necessary here to give, the percentages of water obtained in a more indirect manner from the 100 gram sample are those upon which the calculations for the composition of the flesh of the animals rest. For easier comparison and critical examination the two classes of values are subjoined here in a special table.

WATER DETERMINATION. CUTS.

(Values are percentages.)

a. (2 grams give a *higher* value than 100 grams.)

No.	2 Grams.	100 gr's.	diff'ce.	No.	2 grams.	100 gr's.	diff'ce.
304	68.60	68.43	0.17	287	59.70	59.54	0.16
308	61.14	60.59	0.55	288	67.51	66.33	1.18
310	67.31	65.57	1.74	290	63.84	63.18	0.66
312	69.46	69.37	0.09	292	71.85	71.65	0.20
186	69.25	68.70	0.55	156	65.12	64.39	0.73
188	69.96	69.35	0.61	364	67 15	66.79	0.36
189	67.35	66.83	0.52	365	64.79	64.21	0.58
191	56.71	56.13	0.58	366	68.54	68.49	0.05
192	69.83	68.54	1.29	367	68.78	68.01	0.77
193	66.10	66.00	0.10	372	67.36	66.67	0.69
325	66.84	65.90	0.94	370	67 47	67.13	0.34
326	67.05	66.75	0.30	373	70.98	70.14	0.84
327	68.59	68.31	0.28	164*a*	53.75	52.88	0.87
328	69.48	66.78	2.70	165	65.90	65.71	0.19
330	56.84	55.48	1.36	168	70.15	69.44	0.71
334	70.33	69.40	0.93	170	62.16	62.08	0.08
263	67.40	66.84	0.56	342	67.80	67.51	0.29
264	66.23	64.58	1.65	344	69.58	69.08	0.50
266	64.20	64.03	0.17	345	63.22	63.22	0.00
268	63.61	63.36	0.25	348	50 22	50.18	0.04
269	66.74	64.30	2.44	349	56.45	56.29	0.16
283	68.72	68.42	0.30	44 sam.	2894.42	2866.20	28.22
285	70.36	69.62	0.74	average.	65.78	65.14	0.64

b. (2 grams give a *lower* value than 100 grams.)

No.	2 grams.	100 gr's.	diff'ce.	No.	2 grams.	100 gr's.	diff'ce.
208	65.93	67.10	1.17	187	67.85	68.69	0.84
209	68.15	68.34	0.19	190	57.46	58.40	0.94
210	68.34	68.63	0.29	194	60.76	61 08	0.32
212	56.18	57.15	0.97	195	68.54	69.20	0.66
213	56.75	58.52	1.77	329	53.67	56.75	3.08
214	57.83	58.14	0.31	331	51.88	51.99	0.11
215	65.67	66.30	0.63	332	61.00	61.65	0.65
216	65.37	65.55	0.18	333	70.10	70.22	0.12
217	69.30	69.31	0.01	265	68.48	68.87	0.39
303	64.50	65.20	0.70	267	63.40	64.20	0.80
305	69.96	71.74	1.78	270	62.80	65.21	2.41
306	68.35	68.77	0.42	272	72.33	72.75	0.42
307	49.48	51.87	2.39	271	68.67	69.87	1.20
309	55.04	56.27	1.23				
311	67.40	67.80	0.40				

No.	2 grams.	100 gr's.	diff'ce.	No.	2 grams.	100 gr's.	diff'ce.
284	65.11	65.46	0.35	166	62.97	63.03	0.06
286	72.85	72 95	0.10	169	61.11	62.17	1.06
289	60.52	61.61	1.09	171	57.53	58.24	0.71
291	64.54	65.21	0.67	172	51.87	53.71	1.84
147	44.15	46.97	2.82	173	68.35	68.42	0.07
148	44.33	45.67	1.34	174	67.03	67.48	0.45
149	57.57	58.35	0.78				
150	58.15	58.29	0.14	342	58.42	59.48	1.06
151	45.78	47.51	1.73	346	51.30	52.69	1.39
152	45.48	46.11	0.63	347	51.90	22.01	0.11
154	57.28	57.78	0.50	350	68.20	68.73	0.53
155	54.45	54.58	0.13	351	68.09	69.30	1.21
368	61.92	62.61	0.69	54 sam.	3289.62	3336.41	46.79
369	54 65	56.44	1.79	average.	60.92	61.78	0.86
371	60.88	62.04	1.16				

WATER DETERMINATION. ORGANS.

a. (2 grams give a *higher* value than 100 grams.)

No.	2 grams.	100 gr's.	diff'ce.	No.	2 grams.	100 gr's.	diff'ce.
203	77.02	76.23	0 79	374	75.42	75.00	0.42
185	75.42	75.29	0.13	141	75.12	74.75	0.37
320	70.42	69.91	0.51	163	76.91	75.72	1.19
278	76.96	76.89	0.07	340	77.11	76.89	0.22
361	78.10	76.57	1.53	256	80.89	78.35	2.54
160	79.36	78.83	0.53	275	77.18	77.02	0.16
341	77.58	77.31	0.27	143 143*a*	78.81	76.55	2.26
182	77.91	77.88	0.03	357	63.42	62.44	0.98
162	78.49	78.04	0.45	158	79.33	79.05	0.28
319	69.16	68.64	0.52	206	74.22	74.04	0.18
159	69.95	69.20	0.75	296	79.64	79.57	0.07
184	76.43	76.06	0.37	181	76.79	75.93	0.86
321	77.49	77.44	0.05	144 145	77.50	75.85	1.65
196	79.92	79.05	0.87	164	71.89	70.33	1.56
323	75.77	74.55	1.22	336	76 80	75.34	1.46
273	78.62	77.23	1.39	32 samp.	2433.04	2407.60.	25.44
153	73 41	71.65	1.76	average.	76 03	75.24	0.79

b. (2 grams give a *lower* value than 100 grams.)

No.	2 grams.	100 gr's.	diff'ce.	No.	2 grams.	100 gr's.	diff'ce.
301	79.68	79.89	0.21	161	76.95	77.05	0.10
138	78.33	78.44	0.11	339	71.89	72.90	1.01
259	76.04	76.83	0.79	207	76.92	77.48	0.56
202	79.06	79.55	0.49	302	74.53	75.93	1.40
300	78.29	78.91	0.62	282	76.73	78.30	1.57
318	78.69	79.11	0.42	175	76.24	76.97	0.73
260	78.26	79.29	1.03	353	77.57	77.77	0.20
279	79.55	79.76	0.21	204	75.40	76.68	1.28
142	78.51	78.70	0.19	298	78.68	78.69	0.01
359	78.63	78.86	0.23	179	76.67	76.84	0.17
337	78.48	78.90	0.42	317	77.66	79.44	1.78
200	67.71	68.75	1.04	262	76.20	77.26	1.06
297	70.14	71.20	1.06	280	76.71	77.83	1.12
183	67.74	68.01	0.27	358	77.12	79.19	2.07
258	68.69	68.88	0.19	205	79.09	81.19	2.10
277	71.72	72.11	0.39	295	76.70	77.48	0.78
140	69.33	69.60	0.27	180	74.21	76.31	2.10
362	70.07	70.33	0.26	315	76.70	76.82	0.12
338	67.18	67.49	0.31	335	70 40	71.15	0.75
201	76.17	76.56	0.39	316	71.35	71.48	0.13
299	76.51	77.93	1.42	257	77.23	79.58	2.35
261	73.34	74.68	1.34	276	74.55	76.26	1.71
281	74.92	76.63	1.71	356	73.36	74.24	0.88
139	75.12	76.16	1.04	48 samp.	3610.37	3649.39	39.02
360	75.35	75.98	0.63	average.	75.22	76.03	0.81

3. The Determination of Fat.

The dried and pulverized meat (b) was the material in which fat was determined in the usual way by the usual apparatus and with the usual solvent. Two determinations were made for each sample, using each time 2 grams of material, the one after complete drying (it had in fact served for the determination of water), and the other as it came direct from the bottle. The extraction lasted about eight hours, and the residues, enclosed in fat and nitrogen free filtering papers, were used subsequently for nitrogen determinations, and are respectively marked (d) and (c).

The two sets of figures agree closely with a preponderance, perhaps, of larger weights from the incompletely dried materials; but it was thought best not to employ averages for expressing the composition of the original meats, and the larger of the two values is invariably chosen as more nearly correct.

The fat was determined directly, drying in air on account of other facilities being absent, but some indirect determinations, chiefly for comparison were made and are recorded. In these, allowance is, of course, made where necessary for the water contents of the oven-dried meat (b).

COMPARISON OF DIRECT AND INDIRECT DETERMINATION OF FAT.

(Number of grams of fat from 2 grams of substance.)

	Number	Fat, direct.	Fat, by loss.	Difference.	Number	Fat, direct.	Fat, by loss.	Difference.
Preliminary Trial.	1	0.4022	0.4116	0.0094	170	0.8022	0 8070	0.0048
	2	0.4166	0.4174	0.0008	174	0.5940	0.6010	0.0070
	3	0.4182	0.4264	0.0082	193	0.7194	0.7440	0.0246
	140	0.1790	0 2112	0.0322	195	0.5202	0.5420	0.0218
	153	0.7506	0.7574	0.0068	210	0.5354	0.5654	0.0300
	184	0.3556	0.3654	0.0098	213	1.0238	1.0504	0.0266
	279	0.1752	0.1924	0.0172	283	0.5724	0.5854	0.0130
	279	0.1600	0.1784	0.0184	(This and 283 extracted after complete drying.)			

The indirect determination of fat gives in every instance higher values than the direct determination. This was found to be a fact in a former and very elaborate examination of the methods of feeding stuff analysis made at this station some six years ago, where the numerous series of experiments seemed to prove that:

1. The materials examined increase in weight from incipient oxidation, at elevated temperatures, toward and after complete dryness.

2. This occurs whether the substance contains fat or is free from it.

3. The increase in weight is greater for the fat than for the substance from which it has been separated.

4. The fat volatilizes to a certain extent by heating, causing a loss in weight which exceeds the gain from oxidation.

4. The Determination of Nitrogen.

The "Kjeldahl" was the method employed for the estimation of nitrogen, for which three separate and independent analyses were made of each sample; 2 grams of the dried meat (b), as also the residues from the extraction of fat, marked (c) and (d) were taken for digestion and, though the presence of fat demanded at the beginning much attention, all three determinations could be completed in most cases, so that but few of the large number were lost by frothing or the breaking of flasks. The standard solutions were volumetrically equal, and 1 cube centimeter of acid, with cochenille as indicator, equivalent to 7 millegrams of nitrogen.

All related values agree closely; neither the removal of fat nor the complete drying of the sample before extraction appear to affect the result; but, as was done in the case of fat, the highest of the three values was here also preferred to their average and appears in the calculations to obtain the true composition of the flesh analyzed.

5. The Analytical Data.

In presenting the analytical data, the intention of the writer has been to submit such details, as will enable the competent critic to form a correct opinion of the value of the methods selected and of the perform-

ance of the work done; for obviously, only when these are pronounced trustworthy can the calculated results claim general acceptance as correct expressions of the composition of the flesh analyzed, which was in reality the problem submitted to the chemist for decision. Defects appear, it is true, caused mainly by the conditions under which the investigation had to be made, yet the final results of the analytical work, their combination and interpretation are published with entire confidence and some degree of pride in a work which after many delays, finds at last a successful conclusion.

The parts of the animal body to be submitted for analysis were stated in the directions given by Dr. Porter, the director of the station, to the assistant in charge of the killing, as follows:

"No. 19. Cut sections of about one pound weight, for chemical analysis from each of the following:

(*a*) At the joints, cutting in every case from the "rump" side, numbered 1, 2, 3, 7, 8, 9, 10, 12, 13, 14.

(*b*) From the centres of heart, liver, lungs, kidneys and spleen.

(*c*) From the stomach, intestines and brain."

The directions drawn up with much circumspection and knowledge, provided for additional samples, which, as already stated, could not be touched through lack of proper assistance and facilities. The position of the cuts on the animal body is indicated on the diagram.

TABLE I.

FLESH OF SANBORN, SHORTHORN STEER;

(The figures represent weights in grams,

Laboratory number	208	209
Number of cut	No. 1	No. 2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	33.7	32.1
Loss by drying (water)	66.3	67.9
Weight of meat placed in bottle for subsequent analysis	33.6688	32.5118
Loss by adherence to screen	0 0312	+0.4118
Weight of meat just before pulverizing	34.0094	33.0900
Loss or gain during interval (water)	+0.3406	+0 5782
Weight of this calculated for (a)	+0.34	+0.99
Weight of meat after pulverizing (b)	33.8694	33.0500
Loss during operation	0.1400	0.0400
Total gain or loss	+0.1694	+0.95
Weight of water in 2 grams of (b)	0.0570	0.0840
Per cent. of water in (b)	2.85	4.20
Weight of water for total weight of (a)	0.9653	1.3881
Total per cent. of water in fresh meat, *calculated*	67.10	68.34
Actual per cent. of water found at time in 2 grams	65.93	68.15
Weight of fat in 2 grams of (b) without further drying (c)	0.6636	0.4872
Weight of fat in 2 grams of (b) after complete drying (d)	0.6632	0.4864
Difference for or against complete drying	0.0004	0.0008
Weight of fat for total weight of (a) from highest value	11.2379	8.0510
Per cent. of fat in fresh meat	11.24	8.05
Weight of nitrogen in 2 grams of (b)	.....	0.2083
Weight of nitrogen in (c)	0.1828	0.2027
Weight of nitrogen in (d)	0.1831	0.2062
Weight of nitrogen in total weight of (a) from highest value	3.1007	3.4422
Weight of albuminoids from this value	19.3794	21.5137
Per cent. of albuminoids in fresh meat	19.38	21.51

TABLE I.—CONTINUED.

AGE, 1008 DAYS; LIVE WEIGHT, 1712 POUNDS.

excepting where percentages are mentioned.)

210	211	212	213	214	215	216	217
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	not rec'd.	100.	100.	100.	100.	100.	100.
31.9	.....	43.6	42.7	43.7	35.0	35.6	32.2
68.1	....	56.4	57.3	56.3	65.0	64.4	67.8
32.1162	.....	42.1848	41.7458	42.7748	34.2882	35.3918	31.8108
+0.2162	.....	1.4152	0.9542	0.9252	0.7118	0.2082	0.3892
32.1482	.....	42.2692	41.7800	42.7830	34.2882	35.8432	31.8898
+0.0320	.....	+0.0844	+0·0342	+0.0082	+0.0002	+0.4514	+0.0790
+0.25	.....	+0.09	+0.03	+0.01	.. . .	+0.45	+0.08
31.8342	.....	41.0092	40.5540	41.4030	34.1254	35.2832	31.4998
0.3140	.....	1.2600	1.2360	1.3800	0.1628	0.5600	0.3900
0.0658	... .	2.5908	2.1460	2.2970	0.8746	0.3178	0.7002
0.0490	.. ..	0.0384	0.0584	0.0848	0.0746	0.0900	0.0985
2.45	.....	1 92	2.92	4.24	3.73	4.50	4.92
0.7815	.....	0.8371	1.2468	1.8529	1.3055	1.6020	1.5858
68.63	.....	57.15	58.52	58.14	66.30	65.55	69.31
68.34	.....	56.18	56.75	57.83	65.67	65.37	69.30
0.5353	... ..	1.0651	1.0238	1.0282	0.7034	0.7295	0.5639
.....	....	1.0721	.....	1.0448	0.7025	0.7315	0.5637
.....	.....	+0.0070	.....	+0.0166	0.0009	+0.0020	0.0002
8.5396	.....	23.3718	21.8581	22.8289	12.3095	13.0207	9.0788
8.54	.....	23.37	21.86	22.83	12.31	13.02	9.08
.....	....	0.1356	... .	0.1325	0.1796	0.1748	0.1961
0.1953	.....	0.1307	0.1395	0 1265	0.1744	0.1695	0.1912
0.1967	. . . .	.....	0.1316	0.1262	0.1748	0.1653	0.1915
3.1374	... .	2.9561	2.9783	2.8951	3.1430	3.1114	3.1572
19.6087	... .	18.4756	18.6144	18.0944	19.6437	19.4462	19.7325
19.61	.....	18.48	18.61	18.09	19.64	19.45	19.73

TABLE II.

FLESH OF GOV. FRANCIS, SHORTHORN STEER;

(The figures represent weights in grams,

Laboratory number	303	304
Number of cut.	No. 1	No. 2
Weight of fresh meat taken	100	100.
Weight of oven-dried meat, on screen, (a)	37.	33.6
Loss by drying (water)	63.	66.4
Weight of meat placed in bottle for subsequent analysis	36.2930	33.6232
Loss by adherence to screen	0.7070	+0.0232
Weight of meat just before pulverizing	36.3544	33.6712
Loss or gain during interval (water)	+0.0614	+0.0480
Weight of this calculated for (a)	+0.06	+0.05
Weight of meat after pulverizing (b)	35.9436	33.4058
Loss during operation	0.4108	0.2654
Total gain or loss.	1.0564	0.1942
Weight of water in 2 grams of (b)	0.1274	0.1238
Per cent. of water in (b)	6.37	6.19
Weight of water for total weight of (a)	2.2569	2.0798
Total per cent. of water in fresh meat, *calculated*	65.20	68.43
Actual per cent. of water found at time in 2 grams.	64.50	68.60
Weight of fat in 2 grams of (b) without further drying (c)	0.7532	0.6244
Weight of fat in 2 grams of (b) after complete drying (d)	0.7572	0.6206
Difference for or against complete drying.	+0.0040	0.0038
Weight of fat for total weight of (a), from highest value	14.0082	10.7899
Per cent. of fat in fresh meat	14.01	10.79
Weight of nitrogen in 2 grams of (b).	0.1645	0.1802
Weight of nitrogen in (c)	0.1669	0.1820
Weight of nitrogen in (d)	0.1620	0.1813
Weight of nitrogen in total weight of (a), from highest value	3.0876	3.0876
Weight of albuminoids from this value	19.2975	19.2975
Per cent. of albuminoids in fresh meat	19.30	19.30

TABLE II.—CONTINUED.

AGE, 1015 DAYS; LIVE WEIGHT, 1008 POUNDS.

excepting where percentages are mentioned.)

305	306	307	308	309	310	311	312
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	100.	100.	100.	100.	100.	100	100.
28.8	31.8	49.7	42.	44.5	35.6	33.5	31.3
71.2	68.2	50.3	58.	55.5	64.4	66.5	68.7
29.3712	31.5722	47.7192	40.7472	41.6080	34.7500	33.1418	30.6080
+0.5712	0.2278	1.9808	1.2528	2.8920	0.8500	0.3582	0.6920
30.6014	31.7928	47.7424	40.7472	41.7486	34.9650	33.2640	30.8158
+1.2302	+0.2206	+0.0232	.....	+0.1406	+0.2150	+0.1222	+0.2078
+1.23	+0.22	+0.02	...	+0.14	+0.22	+0.12	+0.21
30.4568	31.3924	46.8570	39.9632	41.0778	34.3484	32.9136	30.7500
0.1446	0.4004	0.8854	0.7840	0.6708	0.6166	0.2504	0.0658
+1.6568	0.4076	2.8430	2.1368	3.4222	1.2516	0.5864	0.5500
0.0912	0.0498	0.0642	0.1235	0.0408	0.0780	0.0846	0.0530
4.56	2.49	3.21	6.17	2.04	3.90	4.23	2.65
1.3133	0.7918	1.5954	2.5935	0.9078	1.3884	1.4170	0.8294
71.74	68.77	51.87	60.59	56.27	65.57	67.80	69.32
69.96	68.35	49.48	61.14	55.04	67.31	67.40	69.46
0.4406	0.6422	1.1559	0.9000	1.0612	0.6542	0.6468	0.5432
0.4444	0.6356	1.2474	0.9416	1.0832	0.6726	0.6390	0.5504
+0.0038	0.0066	+0.0915	+0.0416	+0.0220	+0.0184	0.0078	+0.0072
7.5094	10.2110	30.9979	19.7736	24.1012	11.9723	10.8339	8.6138
7.51	10.21	31.00	19.77	24.10	11.97	10 84	8.61
0.2103	0.1942	0.1043	0.1337	0.1295	.....	0.1834	.....
0.2142	0.1981	0.1001	0.1326	0.1281	0.1708	0.1862	.....
0.2058	0.1928	0.1093	0.1356	0.1310	0.1786	0.1864	0.2052
3.0845	3.1498	2.7161	2.8476	2.9147	3.1791	3.1222	3.2114
19.2781	19.6862	16.9756	17.7975	18.2169	19.8724	19.5137	20.0713
19.28	19.69	16.98	17.80	18.22	19.87	19.51	20.07

TABLE III.

FLESH OF ZENO, HEREFORD STEER;

(The figures represent weights in grams,

Laboratory number	186	187
Number of cut	No. 1	No. 2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	33.4	.....
Loss by drying (water)	66.6	.....
Weight of meat placed in bottle for subsequent analysis	32.6012	33.7568
Loss by adherence to screen	0.7988	.....
Weight of meat just before pulverizing	32.6482	33.4842
Loss or gain during interval (water)	+0.0470	0.2726
Weight of this calculated for (a)	+0.05	0.27
Weight of meat after pulverizing (b)	32.6792	33 4480
Loss during operation	+0.0310	0.0362
Total gain or loss	0.7208	.....
Weight of water in 2 grams of (b)	0.1286	0.1292
Per cent. of water in (b)	6.43	6.46
Weight of water for total weight of (a)	2.1476	2.1807
Total per cent. of water in fresh meat, *calculated*	68.70	68.69
Actual per cent. of water found at time in 2 grams	69.25	67.85
Weight of fat in 2 grams of (b) without further drying (c)	0.4408	0.5200
Weight of fat in 2 grams of (b) after complete drying (d)	0.4336	0.5248
Difference for or against complete drying	0.0072	+0.0048
Weight of fat for total weight of (a), from highest value	7.3614	8.8578
Per cent. of fat in fresh meat	7.36	8.86
Weight of nitrogen in 2 grams of (b)	0.2059	0.1992
Weight of nitrogen in (c)	.....	0.1947
Weight of nitrogen in (d)	0.2048	0.1908
Weight of nitrogen in total weight of (a), from highest value	3 4385	3.3622
Weight of albuminoids from this value	21.4906	21.0137
Per cent. of albuminoids in fresh meat	21.49	21.02

TABLE III.—CONTINUED.

AGE, 998 DAYS; LIVE WEIGHT, 1541 POUNDS.

excepting where percentages are mentioned.)

188	189	190	191	192	193	194	195
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	45.	100.	100.	100.	100.	100	100.
31.7	15.3	44.5	48.8	32.4	34.9	40.5	32.2
68.3	29 7	55.5	51.2	67.6	65.1	59.5	67.8
30.8930	15.1158	43.0940	46.9774	32.5090	34.7548	39.8166	32.0986
0.8070	0.1842	1.4060	1.8226	+0.1090	0.1452	0.6834	0.1014
31.1520	15.2682	42.9426	47.0156	32.7064	34.7680	39.8686	32.1060
+0.2590	+0.1524	0.1514	+0.0382	+0.1974	+0.0132	+0.0520	+0.0074
+0.26	+0.15	+0.15	+0.04	+0.20	+0.01	+0.05	+0.01
31.1080	14.7250	42.1196	46.1156	32.6334	34.1054	39.1486	31.8148
0.0440	0.5432	0.8230	0.9000	0.0730	0.6626	0.7200	0.2912
0.5920	0.5750	2.3804	2.6844	+0.2334	0.7946	1.3514	0.3852
0.0824	0.0683	0.1237	0.2036	0.0705	0.0520	0.0806	0.0874
4.12	3.41	6.18	10.18	3.52	2.60	4.03	4.37
1.3060	0.5225	2.7523	4.9678	1.1421	0.9074	1.6321	1.4071
69.35	66.83	58.40	56.13	68.54	66.00	61.08	69.20
69.96	67.35	57.46	56.71	69.83	66.10	60.76	68.54
0.4544	0.6592	0.9532	0.9668	0.5883	0.7194	0.9525	0.5202
0.4338	0.6573	0.9465	0.9781	0.6148	.....	0.9604	.....
0.0206	0.0019	0.0067	+0.0113	+0.0265	.....	+0.0079	.....
7.2022	5.0429	21.2087	23.8656	9.9598	12.5535	19.4481	8.3752
7.20	11.21	21.21	23.87	9.96	12.55	19.45	8.37
0.2174	0.1912	0.1422	0.1171	0.1795	.....	0.1401	.....
0.2132	0.1877	.....	.....	0.1917	0.1711	0.1363	0.1963
0.2128	0.1877	0.1324	0.1091	0.1899	0.1788	0.1373	0.1970
3.4458	1.4627	2.9459	2.8572	3.1055	3.1201	3.1172	3.1717
21.5362	9.1419	18.4119	17.8575	19.4094	19.5006	19.4825	19.8231
21.54	20.31	18.41	17.86	19.41	19.50	19.48	19.82

TABLE IV.

FLESH OF CURLEY, HEREFORD STEER;

(The figures represent weights in grams,

Laboratory number	325	326
Number of cut	No. 1	No. 2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat on screen (a)	35.6	33.7
Loss by drying (water)	64.4	66.3
Weight of meat placed in bottle for subsequent analysis	33.9786	32.5122
Loss by adherence to screen	1.6214	1.1878
Weight of meat just before pulverizing	34.1056	32.6738
Loss or gain during interval (water)	+0.1270	+0.1616
Weight of this calculated for (a)	+0.13	+0.16
Weight of meat after pulverizing (b)	33.6720	32.2300
Loss during operation	0.4336	0.4438
Total loss	1.9280	1.4700
Weight of water in 2 grams of (b)	0.0918	0.0364
Per cent. of water in (b)	4.59	1.82
Weight of water for total weight of (a)	1.6340	0.6133
Total per cent. of water in fresh meat, *calculated*	65.90	66.75
Actual per cent of water found at time in 2 grams	66.84	67.05
Weight of fat in 2 grams of (b) without further drying (c)	0.6918	0.7020
Weight of fat in 2 grams of (b) after complete drying (d)	0.6954	0.6846
Difference for or against complete drying	+0.0036	0.0174
Weight of fat for total weight of (a), from highest value	12.3781	11.8287
Per cent. of fat in fresh meat	12.38	11.83
Weight of nitrogen in 2 grams of (b)	0.1792	0.1827
Weight of nitrogen in (c)	0.1799	0.1596
Weight of nitrogen in (d)	0.1826	0.1768
Weight of nitrogen in total weight of (a), from highest value.	3.2503	3.0783
Weight of albuminoids from this value	20.3144	19.2404
Per cent. of albuminoids in fresh meat	20.31	19.24

TABLE IV.—CONTINUED.

AGE, 1096 DAYS; LIVE WEIGHT, 1630 POUNDS.

excepting where percentages are mentioned.)

327	328	329	330	331	332	333	334
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100	100.	100.	100.	100.	100.	100.	100.
32.9	34.3	43.4	46.0	51.1	40.8	31.6	34.
67.1	65.7	56.6	54.0	48.9	59.2	68.4	66.
32.3780	33.5928	40.0234	41.5120	47.4026	38.9366	31.6756	33 2936
0.5220	0.7072	3.3766	4 4880	3.6974	1.8634	+0.0756	0.7064
32.5360	33.7446	40.5554	41.6714	47.4246	38.9752	31.7522	83.2588
+0.1580	+0.1518	+0.5320	+0.1594	+0.0220	+0.0386	+0.0766	0.0348
+0.16	+0.15	+0.53	+0.16	+0.02	+0.04	+0.08	0.04
32.2770	33.4590	39.9544	40.8636	46.8830	38.4520	31.2754	32.8012
0.2590	0.2856	0.6010	0.8078	0.5416	0.5232	0.4768	0.4576
0.6230	0.8410	3.4456	5.1364	4.2170	2.3480	0.3246	1.1988
0.0834	0.0716	0.0312	0.0712	0.1218	0.1222	0.1196	0.1974
4.17	3.58	1.56	3.56	6.09	6.11	5.98	9.87
1.3719	1.2279	0.6770	1.6376	3.1120	2.4929	1.8897	3.3558
68.31	66.78	56.75	55.48	51.99	61.65	70.22	69.40
68.59	69.48	53.67	56.84	51.88	61.00	70.10	70.23
0.5504	0.6556	1.1012	1.1678	1.1720	0.9060	0.4218	0.5116
0.5494	0.6636	1.1232	1.1562	1.1472	0.9046	0.4152	0.4810
0.0010	+0.0080	+0.0120	0.0116	0.0248	0.0014	0.0066	0.0306
9.0541	11.3807	24.3234	26.8594	29.9446	18.4824	6.6644	8.6972
9.05	11.38	24.32	26.86	29.94	18.48	6.66	8.70
0.2006	0.1897	0.1277	0.1071	0.0990	0.1400	0.2142	0.1904
.....	0.1890	0.1264	0.1074	0.1018	0.1467	0.2141	.. ..
... .	0.1927	0.1228	0.1113	0.1001	....	0.2122	0.1898
3.2999	3.3048	2.7711	2.5599	2 6010	2.9927	3.3844	3.2368
20.6244	20.6550	17.3194	15.9994	16.2562	18.7044	21.1525	20.2300
20.62	20.65	17.32	16.00	16.26	18.70	21.15	20.23

TABLE V.

FLESH OF BEAR, ANGUS STEER;

(The figures represent weights in grams,

Laboratory number	263	264
Number of cut	No. 1	No. 2.
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	35.7	37.
Loss by drying (water)	64.3	63.
Weight of meat placed in bottle for subsequent analysis	34.8168	36.7716
Loss by adherence to screen	0.8832	0.2284
Weight of meat just before pulvering	34.8360	36.7412
Loss or gain during interval (water)	+0.0192	0.0304
Weight of this calculated for (a)	+0.02	0.03
Weight of meat after pulverizing (b)	34.6650	35.4972
Loss during operation	0.1710	1.2440
Total loss	1.0350	1.5028
Weight of water in 2 grams of (b)	0.1435	0.1822
Per cent. of water in (b)	7.17	9.11
Weight of water for total weight of (a)	2.5615	1.5487
Total per cent. of water in fresh meat, *calculated*	66.84	64.58
Actual per cent. of water found at time in 2 grams	67.40	66.23
Weight of fat in 2 grams of (b) without further drying (c)	0.5800	0.6657
Weight of fat in 2 grams of (b) after complete drying (d)	0.5854	0.6635
Difference for or against complete drying	+0.0054	0.0022
Weight of fat for total weight of (a), from highest value	10.4494	12.3154
Per cent. of fat in fresh meat	10.45	12.31
Weight of nitrogen in 2 grams of (b)	0.2044	0.1722
Weight of nitrogen in (c)	0.1845	0.1667
Weight of nitrogen in (d)	0.1802	0.1648
Weight of nitrogen in total weight of (a), from highest value	3.6485	3.1857
Weight of albuminoids from this value	22.8031	19.9106
Per cent. of albuminoids in fresh meat	22.80	19.91

TABLE V.—CONTINUED.

AGE, 1046 DAYS; LIVE WEIGHT, 1694 POUNDS.

excepting where percentages are mentioned.)

265	266	267	268	269	270	272	271
No. 3.	No. 7.	No. 8.	No. 9.	No. 10.	No. 12.	No. 13.	No. 14.
100.	100.	100.	100.	100.	100.	100.	100.
33.9	36.6	36.5	36.8	36.5	35.8	.....	31.
66.1	63.4	63.5	63.2	63.5	64.2	.....	69.
33.5336	34.9028	36.0530	35.5080	35.5570	34.9332	28.6810	31.0760
0.3664	1.6972	0.4470	1.2920	0.9430	0.8668	.....	+0.0760
33.5488	35.2190	36.4716	36.0580	35.8304	35.1102	28.8458	32.2546
+0.0152	+0.3162	+0.4186	+0.5500	+0.2734	+0.1770	+0.1648	+1 1786
+0.01	+0.32	+0.42	+0.55	+0.27	+0.18	+0.16	+1.18
33.3708	34.7390	35.7936	35.3580	35.2314	34.7612	28.9244	31.9746
0.1780	0.4800	0.6780	0.7000	0.5990	0.3490	+0.0786	0.2800
0.5292	1.8610	0.7064	1.4420	1.2686	1.0388	.....	+0.9746
0.1640	0.0518	0.0616	0.0386	0.0589	0.0667	0.1156	0.1321
8.20	2.59	3.08	1.93	2.94	3.33	5.78	6.60
2.7798	0.9479	1.1242	0.7102	1.0749	1.1939	1.6718	2.0475
68.87	64.03	64.20	63.36	64 30	65.21	72.75	69.87
68.84	64.20	63.40	63.61	66.74	62.80	72.33	68.67
0.4502	0.7727	0.8523	1.0411	0.8920	0.8230	0.4262	0.5575
0.4447	0.7616	0.8403	0.9957	0.9025	0.8194	0.4006	0.5609
0.0055	0.0111	0.0120	0.0454	+0.0105	0.0036	0.0256	+0.0034
7.6309	14.1404	15.5545	19.1562	16.4706	14.7317	6.1638	8.6939
7.63	14.14	15.55	19.16	16.47	14.73	6.16	8.69
.....	0.1830	0.1652	0.1491	0.1613	0.1673	0.2229	0.1918
0.2006	0.1909	0.1655	0.1403	0.1610	0.1683	0.2023	0.1767
0.2009	0.1788	0.1641	0.1414	0.1519	0.1694	0.1239	0.1904
3.4052	3.4935	3.0204	2.7434	2.9437	3.0126	3.2236	2.9729
21.4825	21.8344	18.8775	17.1463	18.3981	18.8287	20.1475	18.5806
21.48	21.83	18.88	17.15	18.40	18.83	20.15	18.58

TABLE VI.

FLESH OF BONNIE, ANGUS STEER;

(The figures represent weights in grams,

Laboratory number	283	284
Number of cut	No. 1.	No. 2.
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	32.9	36.7
Loss by drying, (water)	67.1	63.3
Weight of meat placed in bottle for subsequent analysis	32.8844	36.6252
Loss by adherence to screen	0.0156	0.0748
Weight of meat just before pulverizing	32.9382	36.6724
Loss or gain during interval, (water)	+0.0538	+0.0472
Weight of this calculated for (a)	+0.05	+0.05
Weight of meat after pulverizing (b)	32.8382	36.4542
Loss during operation	0 1000	0.2182
Total loss	0.0618	0.2458
Weight of water in 2 grams of (b)	0.0836	0.1204
Per cent. of water in (b)	4.18	6.02
Weight of water for total weight of (a)	1.3752	2.2093
Total per cent. of water in fresh meat, *calculated*	68.42	65.46
Actual per cent. of water found at time in 2 grams	68.72	65.11
Weight of fat in 2 grams of (b) without further drying (c)	.....	0.6968
Weight of fat in 2 grams of (b) after complete drying (d)	0.5724	0.7000
Difference for or against complete drying	.....	+0.0032
Weight of fat for total weight of (a), from highest value	11.0619	12.8450
Per cent. of fat in fresh meat	11.06	12.84
Weight of nitrogen in 2 grams of (b)	.....	0.1760
Weight of nitrogen in (c)	0.1816	0.1396
Weight of nitrogen in (d)	0.1872	0.1722
Weight of nitrogen in total weight of (a), from highest value	3.0794	3.2296
Weight of albuminoids from this value.	19.2462	20.1850
Per cent. of albuminoids in fresh meat	19.25	20.18

TABLE VI.—CONTINUED.

AGE, 838 DAYS; LIVE WEIGHT, 1505 POUNDS.

excepting where percentages are mentioned.)

285	286	287	288	289	290	291	292
No. 3.	No. 7.	No. 8.	No. 9.	No. 10.	No. 12.	No. 13.	No. 14.
100.	50.	100.	100.	100.	100.	100.	100.
34.3	15.	43.7	47.1	39.9	39.3	37.20	30.1
65.7	36.	56.3	52.9	60.1	60.7	62.80	69.9
34.1754	13.4600	43.1750	46.3652	37.9856	38.4420	36.8248	29.9084
0.1246	0.5400	0.5250	0.7348	1.9144	0.8580	0.3752	0.1916
34.1224	14.0566	43.0726	45.7688	38.3070	38.4690	36.8652	39.9658
0.0530	+0.5966	0.1024	0.5964	+0.3214	+0.0270	+0.0404	+0.0574
0.05	+0.60	0.10	0.60	+0.32	+0.03	+0.04	+0.06
33.7376	14.0352	42.1206	44.4436	38.0614	38.0558	36.3390	29.8324
0.3848	0.0214	0.9520	1.3252	0.2456	0.4132	0.5262	0.1334
0.5624	+0.0352	1.5794	2.6564	1.8386	1.2442	0.8610	0.2676
0.2254	0.1536	0.1438	0.5450	0.0920	0.1276	0.1318	0.1202
6.27	7.68	7.19	27.25	4.60	6.38	6.59	6.01
3.8656	1.0752	3.1420	12.8347	1.8354	2.5073	2.4515	1.8090
69.62	72.95	59.54	66.33	61.61	63.18	65.21	71.65
70.36	72.85	59.70	67.51	60.52	63.84	64.54	71.85
0.3742	0.3026	0.9304	0.5436	0.9874	0.8278	0.7290	0.4072
0.3664	0.3070	0 9374	0.5522	0.9968	0.8322	0.7336	0.4000
0.0078	+0.0044	+0.0070	+0.0086	+0.0094	+0.0044	+0.0046	0.0072
6.4175	2.1490	20.4822	13.0043	19.8862	16.3527	13.6450	6.1284
6.42	4.30	20.48	13.00	19.89	16.35	13.64	6.13
0.2079	0.2341	0.1386	0.1257	0.1386	0.1565	0.1680	0.2191
0.1879	0.2128	0.1372	0.1211	0.1428	0.1540	0.1690	0.2166
(0.2408)	(0.2464)	0.1358	0.1180	0.1393	0.1540	0.1677	0.2181
3.5655	1.6386	3.0284	2 9602	2.8489	3.0752	3.1434	3.2974
22.2844	19.2410	18.6275	18.5012	17.8056	19.2200	19.6463	20.6087
22.28	20.48	18.63	18.50	17.81	19.22	19.65	20.61

TABLE VII.

FLESH OF JOE, SHORTHORN GRADE STEER;

(The figures represent weights in grams,

Laboratory number	147	148
Number of cut	No.1	No.2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	64.	66.7
Loss by drying (water)	36.	33.3
Weight of meat placed in bottle for subsequent analysis	59.9890	58.4838
Loss by adherence to screen	4.0110	8.2162
Weight of meat just before pulverizing	59.9721	58.4094
Loss or gain during interval (water)	0.0169	0.0744
Weight of this calculated for (a)	0.0180	0.0848
Weight of meat after pulverizing (b)	59.5244	56.7024
Loss during operation	1.4777	1.7070
Total loss	4.4756	9.9976
Weight of water in 2 grams of (b)	0.3532	0.3686
Per cent. of water in (b)	17 66	18.43
Weight of water for total weight of (a)	10.9500	12.29
Total per cent. of water in fresh meat, *calculated*	46.97	45.67
Actual per cent. of water found at time in 2 grams	44.15	44.33
Weight of fat in 2 grams of (b) without further drying (c)	1.2580	1.1506
Weight of fat in 2 grams of (b) after complete drying (d)	1 2208	1.1250
Difference for or against complete drying	0.0372	0.0256
Weight of fat for total weight of (a), from highest value	38.9980	38.3725
Per cent. of fat in fresh meat	39.00	38.37
Weight of nitrogen in 2 grams of (b)	0.0665	0.0648
Weight of nitrogen in (c)	0.0644	0.0630
Weight of nitrogen in (d)	0.0641	0.0581
Weight of nitrogen in total weight of (a), from highest value	2.1280	2.1611
Weight of albuminoids from this value	13.3000	13.5069
Per cent. of albuminoids in fresh meat	13.30	13.51

TABLE VII.—CONTINUED.

AGE, 1053 DAYS; LIVE WEIGHT, 1633 POUNDS.

excepting where percentages are mentioned.)

149	150	151	152	154		155	156
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No 13	No. 14
100.	100.	100.	100.	100.	Not rec'd.	100.	50.0
47.8	55.	81.1	89.3	49.5	.. ..	58.9	19.3
52.2	45.	18.9	10.7	50.5	.....	41.1	30.7
40.4520	53.4272	80.8290	88.7574	47.5826	.....	58.5056	18.7476
7.3480	1.5728	0.2710	0.5426	1.9174	.....	0.3944	0.5524
40.3814	53.1164	80.5436	88.1814	47.5196	. .....	58.3428	18 7386
0.0706	0.3108	0.2854	0.5760	0.0630	..... .	0.1628	0.0090
0.0830	0.3219	0.2863	0.5800	0.0659	.....	0.1638	0.0092
39.3226	51.5440	76.9180	85.1304	46.5330	....	56.8338	18.0304
1.0588	1.5724	3.6256	3.0510	0.9866	.....	1.5090	0.7082
8.4774	3.4560	4.1820	4.1696	2.9670	.....	2.0662	1.2696
0.2540	0.4716	0.6984	0.7800	0.2914	.. ..	0.4522	0.1540
12.70	23.58	34.92	39.00	14.57	.....	22.61	7.70
6.0706	12.9690	28.3201	34.8270	7.2121	....	13.3173	1.4861
58.35	58.29	47.51	46.11	57.78	.....	54.58	64.39
57.57	58.15	45.78	45.48	57.28	.. ..	54.45	65.12
0.9660	0.8018	0.9200	0.8578	1.0584	.....	0.9740	0.6494
0.9682	0.7704	0.8824	0.8370	1.0247	.....	0.9068	0.6314
+0.0022	0.0314	0.0376	0.0208	0.0337	.....	0.0672	0.0180
22.1390	22.0495	37.3060	38.3008	26.1954	... .	26.6843	6.2667
22.14	22.05	37.31	38.30	26.19	.....	26.68	12.53
0.1291	0.1043	0.0574	0.0510	0.0983	.....	0.0917	0.1711
0.1260	0.0959	0.0542	0.0460	0.0924	.....	0.0864	0.1683
0.1241	0.0991	0.0528	0.0432	0.0903	.....	0.0861	0.1684
3.0855	2.8682	2.3276	2.2771	2.4329	.....	2.7006	1.6511
19.2844	17.9262	14.5475	14.2319	15.2056	.....	16.8787	10.3194
19.28	17.93	14.55	14.23	15.21	.....	16.88	20.64

TABLE VIII.

FLESH OF NANCY, ANGUS GRADE STEER;

(The figures represent weights in grams,

Laboratory number	364	365
Number of cut	No. 1	No. 2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	35.	37.8
Loss by drying (water)	65.	62.2
Weight of meat placed in bottle for subsequent analyis	34.0668	37.0552
Loss by adherence to screen	0.9332	0.7448
Weight of meat just before pulverizing	34.1672	37.0426
Loss or gain during interval (water)	+0.1004	0.0126
Weight of this calculated for (a)	+0.10	0.01
Weight of meat after pulverizing (b)	33.8522	35.3602
Loss during operation	0.3150	1.6824
Total loss	1.1478	2.4398
Weight of water in 2 grams of (b)	0.1068	0.1060
Per cent. of water in (b)	5.34	5.30
Weight of water for total weight of (a)	1.8890	2.0034
Total per cent. of water in fresh meat, *calculated*	66.79	64.21
Actual per cent. of water found at time in 2 grams	67.15	64.79
Weight of fat in 2 grams of (b) without further drying (c)	0.6436	0.7806
Weight of fat in 2 grams of (b) after complete drying (d)	0.6456	0.7774
Difference for or against complete drying	+0.0020	0 0032
Weight of fat for total weight of (a), from highest value	11.2980	14.7543
Per cent. of fat in fresh meat	11.30	14.75
Weight of nitrogen in 2 grams of (b)	0.1853	0.1658
Weight of nitrogen in (c)	0.1870	0.1638
Weight of nitrogen in (d)	0.1848	0 1631
Weight of nitrogen in total weight of (a), from highest value	3.2725	3.1336
Weight of albuminoids from this value	20.4531	19.5850
Per cent. of albuminoids in fresh meat	20.45	19.58

TABLE VIII.—CONTINUED.

AGE, 1068 DAYS; LIVE WEIGHT, 1642 POUNDS.

excepting where percentages are mentioned.)

366	367	368	369	371	372	370	373
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	100.	100.	100.	100.	100.	100.	100.
32.9	34.1	37.8	.....	50.5	35.3	34.5	31.6
67.1	65.9	62.2	.....	49.5	64.7	65.5	68.4
32.4306	33.4794	36.8026	45.2396	48.9830	34.2740	33.9192	30.9980
0.4694	0.6206	0.9974	.....	1.5170	1.0260	0.5808	0.6020
32.6480	33.5038	36.7394	45.2252	48.3452	34.2482	33.9844	31.0706
+0.2174	+0.0244	0.0632	0.0144	0.6378	0.0258	+0.0652	+0.0726
+0.22	+0.03	0.06	0.02	0.64	0.03	+0.07	+0.07
32.2884	33.1904	36.7100	44.8652	44.8652	33.4468	33.5766	30.5466
0.3596	0.3134	0.0294	0.3600	3.4800	0.8014	0.4078	0.5240
0.6116	0.9096	1.0900	.....	5.6348	1.8532	0.9234	1.0534
0.0974	0.1254	0.0184	0.0700	0.4712	0.1098	0.0984	0.1144
4.87	6.27	0.92	3.50	23.56	5.49	4.92	5.72
1.6061	2.1381	0.3478	1.5834	11.8976	1.9380	1.6974	1.8075
68.49	68.01	62.61	56.44	62.04	66.67	67.13	70.14
68.54	68.78	61.92	54.65	60.88	67.36	67.47	70.98
0.5276	0.5886	0.8894	1.1906	0.7242	0.6472	0.6060	0.4998
0.5340	0.5936	0.8906	1.1972	0.7394	0.6476	0.6044	0.4970
+0.0064	+0.0050	+0.0112	+0.0066	+0 1052	+0.0004	0.0016	0.0028
8.8057	10.1209	16.8323	27.0804	18.6698	11.4301	10.4535	7.9000
8.81	10.12	16.83	27.08	18.67	11.43	10.45	7.90
0.1981	0.1938	0.1605	0.1129	0.1171	.....	0.1931	0.2066
0.2060	0.1926	0.1624	0.1047	0.1051	.....	0.1898	0.2025
0.1996	0.1916	0.1634	0.1047	0.0995	0.1803	0.1877	0.2028
3.3969	3.3043	3.0283	2.5538	2.9568	3.1823	3.3310	3.2643
21.2306	20.6519	19.3019	15.9612	18.4800	20.0894	20.8185	20 4019
21.23	20.65	19.30	15.96	18.48	20.09	20.82	20.40

TABLE IX.

FLESH OF JACK, SCRUB STEER;

(The figures represent weights in grams,

Laboratory number	164a	165
Number of cut	No. 1	No. 2
Weight of fresh meat taken	50.	100.
Weight of oven-dried meat, on screen (a)	24.1	35.1
Loss by drying (water)	25.9	64.9
Weight of meat placed in bottle for subsequent analysis	23.1232	34.1568
Loss by adherence to screen	0.9768	0.9432
Weight of meat just before pulverizing	23.1634	34.3124
Loss or gain during interval (water)	+0.0402	+0.1556
Weight of this calculated for (a)	+0.04	+0.16
Weight of meat after pulverizing (b)	22.8018	34.1406
Loss during operation	0.3616	0.1718
Total loss	1.2982	0.9594
Weight of water in 2 grams of (b)	0.0486	0.0552
Per cent. of water in (b)	2.43	2.76
Weight of water for total weight of (a)	0.5856	0.9688
Total per cent. of water in fresh meat, *calculated*	52.88	65.71
Actual per cent. of water found at time in 2 grams	53.75	65.90
Weight of fat in 2 grams of (b) without further drying (c)	1.1316	0.6452
Weight of fat in 2 grams of (b) after complete drying (d)	1.1262	0.6530
Difference for or against complete drying	0.0054	+0.0078
Weight of fat for total weight of (a), from highest value	13.6358	11.3233
Per cent. of fat in fresh meat	27.27	11.32
Weight of nitrogen in 2 grams of (b)	0.1221	.....
Weight of nitrogen in (c)	0.1134	0.1858
Weight of nitrogen in (d)	0.1155	0.1841
Weight of nitrogen in total weight of (a), from highest value	1.4713	3.2608
Weight of albuminoids from this value	10.1956	20.3800
Per cent. of albuminoids in fresh meat	18.39	20.38

TABLE IX.—CONTINUED.

AGE, 1062 DAYS; LIVE WEIGHT, 1481 POUNDS.

excepting where percentages are mentioned.)

166	168	169	170	171	172	173	174
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	25.	100.0	50.	100.	50.	100.	100.
38.6	8.4	.....	20.3	43.6	24.5	33.3	34.3
61.4	16.6	.....	29.7	56.4	25.5	66.7	65.7
38.8314	7.6674	40.1848	19.3432	43.2340	24.0734	32.9064	34.1460
+0.2314	0.7326	.....	0.9568	0.3660	0.4266	0.3936	0.1540
38.9162	7.7260	40.2004	19.3288	43.2510	23.9876	32.9210	34.1606
+0.0848	+0.0586	+0.0156	0.0164	+0.0170	0.0858	0.0146	+0.0146
+0.08	+0.06	+0.02	0.02	+0.02	0.09	0.02	+0.02
38.5244	7.5460	39.7800	18.8538	42.5966	23.6377	32.4132	33.6756
0.3918	0.1800	0.4204	0.4750	0.6544	0.3499	0.5078	0.4850
0.0756	0.8540	.....	1.4462	1.0034	0.8623	0.8868	0.6244
0.0884	0.1954	0.1180	0.1300	0.0854	0.1034	0.1044	0.1048
4.42	9.77	5.90	6.50	4.27	5.17	5.22	5.24
1.7061	0.8207	2.3709	1.3195	1.8617	1.2666	1.7383	1.7973
63.03	69.44	62.17	62.08	58.24	53.71	68.42	67.48
62.97	70.15	61.11	62.16	57.53	51.87	68.35	67.03
0.7684	0.4144	0.8088	0.8022	1.0730	1.1526	0.5434	0.5940
0.7702	0.4014	0.8114	.....	1.0538	1.1756	.....	.....
+0.0018	0.0130	+0.0026	.....	0.0192	+0.0230	.....	.....
14.8301	1.7405	16.2507	8.1423	23.3914	14.1193	9.0476	10.1871
14.83	6.96	16.25	16.29	23.39	28.24	9.05	10.19
.....	0.2222	0.1634	0.1547	0.1302	0.1057	0.1988	0.1890
0.1645	0.2177	0.1522	0.1533	0.1225	0.1029	.....	0.1837
0.1645	0.2082	0.1578	.....	0.1284	0.1025	.....	.....
3.1748	0.9324	3.2831	1.5702	2.8384	1.2948	3.3100	3.2413
19.8425	5.8327	20.5193	9.8137	17.7400	8.0925	20.6875	20.2581
19.84	23.33	20.52	19.63	17.74	16.18	20.69	20.26

TABLE X.

FLESH OF SLOCUM, SCRUB STEER;

(The figures represent weights in grams,

Laboratory number	342	343
Number of cut	No. 1	No. 2
Weight of fresh meat taken	100.	100.
Weight of oven-dried meat, on screen (a)	35.7	41.7
Loss by drying (water)	64.3	58.3
Weight of meat placed in bottle for subsequent analysis	35.4628	39.8308
Loss by adherence to screen	0.2372	1.8692
Weight of meat just before pulverizing	35.4534	39.9228
Loss or gain during interval (water)	0.0094	+0.0920
Weight of this calculated for (a)	0.01	+0.10
Weight of meat after pulverizing (b)	34.6718	38.9738
Loss during operation	0.7816	0.9490
Total loss	1.0282	2.7262
Weight of water in 2 grams of (b)	0.1792	0.0616
Per cent. of water in (b)	7.46	3.08
Weight of water for total weight of (a)	3.1987	1.2844
Total per cent. of water in fresh meat, *calculated*	67.51	59.48
Actual per cent. of water found at time in 2 grams	67.80	58.42
Weight of fat in 2 grams of (b) without further drying (c)	0.5896	1.0020
Weight of fat in 2 grams of (b) after complete drying (d)	0.5854	0.9893
Difference for or against complete drying	0.0042	0.0127
Weight of fat for total weight of (a), from highest value	10.5444	20.8917
Per cent. of fat in fresh meat	10.54	20.89
Weight of nitrogen in 2 grams of (b)	0.1868	0.1382
Weight of nitrogen in (c)	0.1769	0.1376
Weight of nitrogen in (d)	0.1770	0.1375
Weight of nitrogen in total weight of (a), from highest value	3.3546	2.8815
Weight of albuminoids from this value	20.9663	18.0094
Per cent. of albuminoids in fresh meat	20.97	18.01

TABLE X.—CONTINUED.

AGE, 1072 DAYS; LIVE WEIGHT, 1278 POUNDS.

excepting where percentages are mentioned.)

344	345	346	347	348	349	350	351
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
100.	100.	100.	100.	100.	100.	100.	100.
32.3	38.	49.2	49.7	54.4	46.8	33.	31.1
67.7	62.	50.8	50.3	45.6	53.2	67.	68.9
31.6190	37.1334	45.7374	45.5412	50.7114	43.8876	32.9156	30.2444
0.6810	0.8666	3.4626	4.1588	3.6886	2.9124	0.0844	0.8556
32.2330	37.2956	45.7726	45.5374	50.6350	43.7964	32.3242	30.4122
+0.6140	+0.1622	+0.0352	0.0138	0.0764	0.1912	0.5914	+0.1678
+0.61	+0.16	+0.04	0.02	0.08	0.19	0.59	+0.17
31.9022	36.8384	45.5968	44.6514	49.3626	42.7864	32.9838	30.2052
0.3308	0.4572	0.1758	0.8860	1.2724	1.0100	0.3404	0.2070
0.3978	1.1616	3.6032	5.0486	5.0374	4.0136	0.0162	0.8948
0.1230	0.0728	0.0782	0.0680	0.1656	0.1240	0.0692	0.0256
6.15	3.64	3.91	3.40	8.28	6.20	3.46	1.28
1.9864	1.3832	1.9336	1.6808	4.5043	2.9016	1.1418	0.3981
69.08	63.22	52.69	52.01	50.18	56.29	68.73	69.13
69.58	63.22	51.30	51.90	50.22	56.45	68.20	68.09
0.5016	0.8416	1.2016	1.2668	1.1596	1.0234	0.6084	0.5484
0.5136	0.8578	1.2014	1.2426	1.1226	1.0214	0.6118	0.5522
+0.0120	+0.0162	0.0002	0.0242	0.0370	0.0020	+0.0034	+0.0038
8.8946	16.2982	29.5594	31.4800	31.5411	23.9476	10.0947	8.5867
8.89	16.30	29.56	31.48	31.54	23.95	10.09	8.59
0.1973	0.1590	0.1099	0.0973	0.0962	0.1186	0 1961	0.2089
0.1980	0.1587	0.1039	0.0973	0.0923	0.1179	0.1952	0.2084
0.1959	0.1618	0.1053	0.1044	0.0930	0.1175	0.1935	0.2066
3.1977	3.0742	2.7059	2.5503	2.6166	2.7752	3.2356	3.2484
19.9856	19.2137	16.9119	15.9394	16.3537	17.3450	20.2225	20.3025
19.99	19.21	16.91	15.94	16.35	17.34	20.22	20.30

TABLE XI.

FLESH OF HEART OF

(The figures represent weights in grams,

Laboratory number	203	301
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	24.6	20.8
Loss by drying (water)	75.4	79 2
Weight of substance placed in bottle for subsequent analysis	24.8548	20.9706
Loss by adherence to screen	+0.2548	+0.1706
Weight of substance just before pulverizing	24.9458	21.0780
Loss or gain during interval (water)	+0.0910	+0.1074
Weight of this calculated for (a)	+0.27	+0.17
Weight of substance after pulverizing (b)	25.1274	21.1436
Loss during operation	+0.1816	+0.0656
Total gain or loss	+0.5274	+0.3436
Weight of water in 2 grams of (b)	0.0896	0.0823
Per cent. of water in (b)	4 48	4.11
Weight of water for total weight of (a)	1.1021	0.8559
Total per cent. of water in fresh organ, *calculated*	76.23	79.89
Actual per cent. of water found at time in 2 grams	77.02	79.68
Weight of fat in 2 grams of (b) without further drying (c)	0.4140	0.1838
Weight of fat in 2 grams of (b) after complete drying (d)	0.4126	0.1886
Difference for or against complete drying	0.0014	+0.0048
Weight of fat for total weight of (a) from highest value	5.0922	1.9614
Per cent. of fat in fresh organ	5.09	1.96
Weight of nitrogen in 2 grams of (b)	0.2184	0.2454
Weight of nitrogen in (c)	0.2162	0 2474
Weight of nitrogen in (d)	0.2143	0.2425
Weight of nitrogen in total weight of (a), from highest value	2.6863	2.5730
Weight of albuminoids from this value	16.7894	16.0812
Per cent. of albuminoids in fresh organ	16.79	16.08

TABLE XI.—CONTINUED.

EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

185	320	259	278	138	361	160	341
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
26.4	31.7	23.9	24.9	22.5	23.8	22.	24.3
73.6	68.3	76.1	75.1	77.5	76.2	78.	75.7
23.8128	31.1794	23.8836	25.1454	22.5764	23.6828	21.5254	24.3144
2.5872	0.5206	0.0164	+0.2454	+0.0764	0.1172	0.4746	+0.0144
23.8730	31.2682	24.8482	25.2826	22.6718	24.0322	21.6722	24.4112
+0.0602	+0.0888	+0.9646	+0.1372	+0.0954	+0.3494	+0.1468	+0.0968
+0.25	+0.09	+0.97	—0.31	+0.18	+0.35	+0.15	+0.14
24.0600	31.1856	24.7482	25.4502	22.6540	23.9626	21.6482	24.4554
+0.1870	0.0826	0 1000	+0.1676	0.0178	0.0696	0.0240	+0.0442
2.3400	0.5144	+0.8482	+0.5502	+0.1540	+0.1626	0.3518	+0.1554
0.1472	0.1070	0.1420	0.1186	0.1000	0 0608	0.0888	0.1442
7.36	5.35	7.10	5.93	5.00	3.04	4.44	7.21
1.9430	1.6959	1.6969	1.4766	1.1250	0.7235	0.9768	1.7520
75.29	69.91	76.83	76.89	78.44	76.57	78 83	77.31
75.42	70.42	76 04	76.96	78.33	78.10	79.36	77.58
0.2567	0.7472	0.4496	0.5308	0.2570	0.3844	0.2382	0.2562
0.2658	0.7392	0.4228	0.3820	0.2316	0.3926	0.2458	0.2642
+0.0091	0.0080	0.0268	0.1488	0.0254	+0.0082	+0.0076	+0.0080
3.5086	11.8431	5.3727	6.6085	2.8912	4.6719	2.7038	3.2100
3.51	11.84	5.37	6.61	2.89	4.67	2.70	3.21
.. ...	(0.2095)	0.2059	0.2077	0.2387	0.2227	0.2415	0.2253
0.2247	0.1588	0.1992	0.2072	.. ...	.....	0.2327	0.2253
0.2240	0.1603	0.1985	...	0.2342	0.2222	0.2317	0.2236
2.9660	2.5407	2.4605	2.5858	2.6854	2.6501	2.6565	2.7374
18.5375	15.8794	15.3781	16.1612	16.7837	16.5631	16.6031	17.8087
18.54	15.88	15.38	16.16	16.78	16.56	16.60	17.81

TABLE XII.

FLESH OF LUNGS OF

(The figures represent weights in grams,

Laboratory number	202	300
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	20.9	22.4
Loss by drying (water)	79.1	77.6
Weight of substance placed in bottle for subsequent analysis.	21.5550	22.6498
Loss by adherence to screen	+0.6550	+0.2498
Weight of substance just before pulverizing	21.8160	.....
Loss or gain during interval (water)	+0.2610	.....
Weight of this calculated for (a)	+0.60	.....
Weight of substance after pulverizing (b)	22.1518	22.3242
Loss during operation	+0.3358	.....
Total gain or loss	+1.2518	—0.0758
Weight of water in 2 grams of (b)	0.1002	0.1170
Per cent. of water in (b)	5.01	5.85
Weight of water for total weight of (a)	1.0471	1.3104
Total per cent. of water in fresh organ, *calculated*	79.55	78.91
Actual per cent. of water found at time in 2 grams	79.06	78.29
Weight of fat in 2 grams of (b) without further drying (c)	0.1792	0.1652
Weight of fat in 2 grams of (b) after complete drying (d)	0.1786	0.1434
Difference for or against complete drying	0.0006	0.0218
Weight of fat for total weight of (a), from highest value	1.8726	1.8502
Per cent. of fat in fresh organ	1.87	1.85
Weight of nitrogen in 2 grams of (b)	0.2375	0.2457
Weight of nitrogen in (c)	.....	.....
Weight of nitrogen in (d)	0.2422	0.2401
Weight of nitrogen in total weight of (a), from highest value	2.5310	2 7518
Weight of albuminoids from this value	15.8185	17.1987
Per cent. of albuminoids in fresh organ	15.82	17.20

TABLE XII.—CONTINUED.

EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

182	318	260	279	142	359	162	337
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
22.4	21.7	21.4	21.8	21.8	21.1	25.	22.8
77.6	78.3	78.6	78.2	78.2	78.9	75.	77.2
22.1812	21.7050	21.7762	22.0070	21.7680	20.9482	24.5894	22.8422
+0.3812	+0.0050	+0.3762	+0.2070	0.0320	0.1518	0.4106	+0.0422
22.2538	21.9536	22.5188	22.0370	21.8442	21.2466	24.5972	22.9378
+0.0726	+0.2486	+0.7426	+0.0300	+0.0762	+0.2984	+0.0078	+0.0956
+0.22	+0.37	+0.79	+0.03	+0.09	+0.34	+0.15	—0.10
22.4088	22.0700	22.5648	21.9880	21.9748	21.2896	24.4548	22.7708
+0.1550	+0.1164	+0.0460	0.0490	+0.1306	+0.0430	0.1424	0.1670
+0.0088	+0.3700	+1.1648	+0.1880	+0.1748	+0.1896	—0.1346	—0.6814
0.0446	0.1086	0.1386	0.1456	0.0546	0.0290	0.2554	0.1408
2.23	5.43	6.93	7.28	2.73	1.45	12.77	7.04
0.4995	1.1783	1.4830	1.5870	0.5951	0.3059	3.1925	1.6051
77.88	79.11	79.29	79.76	78.70	78.86	78.04	78.90
77.91	78.69	78.26	79.55	78.51	78.63	78.49	78.48
0.2174	0.1000	0.1651	0.1752	0.2058	0.1556	0.1388	0.2092
0.2068	0.1048	0.1637	0.1600	0.1974	0.1656	0.1362	0.2170
0.0106	+0.0048	0.0014	0.0152	0.0084	+0.0100	0.0026	+0.0078
2.4349	1.1371	1.7666	1.9097	2.2432	1.7471	1.7350	2.4738
2.43	1.14	1.77	1.91	2.24	1.75	1.73	2.47
0.2411	0.2486	0.2415	0.2268	0.2475	0.2574	0.2201	0.2414
.....	.....	0.2390	.....	0.2404	.....	0.2208	0.2393
.....	0.2513	.....	.....	.....	0.2435	0.2201	0.2330
2.7003	2.7266	2.5840	2.4721	2.6977	2.7156	2.7700	2.7520
16.8769	17.0412	16.1500	15.450$_6$	16.8606	16.9725	17.3125	17.2000
16.88	17.04	16.15	15.45	16.86	16.97	17.31	17.20

TABLE XIII.

FLESH OF LIVER OF

(The figures represent weights in grams,

Laboratory number	200	297
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	32.7	31.2
Loss by drying (water)	67.3	68.8.
Weight of substance placed in bottle for subsequent analysis	32.6342	31.1652
Loss by adherence to screen	0.0658	0.0348
Weight of substance just before pulverizing	32.7116	.....
Loss or gain during interval (water)	+0.0774	.....
Weight of this calculated for (a)	+0.09	.....
Weight of substance after pulverizing (b)	32.8826	30.8594
Loss during operation	+0.1710	.....
Total gain or loss	+0.1826	0.3406
Weight of water in 2 grams of (b)	0.0944	0.1542
Per cent. of water in (b)	4.72	7.71
Weight of water for total weight of (a)	1.5434	2.4055
Total per cent. of water in fresh organ, *calculated*	68.75	71.20
Actual per cent. of water found at time in 2 grams	67.71	70.14
Weight of fat in 2 grams of (b) without further drying (c)	0.4272	0.2728
Weight of fat in 2 grams of (b) after complete drying (d)	0.4194	0.2634
Difference for or against complete drying	0.0078	0.0094
Weight of fat for total weight of (a), from highest value	6.9847	4.2557
Per cent. of fat in fresh organ	6.98	4.26
Weight of nitrogen in 2 grams of (b)	0.1732	0.1850
Weight of nitrogen in (c)	0.1652	0.1666
Weight of nitrogen in (d)	0.1655	.....
Weight of nitrogen in total weight of (a), from highest value	2.8618	2.8860
Weight of albuminoids from this value	17.8862	18.0375
Per cent. of albuminoids in fresh organ	17.89	18.04

TABLE XIII.—CONTINUED.

EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

183	319	258	277	140	362	159	338
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
33.8	33.2	32.9	29.6	31.3	31.6	32.1	33.6
66.2	66.8	67.1	70.4	68.7	68.4	67.9	66.4
33.0878	33.2274	32.7094	31.4642	31.1972	31.9428	31.5434	32.9756
0.7122	+0.0274	0.1906	+1.8642	0.1028	+0.3428	0.5566	0.6244
33.2488	33.5090	33.4374	32.0240	31.2464	32.2718	31.6352	33.2675
+0.1610	+0.2816	+0.7280	+0.5598	+0.0492	+0.3290	+0.0918	+0.2919
+0.29	+0.31	+0.73	+0.56	+0.05	+0.33	+0.10	+0.30
33.3778	33.4700	33.3974	32.2074	31.2088	31.9726	31.3250	33.1740
+0.1290	0.0390	0.0400	+0.1834	0.0376	0.2992	0.3102	0.0935
0.4222	+0.2700	+0.4974	+2.6074	0.0912	+0.3726	0.7750	0.4260
0.1241	0.1298	0.1526	0.1670	0.0608	0.1432	0.0870	0.0830
6.20	6.49	7.63	8.35	3.04	7.16	4.35	4.15
2.0973	2.1547	2.5103	2.2716	0.9515	2.2626	1.3963	1.3944
68.01	68.64	68.88	72.11	69.60	70.33	69.20	67.49
67.74	69.16	68.69	71.72	69.33	70.07	69.95	67.18
0.2534	0.0948	0.1747	0.1726	0.1790	0.1304	0.1118	0.2116
0.2172	0.0770	0.1305	0.1356	.....	0.1064	0.1058	0.1820
0.0362	0.0178	0.0442	0.0370	.....	0.0240	0.0060	0.0296
4.2825	1.5737	2.8738	2.5545	2.8013	2.0603	1.7944	3.4549
4.28	1.57	2.87	2.55	2.80	2.06	1.79	3.45
0.1716	0.1850	0.1734	0.1834	0.1837	0.1945	0.1795	.....
0.1639	0.1872	0.1702	0.1855	0.1792	0.1923	0.1718	0.1714
0.1670	0.1872	0.1702	0.2035	.....	0.1947	.....	0.1742
2.9000	3.1075	2.8524	3.0118	2.8749	3.0763	2.8810	2.9266
18.1250	19.4219	17.8275	18.8237	17.9681	19.2269	18.0082	18.2912
18.12	19.42	17.83	18.82	17.97	19.23	18.01	18.29

TABLE XIV.

FLESH OF SPLEEN OF

(The figures represent weights in grams,

Laboratory number	201	299
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen, (a)	24.1	23.6
Loss by drying (water)	75.9	76.4
Weight of substance placed in bottle for subsequent analysis	24.5988	24.2626
Loss by adherence to screen	+0.4988	+0.6626
Weight of substance just before pulverizing	24.7986	.....
Loss or gain during interval (water)	+0.1998	.....
Weight of this calculated for (a)	+0.33	.....
Weight of substance after pulverizing (b)	24.9330	24.0614
Loss during operation	+0.1344	.....
Total gain or loss	+0.8330	+0.4614
Weight of water in 2 grams of (b)	0.0820	0.1300
Per cent. of water in (b)	4.10	6.50
Weight of water for total weight of (a)	0.9881	1.5340
Total per cent. of water in fresh organ, *calculated*	76.56	77.93
Actual per cent. of water found at time in 2 grams	76.17	76.51
Weight of fat in 2 grams of (b) without further drying (c)	0.2578	0.3562
Weight of fat in 2 grams of (b) after complete drying (d)	0.2592	0.3780
Difference for or against complete drying	+0.0014	+0.0218
Weight of fat for total weight of (a), from highest value	3.1234	4.4604
Per cent. of fat in fresh organ	3.12	4.46
Weight of nitrogen in 2 grams of (b)	0.2311	0.2254
Weight of nitrogen in (c)	0.2268	0.2079
Weight of nitrogen in (d)	0.2222	0.2079
Weight of nitrogen in total weight of (a), from highest value	2.7847	2.6597
Weight of albuminoids from this value	17.4044	16.6231
Per cent. of albuminoids in fresh organ	17.40	16.62

TABLE XIV.—CONTINUED.

EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

184 Zeno.	321 Curley.	261 Bear.	281 Bonnie.	139 Joe.	360 Nancy.	161 Jack.	339 Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
24.9	23.1	28.5	23.9	24.	24.9	24.6	26.7
75.1	76.9	71.5	76.1	76.	75.1	75.4	73.3
24 4182	23.0776	27.9034	24.1760	24.1814	24.9890	23.8608	25.8152
0.4818	0.0224	0.5966	+0.2760	+0.1814	+0.0890	0.7692	0.8848
24.4778	23.2360	28.0954	24.3832	24.2704	24.5658	23.9356	26.1308
+0.0596	+0.1584	+0.1920	+0.2072	+0.0890	0.4232	+0.0748	+0.3156
+0.06	+0.33	+0.19	+0.48	+0.15	0.36	0.07	+1.15
24.2384	23.4116	28.0354	24.6532	24.3266	25.5076	23.7974	26.9618
0.2394	+0.1756	0.0600	+0.2700	+0.0562	+0.0582	0.1382	+0.8310
0.6616	+0.3116	0.4646	+0.7532	+0.3266	+0.6076	0.8026	+0.2618
0.0820	0.0754	0.1944	0.0842	0.0258	0.0654	0.1282	0.0560
4.10	3.77	9.72	4.21	1.29	3.27	6.41	2.80
1.0209	0.8709	2.7702	1.0062	0.3096	0.8142	1.5769	0.7466
76.06	77.44	74.08	76.63	76.16	75.98	77.05	72.90
76.43	77.49	73.34	74.92	75.12	75.35	76.95	71.89
0.3556	0.1936	0.4758	0.4278	0.3278	0.3672	0.2390	0.4226
.....	0.1964	0.4737	0.4024	0.3286	0.3818	0.2372	0.4318
.. ..	+0.0028	0.0021	0.0254	0.0008	+0.0146	0.0018	+0.0092
4.4272	2.2684	6.7801	5.1122	3.9432	4.7534	2.9397	5.7645
4.43	2.27	6.78	5.11	3.94	4.75	2.94	5.76
0.2117	0.2373	0.1935	0.2170	0.2342	0.2210	0.2299	0.2090
0.2117	.....	0.1838	0.1886	0.2220	.....	0.2194	0.2099
....	0.2349	0.1802	0.2072	0.2230	0.2091	0.2205	0.2039
2.6357	2.7408	2.7574	2.5931	2.8104	2.7514	2.8290	2.8035
16.4731	17.1300	17.2337	16.2069	17.5650	17.1963	17.6812	17.5219
16.47	17.13	17.23	16.21	17.56	17.20	17.68	17.52

TABLE XV.

FLESH OF KIDNEYS OF

(The figures represent weights in grams,

Laboratory number	207	302
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	22.9	26.5
Loss by drying (water)	77.1	73.8
Weight of substance placed in bottle for subsequent analysis	23.2324	26.5756
Loss by adherence to screen	+0.3324	+0.0756
Weight of substance just before pulverizing	23.3850	26.6442
Loss or gain during interval (water)	+0.1526	+0.0686
Weight of this calculated for (a)	+0.28	+0.14
Weight of substance after pulverizing (b)	23.5150	26.7122
Loss during operation	+0.1300	+0.0680
Total gain or loss	+0.6150	+0.2122
Weight of water in 2 grams of (b)	0.0576	0.1710
Per cent. of water in (b)	2.88	8.55
Weight of water for total weight of (a)	0.6595	2.2657
Total per cent. of water in fresh organ, *calculated*	77.48	75.93
Actual per cent. of water found at time in 2 grams	76.92	74.53
Weight of fat in 2 grams of (b) without further drying (c)	0.5250	0.4211
Weight of fat in 2 grams of (b) after complete drying (d)	0.5280	0.4094
Difference for or against complete drying	+0.0030	0.0117
Weight of fat for total weight of (a) from highest value	6.0456	5.5795
Per cent. of fat in fresh organ	6.05	5.58
Weight of nitrogen in 2 grams of (b)	0.1821	0.1970
Weight of nitrogen in (c)	.....	0.1928
Weight of nitrogen in (d)	0.1750	0.1883
Weight of nitrogen in total weight of (a) from highest value.	2.0850	2.6102
Weight of albuminoids from this value	13.0312	16.3137
Per cent. of albuminoids in fresh organ	13.03	16.31

TABLE XV.—CONTINUED.

EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

196	323	273	282	153	374	175	253
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
21.5	26.1	24.2	22.4	29.4	27.6	26.1	22.8
78.5	73.9	75.8	77.6	70.6	72.4	73.9	77.2
21.2531	25.3382	24.8674	23.1562	27.2720	27.5190	25.9408	23.0720
0.2469	0.7618	+0.6674	+0.7562	2.1280	0.0810	0.1592	+0.2720
21.3358	25.7178	24.9804	23.4434	27.3082	27.3900	25.9578	23.9070
+0.0827	+0.3796	+0.1130	+0.2872	+0.0362	0.1290	+0.0190	+0.8350
+0.22	+0.38	+0.29	+0.46	+0.04	0.13	+0.02	+0.83
21.4800	25.6474	25.1592	23.6156	27.2640	26.9254	25.8912	23.5924
+0.1442	0.0704	+0.1788	+0.1722	0.0442	0.4646	0.0686	0.3146
0.0200	0.4526	+0.9592	+1.2156	2.1360	0.6746	0.2088	+0.7924
0.0714	0.0792	0.1418	0.1032	0.0742	0.1790	0.2366	0.1231
3.57	3.96	7.09	5.16	3.71	8.95	11.83	6.15
0.7675	1.0336	1.7158	1.1558	1.0907	2.4702	3.0876	1.4033
79.05	74.55	77.23	78 30	71.65	75.00	76.97	77.77
79.92	75.77	78.62	76.73	73.41	75.42	76.24	77.57
0.4196	0.5818	0.5310	0.4552	0.7506	0.3128	0.3664	0.3524
0.3886	0.5924	0.4700	0.4174	.. ..	0.3036	0.3444	0.3696
+0.0310	+0.0106	0.0610	0.0378	.....	0.0092	0.0220	+0.0172
4.5107	7.7308	6.4251	5.0982	11.0338	4.3166	4.7815	4.2134
4.51	7.73	6.42	5.10	11.03	4.32	4.78	4.21
.....	0.1827	0.1960	0.2117	0.1568	0.2130	0.2005	0.2086
0.2039	0.1809	0.1848	0.1634	0.1526	0.2077	0.1904	.....
0.2070	0.1827	0.2044	0.2016	.....	0.2039	0.1914	0.2038
2.2252	2.3842	2.4732	2.2579	2.3060	2.9394	2.6165	2.3780
13.9075	14.9012	15.4575	14.1119	14.4125	18.3712	16.3531	14.8625
13.91	14.90	15.46	14.11	14.41	18.37	16.35	14.86

TABLE XVI.

BRAIN OF EXPERIMENTAL ANIMALS.

(The figures represent weights in grams,

Laboratory number	204	298
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	24.	23.4
Loss by drying (water)	76.	76.6
Weight of substance placed in bottle for subsequent analysis	23.9183	22.8690
Loss by adherence to screen	0.0817	0.5310
Weight of substance just before pulverizing	24.0702	
Loss or gain during interval (water)	+0.1519	
Weight of this calculated for (a)	+0.31	
Weight of substance after pulverizing (b)	24.2354	22.7088
Loss during operation	+0.1652	
Total gain or loss	+0.2354	0.6912
Weight of water in 2 grams of (b)	0.0828	0.2638
Per cent of water in (b)	4.14	13.19
Weight of water for total weight of (a)	0.9936	3.0865
Total per cent. of water in fresh organ, *calculated*	76.68	79.69
Actual per cent. of water found at time in 2 grams	75.40	78.68
Weight of fat in 2 grams of (b) without further drying (c)	0.9544	0.8308
Weight of fat in 2 grams of (b) after complete drying (d)	0.8976	0.9062
Difference for or against complete drying	0.0568	+0.0754
Weight of fat for total weight of (a), from highest value	11.4528	10.6025
Per cent. of fat in fresh organ	11.45	10.60
Weight of nitrogen in 2 grams of (b)	0.1339	0.1392
Weight of nitrogen in (c)		
Weight of nitrogen in (d)	0.1311	0.0998
Weight of nitrogen in total weight of (a), from highest value	1.6068	1.6286
Weight of albuminoids from this value	10.0425	10.1787
Per cent. of albuminoids in fresh organ	10.04	10.18

TABLE XVI.—CONTINUED.

BRAIN OF EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

179	317	262	280	141	358	163	340
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
50.	100.	100.	100.	40.	100.	50.	100.
11.8	22.2	23.4	22.8	10.8	22.2	15.1	27.7
38.2	77.8	76.6	77.2	29.2	77.8	34.9	72.3
11.3530	21.9426	22.7088	22.5762	10.5850	22.7594	14.2892	26.7558
0.4470	0.2574	0.6912	0.2238	0.2150	+0.5594	0.8108	0.9442
11.4036	22.1274	23.1720	72 7842	10.5820	23.0470	14.2828	26.6126
+0.0506	+0.1848	+0.4632	+0.2080	0.0030	+0.2876	0.0064	0.1432
+0.11	+0.18	+0.47	+0.29	0.01	+0.29	0.01	0.14
11.4649	22.1296	22.8890	72.8722	10.4218	22.8884	14 0528	25.7306
+0.0613	+0.0022	0.2830	+0.0880	0.1602	0.1586	0.2300	0.8820
0.3351	0.0704	0.5110	+0.0722	0.3782	+0.6884	1.0472	1.9694
0.0392	0.1638	0.0966	0.0808	0.1278	0.1510	0.3908	0.3214
1.96	8.19	4.83	4.04	6.39	7.55	19.54	16.07
0.3313	1.8182	1.1302	0.9211	0.6901	1.6761	2.9505	4.4514
76.84	79.44	77.26	77.83	74.75	79.19	75.72	76.89
76.67	77.66	76.20	76.71	75.12	77.12	76.91	77.11
0.9180	0.6530	0.8241	0.8428	0.7802	0.7192	0.7298	0.5758
0.8676	0.7896	0.9945	0.8890	0.9270	0.9678	0.8300	0.6540
0 0504	+0.1366	+0.1704	+0.0462	+0.1468	+0.2486	+0.1002	+0.0782
5.4162	8.7646	11.6356	10 1346	5.0058	10.7426	6.2665	9 0579
10.83	8.76	11.64	10.13	12.51	10.74	12.53	9.06
0.1515	0.1407	0.1361	0.1463	0.1344	0.1353	0 1190	0.1358
0.1319	.....	.....	.. ..	0.1127	.....	0.1001	0.1277
0.1344	0.1168	0.1141	0.1589	0.1134	0.1037	0.0987	0.1179
0.8938	1.5618	1.5924	1.8115	0.7258	1.5018	0.8984	1.8808
5.5862	9 7612	9.9525	11.3219	4.5362	9.3862	5 6150	11.7550
11.17	9.76	9.95	11.32	11.34	9.39	11.23	11.75

TABLE XVII.

STOMACH OF EXPERIMENTAL ANIMALS.

(The figures represent weights in grams,

Laboratory number	205	295
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	19.2	23.
Loss by drying (water)	80.8	77.
Weight of substance placed in bottle for subsequent analysis	19.8708	23.2084
Loss by adherence to screen	+0.6708	+0.2084
Weight of substance just before pulverizing	20.0000	
Loss or gain during interval (water)	+0.1292	
Weight of this calculated for (a)	+0.25	
Weight of substance after pulverizing (b)	20 1144	23.0618
Loss during operation	+0.1144	
Total gain or loss	+0.9144	+0.0618
Weight of water in 2 grams of (b)	0.0670	0.0416
Per cent. of water in (b)	3.35	2.08
Weight of water for total weight of (a)	0.6432	0.4784
Total per cent. of water in fresh organ, *calculated*	81.19	77.48
Actual per cent. of water found at time in 2 grams	79.09	76.70
Weight of fat in 2 grams of (b) without further drying (c)	0.5171	0.7630
Weight of fat in 2 grams of (b) after complete drying (d)	0.5362	0.7654
Difference for or against complete drying	+0.0191	+0.0024
Weight of fat for total weight of (a) from highest value	5.1475	8.8021
Per cent. of fat in fresh organ	5.15	8.80
Weight of nitrogen in 2 grams of (b)	0.1912	0.1603
Weight of nitrogen in (c)	0.1888	0.1624
Weight of nitrogen in (d)	0.1862	0.1589
Weight of nitrogen in total weight of (a) from highest value	1.8355	1.8676
Weight of albuminoids from this value	11.4719	11.6725
Per cent. of albuminoids in fresh organ	11.47	11.67

TABLE XVII.—CONTINUED.

STOMACH OF EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

180	315	256	275	143. 143a	357	158	335
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	100.	100.	100.	100.
24.9	23.8	22.1	23.2	24.6	37.5	21.4	29.6
75.1	76.2	77.9	76.8	75.4	62.5	78.6	70.4
24.1798	23.4168	21.9444	23.0368	23.9700	37.4332	20.4388	29.5104
0.7202	0.3832	+0.8444	0.1632	0.6300	0.0668	+0.0388	0.0896
24.3988	23.6346	22.2074	23.4842	24.0400	37.9750	20.5034	29.5938
+0.2190	+0.2178	+0.2630	+0.4474	+0.0700	+0.5418	+0.0646	+0.0834
+0.29	+0.34	+0.27	+0.57	+0.07	+0.54	+0.07	+0.08
24.4648	23.7526	22.2124	23.5998	23.9600	37.7270	20.3780	29.1788
+0.0660	+0.1180	+0.0050	+0.1156	0.0800	0.2480	0.1254	0.4150
0.4352	0.0474	+0.1124	+0.3998	0.6400	+0.2270	1.0220	0.4212
0.1206	0.0892	0.0652	0.0684	0.0989	0.0258	0.0486	0.0558
6.03	4.46	3.26	3.42	4.94	1.29	2.43	2.79
1.5015	0.9615	0.7205	0.7934	1.2165	0.4837	0.5200	0.8258
76.31.	76.82	78.35	77.02	76.55	62.44	79.05	71.15
74.21	76.70	80.89	77.18	78.81	63.42	79.33	70.40
0.8188	0.6468	0.6895	0.7488	0.7127	1.3282	0.6434	1.0982
0.7964	0.6360	.....	0.7260	0.7119	1.3186	0.6372	1.1068
0.0224	0.0108	.....	0.0228	0.0008	0.0096	0.0062	+0.0086
10.1941	7.6969	7.6190	8.6861	8.7662	24.9037	6.8844	16.3806
10.19	7.70	7.62	8.69	8.77	24.90	6.88	16.38
0.1484	0.1717	0.1678	0.1641	0.1719	0.0779	0.1865	0.1151
0.1428	0.1673	0.1625	0.1578	0.1599	.....	0.1774	0.1137
0.1449	.....	0.1632	.....	0.1549	0.0873	0.1771	0.1130
1.8476	2.0432	1.8542	1.9036	2.1144	1.6369	1.9955	1.7035
11.5475	12.7700	11.5887	11.8975	13.2150	10.2306	12.4719	10.6469
11.55	12.77	11.59	11.90	13.21	10.23	12.47	10.65

TABLE XVIII.

INTESTINES OF EXPERIMENTAL ANIMALS.

(The figures represent weights in grams,

Laboratory number	206	296
Name of animal	Sanborn.	G.Francis
Weight of fresh organ taken	100.	100.
Weight of oven-dried organ, on screen (a)	26.5	22.
Loss by drying (water)	73.5	78.
Weight of substance placed in bottle for subsequent analysis	26.4890	22.9536
Loss by adherence to screen	0.0110	+0.9536
Weight of substance just before pulverizing	26.5988	
Loss or gain during interval (water)	+0.1098	
Weight of this calculated for (a)	+0.11	
Weight of substance after pulverizing (b)	26.1774	21.9732
Loss during operation	0.4214	
Total loss	0.3226	0.0268
Weight of water in 2 grams of (b)	0.0490	0.1430
Per cent. of water in (c)	2.45	7.15
Weight of water for total weight of (a)	0.6492	1.5730
Total per cent. of water in fresh organ, *calculated*	74.04	79.57
Actual per cent. of water found at time in 2 grams	74.22	79.64
Weight of fat in 2 grams of (b) without further drying, (c)	0.8565	0.7550
Weight of fat in 2 grams of (b) after complete drying, (d)	0.8722	0.7412
Difference for or against complete drying	+0.0157	0.0138
Weight of fat for total weight of (a) from highest value	11.5566	8.3050
Per cent. of fat in fresh organ	11.56	8.30
Weight of nitrogen in 2 grams of (b)	0.1500	0.1498
Weight of nitrogen in (c)	0.1486	0.1477
Weight of nitrogen in (d)	0.1462	0.1456
Weight of nitrogen in total weight of (a) from highest value	1.9875	1.6478
Weight of albuminoids from this value	12.4214	10.2987
Per cent. of albuminoids in fresh organ	12.42	10.30

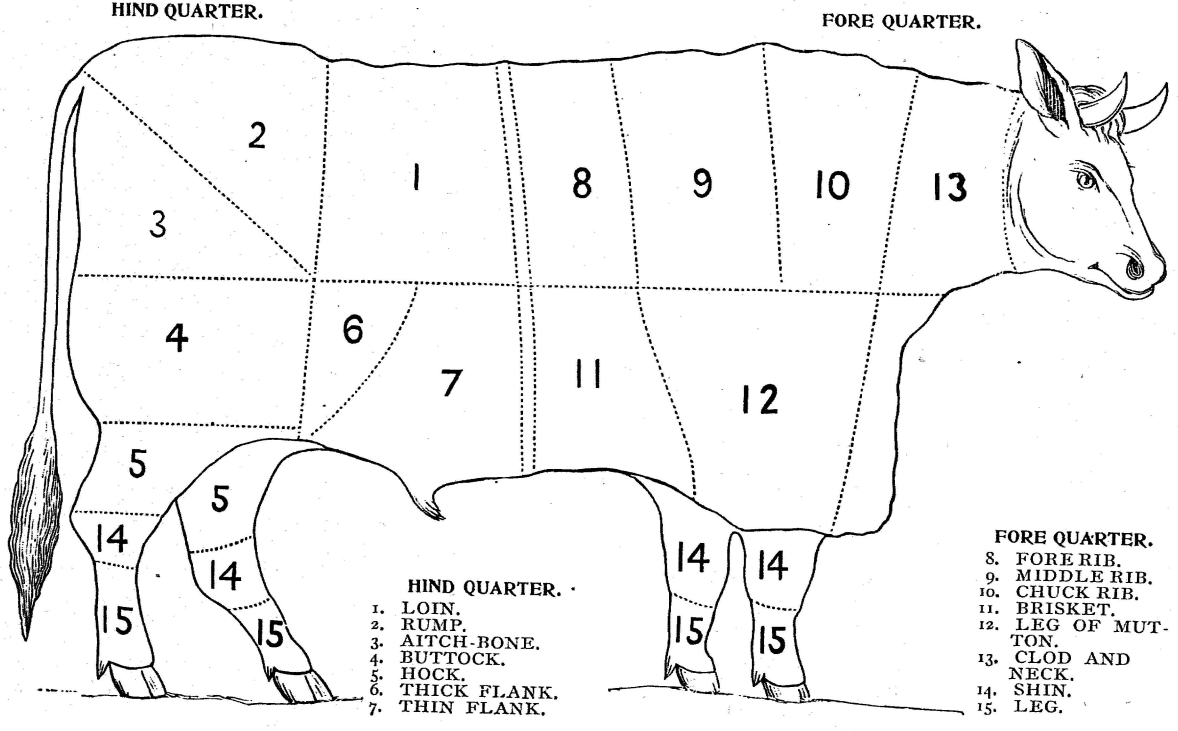
TABLE XVIII.—CONTINUED.

INTESTINES OF EXPERIMENTAL ANIMALS.

excepting where percentages are mentioned.)

181	316	257	276	144 145	356	164	336
Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
100.	100.	100.	100.	50.	100.	100.	100.
24.5	29.5	22.3	24.6	12.8	26.1	31.9	26.8
75.5	70.5	77.7	75.4	37.2	73.9	68.1	73.2
23.7360	28.6998	22.4592	24.5420	12.3950	26.8220	31.3166	26.7132
0.7640	0.8002	+0.1592	0.0580	0.4050	+0.7220	0.5834	0.0868
24.0308	28.8038	21.5232	24.6692	12.4100	27.0724	31.3316	26.7376
+0.2948	+0.1040	0.9360	+0.1272	+0.0150	+0.2504	+0.0150	+0.0244
+0.38	+0.11	0.94	0.13	+0.02	+0.25	+0.02	+0.03
24.1202	28.5112	21.4532	24.4360	12.3750	26.8460	31.0310	26.4054
+0.0894	0.2926	0.0700	0.2332	0.0350	0.2264	0.3006	0.3322
0.3798	0.9888	0.8468	0.1640	0.4250	+0.7460	0.8690	0.3946
0.0658	0.0742	0.0840	0.0592	0.1163	0.0436	0.1408	0.1618
3.29	3.71	4.20	2.96	5.81	2.18	7.04	8.09
0.8060	1.0944	0.9366	0.7282	0.7443	0.5900	2.2458	2.1681
75.93	71.48	79.58	76.26	75.85	74.24	70.33	75.34
76.79	71.35	77.23	74.55	77.50	73.36	71.89	76.80
0.8372	1.0416	0.7581	0.8936	0.6532	0.9148	0.9282	0.7872
0.8674	1.0522	0.7472	0.8786	0.6503	0.8848	0.9326	0.7804
+0.0302	+0.0106	0.0109	0.0150	0.0029	0.0300	0.0044	0.0068
10.6256	15.5129	8.4528	10.9913	4.1805	11.9381	14.8749	10.5485
10.63	15.52	8.45	10.99	8.36	11.94	14.87	10.55
0.1435	.....	0.1625	0.1428	0.1726	0.1399	0.1176	0.1435
0.1396	0.1044	0.1513	0.1356	0.1624	0.1352	0.1085	0.1438
0.1407	0.1083	0.1510	.....	0.1587	0.1363	0.1081	0.1351
1.7579	1.5974	1.8119	1.7564	1.1046	1.8257	1.8757	1.9269
10.9869	9.9837	11.3244	10.9775	6.9037	11.4106	11.7231	12.0431
10.99	9.98	11.32	10.98	13.81	11.41	11.72	12.04

Sections of the Carcass of the Ox.



HIND QUARTER.

1. LOIN.
2. RUMP.
3. AITCH-BONE.
4. BUTTOCK.
5. HOCK.
6. THICK FLANK.
7. THIN FLANK.

FORE QUARTER.

8. FORE RIB.
9. MIDDLE RIB.
10. CHUCK RIB.
11. BRISKET.
12. LEG OF MUTTON.
13. CLOD AND NECK.
14. SHIN.
15. LEG.

6. Additional Facts.

Aside from the numerous and repeated operations (weighing etc.) to ascertain single facts and the systematic precaution and tireless exercise of judgment and watchfulness which the work demanded, the preceding tables comprise the results of the chemical investigation. To better apprehend the facts, however, a more condensed form of tabulation is necessary. Besides, the analyses of the meat cuts do not in every case represent the composition of the meats as most of them, on reaching the laboratory, were freed from the layers and messes of fat adhering, which the work with the first eight or ten samples had proved a matter of necessity.

The portions of fat, and of bone also, were weighed at the time and, neglecting the latter as mere incidents of the work, the weights of fat and of lean meat in grams with their relative percentages, are tabulated below. These values were by simple arithmetic calculation incorporated into the analyses and made to yield the percentage composition of the flesh. The constant error thereby entailed, of considering the fat cut off as being wholly fat in the chemical sense, was unavoidable and is, at worst, not large; it can not affect the practical correctness of the results recorded. Two water determinations each with soft and hard fat (tallow) from different animals gave in the former case 5.00 and 5.05 per cent., and in the latter 3.25 and 3.30 per cent. of water; this doubtless belongs to the nitrogenous connective tissue in which the fat is embedded and would scarcely alter the final results. An investigation of the point will, however, be made at a later time.

TABLE XIX.

TABLE OF WEIGHTS AND PERCENTAGES OF FAT AND LEAN MEAT RECEIVED AT LABORATORY.

Laboratory Number.	Bone.	Fat.	Lean.	P. C. Fat.	P. C. Lean.
151	....	35.2	272.8	11.36	88.64
152	.....	88.5	320.6	21.63	78 37
153	.....	25.8	190.4	11.93	88.07
164a	12.5	69.6	103.4	40.23	59.77
165	23.	129.1	196.8	39.61	60.39
166	.....	29.3	633.8	4.42	95.58
168	.....	88.1	39.9	68.83	31.17
169	103.	152.4	108.9	58.32	41.68
186	49.7	212.4	250.	45.93	54.07
187	43.6	217.9	189.	53.56	46.44
188	39.5	32.2	124.1	20.60	79.40
189	.. .. ..	255.	70.5	78.34	21.66
190	8.5	231.	286.9	44.59	55.41
191	6.2	129.	406.	24.11	75.89
192	65.7	348.5	290.8	46 08	53.92
194	.....	76.8	320.4	19.33	80.67
208	77.7	387.	979.8	28.31	71.69
209	.....	100.	602.8	14.23	85.77
212	37.5	308.5	320.4	49.05	50.95
214	.....	237.	517.4	31.41	68.59
215	44.	284.5	554.4	33.91	66.09
216	145.5	357.	629.9	36.17	63.83
217	80.2	108.	320.9	25.18	74.82
263	94.	205.5	350.5	36.96	63.04
264	175.2	184.5	320.9	36.50	63.50
265	15.	57.	699.1	7.54	92.46
266	.....	184.	173.	51.54	48.46
267	.....	240.	176.	57.69	42.31
268	19.7	108.9	191.8	36.21	63.79
269	47.5	181.9	402.9	31.10	68.90
270	51.8	153.7	279.5	35.48	64.52
271	69.	.....	199.	.....	100.00
272	4.7	130.3	444.4	22 67	77.33
284	101.7	154.2	296.9	34.19	65.81
285	34.	46.9	296.9	13.64	86.36
286	.. ..	147.9	102.9	61.42	38.58
287	101.	183.8	296.7	38.25	61.75
288	40.	147.4	266.9	35.58	64.42
289	74.3	183.9	566.9	24.49	75.51
290	43.	115.1	259.4	30.73	69.27
291	125.5	42.9	365.9	10.49	89.51
292	44.5	32.9	156.9	17.34	82.66
303	42.5	233.4	463.4	33.48	66.52
304	33.	121.1	377.3	24.28	75.72
305	23.	25.5	373.	6.40	93.60

TABLE XIX.— CONTINUED.

LABORATORY NUMBER.	BONE.	FAT.	LEAN.	P. C. FAT.	P. C. LEAN.
306	.....	377.4	287.3	56.78	43.22
307	34.5	198.5	225.2	46.85	53.15
308	25.5	94.4	157.1	27.53	72.47
309	71.6	261.9	450.5	36.76	63.24
310	60.	353.9	400.9	46.89	53.11
311	124.	60.9	316.9	16.12	83.88
312	68.	5.4	196.5	2.18	97.82
325	64.	188.5	511.6	26.92	73.08
326	67.5	134.4	151.1	47.08	52.92
327	29.	59.5	361.2	14.14	85.86
228	.....	440.1	173.9	71.68	28.32
229	18.	131.	238.	35.50	64.50
330	21.7	85.7	158.1	35.11	64.89
331	34.1	197.3	281.4	41.22	58.78
332	45.5	271.4	271.9	49.95	50.05
333	79.	11.1	214.9	4.91	95.09
334	56.	75.9	162.9	31.78	68.22
342	22.1	27.8	543.7	4.86	95.14
343	57.3	142.7	281.	33.68	66.32
344	29.5	16.1	707.	2.23	97.77
345	.....	445.1	226.2	66.30	33.70
346	.....	99.4	244.3	28.92	71.08
347	35.2	111.7	241.7	31.61	68.39
348	60.6	113.3	361.2	23.88	76.12
349	68.6	362.3	361.2	50.08	49.92
350	61.5	48.4	276.7	14.89	85.11
651	69.3	.....	236.3	.....	100.00
364	71.4	130.1	708.8	15.51	84.49
365	126.	171.9	570.4	23.16	76.84
366	27.	.....	628.8	.....	100.00
367	.....	498.6	284.8	63.64	36.36
368	118.	155.7	240.1	39.33	60.67
369	30.2	104.9	333.9	23.90	76.10
370	30.1	58.3	509.8	10.26	89.74
371	31.3	161.9	675.1	19.34	80.66
372	86.1	348.8	399.7	46.60	53.40
373	75.	48.1	259.9	15.61	84.39
374	.....	32.9	400.7	7.59	92.41

TABLE XX.

COMPOSITION OF MEATS ANALYZED AND OF

Laboratory number [Sanborn]	208	209
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	11.24	8.05
Albuminoids	19.38	21.51
Water	67.09	68.34
Loss (Ash, etc.)	2.29	2.10
	100.	100.
Per cent. composition of original flesh:		
Fat	36.37	21.13
Albuminoids	13.89	18.45
Water	48.09	58.62
Loss (Ash, etc.)	1.65	1.80
	100.	100.
Laboratory number [Gov. Francis]	303	304
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	14.01	10.79
Albuminoids	19.30	19.30
Water	65.20	68.43
Loss (Ash, etc.)	1.50	1.48
	100.	100.
Per cent. composition of original flesh:		
Fat	42.80	32.45
Albuminoids	12.84	14.61
Water	43.37	51.82
Loss (Ash, etc.)	0.99	1.12
	100.	100.

TABLE XX.—CONTINUED.

FLESH OF CUTS OF THE TWO SHORTHORN STEERS.

210	211	212	213	214	215	216	217
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
8.54	not rec'vd	23.37	21.86	22.83	12.31	13.02	9.08
19.61		18.48	18.61	18.09	19.64	19.45	19.73
68.63		57.15	58.52	58.14	66.31	65.55	69.31
3.22		1.00	1.01	0.94	1.74	1.98	1.88
100.		100.	100.	100.	100.	100.	100.
same		60.96	same	47.07	42.05	44.48	31.97
		9.41		12.41	12.98	12.42	14.76
		29.11		39.88	43.82	41.84	51.86
		0.52		0 64	1.15	1.26	1.41
		100.		100.	100.	100.	100.
305	306	307	308	309	310	311	312
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
7.51	10.21	31.00	19.77	24.10	11.97	10.83	8.61
19.28	19.69	16.98	17.80	18.22	19.87	19.51	20.07
71.74	68.77	51.87	60.59	56.27	65.57	67.80	69.32
1.47	1.33	0.15	1.84	1.41	2.59	1.86	2.00
100.	100.	100.	100.	100.	100.	100.	100.
13.43	same	63.33	41.86	52.00	53.25	25.20	10.60
18.05		9.02	12.89	11.52	10.55	16.37	19.63
67.15		27.57	43.91	35.59	34.82	56.88	67.81
1.37		0.08	1.34	0.89	1.38	1.55	1.96
100.		100.	100.	100.	100.	100.	100.

TABLE XXI.

COMPOSITION OF MEATS ANALYZED AND OF

Laboratory number [Zeno]	186	187
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	7.36	8.86
Albuminoids	21.49	21 01
Water	68.70	68.69
Loss (Ash, etc.)	2.45	1.44
	100.	100.
Per cent. composition of original flesh:		
Fat	49.88	57.67
Albuminoids	11.63	9.76
Water	37.17	31.90
Loss (Ash, etc.)	1.32	0.67
	100.	100.
Laboratory number [Curley]	325	326
Number of cut		
Per cent. composition of meats analyzed:		
Fat	12.38	11.83
Albuminoids	20.32	19.24
Water	65.90	66.75
Loss (Ash, etc.)	1.40	2.18
	100.	100.
Per cent. composition of original flesh:		
Fat	35.97	53.34
Albuminoids	14.85	10.18
Water	48.16	35.32
Loss (Ash, etc.)	1.02	1.16
	100.	100.

TABLE XXI.—CONTINUED.

FLESH OF CUTS OF THE TWO HEREFORD STEERS.

188	189	190	191	192	193	194	195
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
7.20	11.21	21.21	23.86	9.96	12.55	19.45	8.37
21.54	20.31	18.41	17.86	19.41	19.50	19.48	19.82
69.35	66.83	58.40	56.13	68.54	66.00	61.08	69.20
1.91	1.65	1.88	2.15	2.09	1.95	—0.01	2.61
100.	100.	100.	100.	100.	100.	100.	100.
26.32	80.77	56.34	42.22	51.45	same	35.02	same
17.10	4.39	10.20	13.55	10.46		15.71	
55.06	14.47	32.36	42.59	36 96		49.27	
1.52	0.37	1.10	1.64	1.13		0.00	
100.	100.	100.	100.	100.		100.	
327	328	329	330	331	332	333	334
9.05	11.38	24.32	26.86	29.94	18.48	6.67	8.70
20.63	20.65	17.32	16.00	16.26	18.71	21.15	20.23
68.31	66.78	56.75	55.48	51.99	61.65	70.22	69.40
2.01	1.19	1.61	1.66	1.81	1.16	1.96	1.67
100.	100.	100.	100.	100.	100.	100.	100.
21.91	74.90	51.18	52.54	58.82	59.20	11.25	37.71
17.71	5.84	11.17	10.38	9.56	9.36	20.11	13.80
58.65	18.91	36.61	36.00	30.56	30.86	66.77	47.35
1.73	0.35	1.04	1.08	1.06	0.58	1.87	1.14
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXII.

COMPOSITION OF MEATS ANALYZED AND OF

Laboratory number [Bear]	263	264
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	10.45	12.31
Albuminoids	22.80	19.91
Water	66.15	64.58
Loss (Ash, etc.)	0.60	3.20
	100.	100.
Per cent. composition of original flesh:		
Fat	43.55	44.32
Albuminoids	14.37	12.64
Water	41.70	42.14
Loss (Ash, etc.)	0.38	0.90
	100.	100.
Laboratory number [Bonnie]	283	284
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	11.06	12.84
Albuminoids	19.25	20.19
Water	68.42	65.46
Loss (Ash, etc.)	1.27	1.51
	100.	100.
Per cent. composition of original flesh:		
Fat	same.	42.64
Albuminoids		13.29
Water		43.08
Loss (Ash, etc.)		0.99
		100.

TABLE XXII.—CONTINUED.

FLESH OF CUTS OF THE TWO ANGUS STEERS.

265	266	267	268	269	270	272	271
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
7.63	14.14	15.55	19.16	16.47	14.73	6.16	8.69
21.48	21.83	18.88	17.15	18.40	18.83	20.15	18.58
68.87	64.03	64.21	63.36	64.30	65.21	72.75	69.87
2.02	.....	1.36	0.33	0.83	1.23	0.94	2.86
100.	100.	100.	100.	100.	100.	100.	100.
14.59	58.39	64.27	48.43	42.45	44.98	27.43	same
19.86	10.58	7.99	10.94	12.68	12.15	15.58	
63.68	31.03	27.17	40.42	44.50	42.08	56.26	
1.87	....	0.57	0.21	0.37	0.79	0.73	
100.	100.	100.	100.	100.	100.	100.	
285	286	287	288	289	290	291	292
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
6.42	4.30	20.48	13.00	19.89	16.35	13.64	6.13
22.28	20.48	18.63	18.50	17.81	19.22	19.65	20.61
69.62	72.95	59.54	66.34	61.61	63.18	65.21	71.65
1.68	2.27	1.35	2.16	0.69	1.25	1.50	1.61
100.	100.	100.	100.	100.	100.	100.	100.
19.18	63.08	50.90	43.95	39.51	42.05	22.70	22.41
19.24	7.90	11.25	11.92	13.45	13.32	17.59	17.04
60.13	28.14	36.76	42.74	46.52	43.77	58.37	59.22
1.45	0.88	1.09	1.39	0.52	0.86	1.34	1.33
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXIII.

COMPOSITION OF MEATS ANALYZED AND OF

Laboratory number [Joe]	147	148
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	39.00	38.37
Albuminoids	13.30	13.51
Water	46.97	45.67
Loss (ash, etc.)	0.73	2.45
	100.	100.
Per cent. composition of original flesh:		
Fat	same.	same.
Albuminoids		
Water		
Loss (ash, etc.)		
Laboratory number [Nancy]	364	365
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	11.30	14.75
Albuminoids	20.45	19.59
Water	66.79	64.21
Loss (ash, etc.)	1.46	1.45
	100.	100.
Per cent. composition of original flesh:		
Fat	25.06	34.49
Albuminoids	17.28	15.05
Water	56.43	49.34
Loss (ash, etc.)	1.23	1.12
	100.	100.

TABLE XXIII.—CONTINUED.

FLESH OF CUTS OF THE TWO GRADE STEERS.

149	150	151	152	154		155	156
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
22.14	22.05	37.31	38.30	26.19	not rec'd	26.68	12.53
19.28	17.93	14.55	14.23	15.21		16.88	20.64
58.35	58.29	47.51	46.11	57.78		54.88	64.36
0.23	1.73	0.64	1.36	0.82		1.86	2.47
100.	100.	100.	100.	100.		100.	100.
same.	same.	44.43	51.65	same.		35.43	same.
		12.89	11.15			14.87	
		42.11	36.13			48.06	
		0.57	1.07			1.64	
		100.	100.			100.	
366	367	368	369	371	372	370	373
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
8.81	10.12	16.83	27.08	18.67	11.43	10.45	7.90
21.23	20.65	19.30	15.96	18.48	20.09	20.82	20.40
68.49	68.01	62.61	56.44	62.04	66.67	67.13	70.14
1.47	1.22	1.25	0.52	0.81	1.81	1.60	1.56
100.	100.	100.	100.	100.	100.	100.	100.
same.	67.32	49.54	44.51	34.40	52.70	19.64	22.28
	7.51	11.71	12.14	14.90	10.73	18.68	17.21
	24.73	37.99	42.95	50.04	35.60	60.24	59.19
	0.44	0.76	0.40	0.66	0.97	1.44	1.32
	100.	100.	100.	100.	100.	100.	100.

TABLE XXIV.

COMPOSITION OF MEATS ANALYZED AND OF

Laboratory number [Jack]	164a	165
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	27.27	11.32
Albuminoids	18.39	20.38
Water	52.88	65.71
Loss (ash, etc.)	1.46	2.59
	100.	100.
Per cent. composition of original flesh:		
Fat	56.53	46.45
Albuminoids	10.99	12.30
Water	31.60	39.68
Loss (ash. etc.)	0.88	1.47
	100.	100.
Laboratory number [Slocum]	342	343
Number of cut	No. 1	No. 2
Per cent. composition of meats analyzed:		
Fat	10.54	20.89
Albuminoids	20.97	18.01
Water	67.51	59.48
Loss (ash, etc.)	0.98	1.62
	100.	100.
Per cent. composition of original flesh:		
Fat	14.89	47.53
Albuminoids	19.95	11.94
Water	64.23	39.45
Loss (ash, etc.)	0.93	1.08
	100.	100.

TABLE XXIV.—CONTINUED.

FLESH OF CUTS OF THE TWO SCRUB STEERS.

166	168	169	170	171	172	173	174
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
14.83	6.96	16.25	16.28	23.39	28.24	9.05	10.19
19.84	23.33	20.52	19.63	17.74	16.19	20.69	20.26
63.03	69.44	62.17	62.08	58.24	53.71	68.42	67.48
2.30	0.27	1.06	2.01	0.63	1.86	1.84	2.07
100.	100.	100.	100.	100.	100.	100.	100.
18.59	71.00	64.99	same.	same.	same.	same.	same.
18.96	7.27	8.58					
60.25	21.64	25.99					
2.20	0.09	0.44					
100.	100.	100.					
344	345	346	347	348	349	350	351
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
8.89	16.30	29.56	31.48	31.54	29.95	10.09	8.59
19.99	19.22	16.91	15.94	16.35	17.34	20.23	20.30
69.08	63.22	52.69	52.01	50.19	56.29	68.73	69.13
2.04	1.26	0.84	0.57	1.92	2.42	0.95	1.98
100.	100.	100.	100.	100.	100.	100.	100.
11.92	71.79	48.13	53.14	47.89	62.03	23.48	same.
19.33	6.48	12.45	10.90	12.44	8.66	17.12	
66.72	21.31	38.80	35.57	38.20	28.10	58.49	
2.03	0.42	0.62	0.39	1.47	1.21	0.81	
100.	100.	100.	100.	100.	100.	100.	

TABLE XXV.

COMPOSITION OF THE ORGANS OF THE

Name of animal	Sanborn.	G.Francis
Laboratory number [heart]	203	301
Per cent. composition of organ:		
Fat	5.09	1.96
Albuminoids	16.79	16 08
Water	76.23	79.89
Loss (ash, etc.)	1.89	2.07
	100.	100.
Laboratory number [lungs]	202	300
Per cent. composition of organ:		
Fat	1.87	1.85
Albuminoids	15.82	17.20
Water	79.55	78.91
Loss (ash, etc.)	2.76	2.04
	100.	100.
Laboratory number [liver]	200	297
Per cent. composition of organ:		
Fat	6.98	4.26
Albuminoids	17.89	18.04
Water	68.75	71.20
Loss (ash, etc.)	6.38	6.50
	100.	100.
Laboratory number [spleen]	201	299
Per cent. composition of organ:		
Fat	3.12	4.46
Albuminoids	17.40	16.62
Water	76.56	77.93
Loss (ash, etc.)	2.92	0.99
	100.	100.

TABLE XXV.—CONTINUED.

TEN EXPERIMENTAL ANIMALS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
185	320	259	278	138	361	160	341
3.51	11.84	5.37	6.61	2.89	4.67	2.70	3.21
18.54	15.88	15.38	16.16	16.78	16.56	16.60	17.81
75.29	69.91	76.83	76.89	78.44	76.57	78.83	77.31
2.66	2.37	2.42	0.34	1.89	2.20	1.87	1.67
100.	100.	100.	100.	100.	100.	100.	100
182	318	260	279	142	359	162	337
2.43	1.14	1.77	1.91	2.24	1.75	1.73	2.47
16.88	17.04	16.15	15.45	16.86	16.97	17.31	17.20
77.88	79.11	79.29	79 76	78.70	78.86	70.04	78.90
2.81	2.71	2.79	2.88	2.20	2.42	2.92	1.43
100.	100.	100.	100.	100.	100.	100.	100.
183	319	258	277	140	362	159	338
4.28	1.57	2.87	2.55	2 80	2.06	1.79	3.45
18.12	19.42	17.83	18.82	17.97	19.23	18.01	18.29
68.01	68.64	68.88	72.11	69 60	70.33	69.20	67.49
9.59	10.37	10.42	6.52	9.63	8.38	11.00	10.77
100.	100.	100.	100.	100.	100.	100.	100.
184	321	261	281	139	360	161	339
4.43	2.27	6.78	5.11	3.94	4.75	2.94	5.76
16.47	17.13	17.23	16.21	17.56	17.20	17.68	17.52
76.06	77.44	74.08	76.63	76.16	75.98	77.05	72.90
3.04	3.16	1.91	2.05	2.34	2.07	2.33	3.82
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXVI.

COMPOSITION OF THE ORGANS OF THE

Name of animal	Sanborn.	G.Francis
Laboratory number [kidney]	207	302
Per cent. composition of organ:		
Fat	6.05	5.58
Albuminoids	13.03	16.31
Water	77.48	75.93
Loss (ash, etc.)	3.44	2.18
	100.	100.
Laboratory number [brain]	204	298
Per cent. composition of organ:		
Fat	11.45	10.60
Albuminoids	10.04	10.18
Water	76.68	76.69
Loss (ash, etc.)	1.83	2.53
	100.	100.
Laboratory number [stomach]	205	295
Per cent. composition of organ:		
Fat	5.15	8.80
Albuminoids	11.47	11.67
Water	81.19	77.48
Loss (ash, etc.)	2.19	2.05
	100.	100.
Laboratory number [intestine]	206	296
Per cent. composition of organ:		
Fat	11.56	8.30
Albuminoids	12.42	10.30
Water	74.04	79.57
Loss (ash, etc.)	1.98	1.83
	100.	100.

TABLE XXVI.—CONTINUED.

TEN EXPERIMENTAL ANIMALS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
196	323	273	282	153	374	175	353
4.51	7.73	6.42	5.10	11.03	4.32	4.78	4.21
13.91	14.90	15.46	14.11	14.41	18.37	16.35	14.86
79.09	74.55	77.23	78.30	71.65	75.00	76.97	77.77
2.49	2.82	0.89	2.49	2.91	2.31	1.90	3.16
100.	100.	100.	100.	100.	100.	100.	100.
179	317	262	280	141	358	163	340
10.83	8.76	11.64	10.13	12.51	10.74	12.53	9.06
11.17	9.76	9.95	11.32	11.34	9.39	11.23	11.75
76.84	79.44	77.26	77.83	74.75	79.19	75.72	76.89
1.16	2.04	1.15	0.72	1.40	0.68	0.52	2.30
100.	100.	100.	100.	100.	100.	100.	100.
180	315	256	275	143. 143*a*	357	158	335
10.19	7.70	7.62	8.69	8.77	24.90	6.88	16.38
11.55	12.77	11.59	11.90	13.21	10.23	12.47	10.65
76.31	76.82	78.35	77.02	76.55	62 44	79.05	71.15
1.95	2.71	2.44	2.39	1.47	2.43	1.60	1.82
100.	100.	100.	100.	100.	100.	100.	100.
181	316	257	276	144. 145.	356	164	336
10.63	15.52	8.45	10.99	8.36	11.94	14.87	10.55
10.99	9.98	11.32	10.98	13.81	11.41	11.72	12.04
75.93	71.48	79.58	76.26	75.85	74.24	70.33	75.34
2.45	3.02	0.65	1.77	1.98	2.41	3.08	2.07
100.	100.	100.	100.	100.	100.	100.	100.

7. Deductions and Conclusions.

The foregoing recorded and tabulated facts complete the strictly chemical part of the investigation and the reader might be left to draw from them the proper conclusions. This would impose upon him, however, much unnecessary labor which it seems the part of wisdom as well as of justice to avoid, and the question on whose account really the whole investigation was undertaken might as well be answered by the writer. This question was, *to what extent butcher's meat (beef) as offered in our markets for consumption is the product of breed and of feed.* The question has practically several roots and is, like all physiological questions, extremely complicated.

It is *well* known that animals of certain breeds, notably Shorthorns, Herefords and Angus, both full blood, and grades, grow faster and get fit for the shambles sooner than scrubs. It is *not* known whether this highly desirable quality is specific of the breeds mentioned, or the result of artificial, as distinguished from natural, selection. If the former, all animals of the breed would possess the quality in the same degree; if the latter, judicious coupling of sire and dam, aided by ceaseless attention to a multitude of minor details, would evolve it in any cattle. It is not necessary for the purposes of this paper to decide the point; suffice it to remember that animals of the so called improved breeds can be brought, with proper attention, to weigh 1,600 pounds or more, when 2-year old, while range cattle reach rarely 1,200 pounds at the age of 3 years, even under favorable conditions. Evidently time, care and food are saved in the former case, a strong inducement, indeed, to the farmer for buying and raising for market none but improved breeds of cattle, and accounting for

the abnormally high prices paid at times for pedigreed bulls from celebrated herds. Universal opinion accepts their influence as paramount in predetermining the quality of their offspring, and care and food as of minor importance; but of importance they are, since a scant and irregular supply of inferior food with general neglect reduce in a few generations the descendants of superior sires to veritable scrubs.

We are justified then in conceding to better breeds an advantage in points of time, cost of production and price of product, each of which is expressible in dollars and cents and will be so expressed eventually with precision. They are the roots alluded to before and will receive attention in this investigation; the last, the price of the product, depending upon its quality and this, in the case of beef, upon the proportion and distribution of the fat and lean in the salable cuts, leads to a consideration of the amounts of fat found by analysis; but other considerations are likewise involved in it and it is, for this reason, thought best to tabulate the facts upon which the discussion will rest.

To understand these facts correctly I copy in addition to statements on page 19 from Dr. Porter's directions:

1. The last feed to be the night before slaughtering.
2. The animal to be weighed at 8 A. M.
3. The animal to be killed at 8:15 A. M. by stunning with the killing hammer and bleeding from the neck, cutting both, arteries and veins.
4. All blood to be carefully collected in the collecting pans, poured into the blood tub, and weighed.
5. The blood to be forced from the animal as completely as possible by the process of pumping or "massage."
11. After weighing stomach and intestines with their contents, have them emptied, washed and again weighed.
14. Hoist the carcass, split it and let it remain on the hooks until the second day.
17. Lower the right side, separate the quarters, weigh each, and cut up carefully into butcher's joints as outlined on the diagram, and weigh each joint separately.

TABLE XXVII.

WEIGHTS IN POUNDS OF THE DIFFERENT

	Sanborn.	G.Francis
Live weight	1712	1681
Right fore quarter	301.5	283.
Left fore quarter	282.5	279.
Right hind quarter	252.	237.
Left hind quarter	265.	244.5
Trimmings	10.	6.7
Feet	22.	21.
Head	31.5	35.
Tongue	8.4	6.2
Hide	96.	100.
Blood	60.5	59.5
Heart	5.9	6.7
Lungs	9.8	7.6
Liver	21.4	21.7
Kidneys	(2)	2.3
Spleen	2.5	2.4
Paunch, empty	36.9	34.5
Paunch, contents of	104.	124.
Guts, empty	21.5	21.
Guts, contents of	24.	23.
Gut fat	105.5	132.
Loss	49.1	33.9
Total	1712	1681
Bones, green	150.	150.
Bones, dry	.....	76.

24. Carefully dissect the flesh from each butcher's joint, weigh the bones (green bones), separate them from the flesh, ligaments and tendons, dry them (dry bones) for 24 hours and weigh them.

TABLE XXVII.—CONTINUED.

PORTIONS OF THE EXPERIMENTAL ANIMALS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
1541	1630	1694	1505	1633	1642	1481	1278
269.	284.5	288.	258.	271.5	303.5	249.5	213.
253.	271.5	290.5	248.5	273.	290.	238.5	206.5
219.	233.	245.	221.5	241.5	223.	207.5	173.
234.	252.	246.5	230.	235.	237.5	215.	181.5
8.7	9.	8.7	3.5	15.	8.	8 5	7.5
19.	22.	21.5	21.1	21.5	22.	17.5	18.5
31.5	37.	30.5	29.	30.	31.5	30.5	31.5
4.8	6.2	10.	7.2	6.5	5.7	5.2	6.
120.5	104.5	106.5	103.	86.	103.	93.	80.
51.5	50.	59.5	50.5	59.3	56.	52.	46.5
6.6	5.2	6.1	5.2	5.6	6.4	5.7	4.6
6.9	7.9	9.5	9.8	9.2	9.9	6.5	7.2
16.8	13.9	17.2	14.7	17.5	17.4	18.	12.5
1.8	(2)	2.1	2.5	2.6	(2)	2.1	(2)
2.2	2.	2.7	2.	2.5	2.5	2.5	1.9
27.2	109.	33.	31.4	33.	{ 105.	33.	{ 100.
81.	.....	101.	93.	127.		85.	
22.2	21.2	20.	21.5	21.	22.7	19.	19.5
26.	24.	20.	22.	28.	23.	20.	14.
104.	135.5	128.5	95.5	118.5	112.	131.2	119.
35.3	39.6	46.2	35.1	28.8	60.9	40.8	33.3
1541	1630	1694	1505	1633	1642	1481	1278
106.	159.	162.	146.	188.	170.	151.	146.
72.	75.	70.	70.	93.	.....	74.	.....

NOTE: The bracketed values are averages, the weights in the cases not having been taken.

TABLE XXVIII.

WEIGHT IN POUNDS AND PERCENTAGES OF DIFFERENT

	Sanborn.	G. Francis
Live weight	1712	1681
Weight of quarters	1101.	1043.5
Butcher's cut No. 1	91.	89.5
" " " 2	23.	26.5
" " " 3	32.5	17.5
" " " 4 and 5	72.	66.5
" " " 6	9.	6.5
" " " 7	14.	18.
" " " 8	36.	38.
" " " 9	37.5	35.5
" " " 10	105.5	99.
" " " 11	53.	49.
" " " 12	40.5	37.5
" " " 13	20.	12.5
" " " 14	8.	8.5
Weight of all butcher's cuts	542.	504.5
Weight of butcher's cuts for both halves of animal	1084.	1009.
Loss of cutting up quarters into cuts (pounds)	17.	34.5
Quarters, per cent. of live weight	64.4	62.1
Cuts, " " "	63.4	60.
Feet, " " "	1.28	1.25
Head, " " "	1.84	2.08
Hide, " " "	5.61	5.99
Bones, green, " " "	8.76	8.92
Blood, heart, lungs, per cent. of live weight	4.45	4.39
Feet, head, hide, " " "	8.73	9.32
Feet, head, hide, bones, " " "	20.36	20.26

TABLE XXVIII.—CONTINUED.

PARTS OF THE BODIES OF THE EXPERIMENTAL ANIMALS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
1541	1630	1694	1505	1633	1642	1481	1278
975.	1041.	1070	958.	1021.	1054.	910.5	774.
67.	86.	78.	76.5	47.5	79.	55.5	58.
20.	24.5	22.	23.	43.	24.5	28.	13.5
23.5	25.5	25.	17.5	42.	22.	23.5	17.5
80.	80.5	81.	77.5	69.	76.	68.7	55.
7.5	8.	9.	6.	8.5	5.	7.5	5.5
19.	16.5	18.	7.	9.	15.	15.	14.5
33.	31.5	32.	32	26.5	35.5	27.5	22.
32.5	32	41.	32.5	30.5	32.	32.5	26.5
84.5	111.5	110.	106.	83.5	119.	79.5	73.
47.5	51.	50.5	37.	50.5	50.	46.	44.
48.	41.5	33.	30.	42.	44.	38.	38.
(12.4)	7.5	11.	8.5	21.5	11.	(12.4)	7.5
(8.7)	7.5	8.	8.	15.5	8.	(8.7)	6.
483.6	523.5	518.5	461.5	489.	521.	442.8	381.
967.2	1047.	1037.	923.	978.	1042.	885.6	762.
7.8	.....	33.	35.	43.	12.	24.9	12.
63.3	63.9	63.2	63.6	62.5	64.2	61.5	60.6
62.8	64.2	61.2	61.	59.8	63.4	59.8	59.6
1.23	1.35	1.27	1.40	1.32	1.34	1 18	1.45
2.04	2.27	1.80	1.93	1.84	1.92	2.06	2.46
7.82	6.41	6.29	6.84	5.27	6.28	6.28	6.26
6.88	9.75	9.56	9.70	11.51	10.35	10.19	11.42
4.22	3.87	4.43	4.35	4.54	4.40	4.33	4.56
11.09	10.03	9.36	10.17	8.43	9.54	9.52	10.17
20.26	20.21	21.65	22.20	21.70	23.60	21.47	24.19

TABLE XXIX.

PER CENT. OF FAT IN CUTS ARRANGED

	Sanborn.	G. Fr'cis.
Live weight in pounds	1712	1681
Age in days	1008	1015
Number of days in experiment	741	760
Gain in pounds per day since birth	1.70	1.65
Gain in pounds per day under experiment	1.56	1.44
Per cent. of fat in Cut No. 1	36.37	42.80
" " No. 2	21.13	32.45
" " No. 3	8.54	13.43
" " No. 7	.. .. ..	10.21
" " No. 8	60.96	63.33
" " No. 9	21.86	41.86
" " No. 10	47.07	52.00
" " No. 12	42.05	53.25
" " No. 13	44.48	25.20
" " No. 14	31.97	10.60
Average per cent. of fat in all cuts	34.94	34.51
	Cut No. 1	Cut No. 2
Sanborn	36.37	21.13
Gov. Francis	42.80	32.45
Zeno	49.88	57.67
Curley	35.97	53.34
Bear	43.55	44.32
Bonnie	11.06	42.64
Joe	39.00	38.37
Nancy	25.06	34.49
Jack	56.53	46.45
Slocum	14.89	47.53
Average per cent. of fat in cuts	35.51	41.84

TABLE XXIX.—CONTINUED.

BY NUMBER AND BY ANIMALS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
1541	1630	1694	1505	1633	1642	1481	1278
998	1096	1046	838	1053	1068	1062	1072
696	764	729	758	728	770	721	766
1.54	1.48	1.62	1.79	1.55	1.53	1.39	1.19
1.29	1.35	1.64	1.54	1.40	1.50	1.49	1.19
49.88	35.97	43.55	11.06	39.00	25.06	56.53	14.89
57.67	53.34	44.32	42.64	38.37	34.49	46.45	47.53
26.32	21.91	14.59	19.18	22.14	8.81	18.59	11.92
80.77	74.90	58.39	63.08	22.05	67.32	71.00	71.79
56.34	51.18	64.27	50.90	44.43	49.54	64.99	48.13
42.22	52.54	48.43	43.95	51.65	44.51	16.28	53.14
51.45	58.82	42.45	39.51	26.19	34.40	23.39	47.89
12.55	59.20	44.98	42.05	.....	52.70	28.24	62.03
35.02	11.25	27.43	22.70	35.43	19.64	9.05	23.48
8.37	37.71	8.69	22.41	12.53	22.28	10.19	8.59
42.06	45.68	39.71	35.75	32.42	35.87	34.47	38.94
Cut No. 3	Cut No. 7	Cut No. 8	Cut No. 9	Cut No.10	Cut No.12	Cut No.13	Cut No.14
8.54	.... ..	60.96	21.86	47.07	42.05	44.48	31.97
13.43	10.21	63.33	41.86	52.00	53.25	25.20	10.60
26.32	80.77	56.34	42.22	51.45	12.55	35.02	8.37
21.91	74.90	51.18	52.54	58.82	59.20	11.25	37.71
14.59	58.39	64.27	48.43	42.45	44.98	27.43	8.69
19.18	63.08	50.90	43.95	39.51	42.05	22.70	22.41
22.14	22.05	44.43	51.65	26.19	.....	35.43	12.53
8.81	67.32	49.54	44.51	34.40	52.70	19.64	22.28
18.59	71.00	64.99	16.28	23.39	28.24	9.05	10.19.
11.92	71.79	48.13	53.14	47.89	62.03	23.48	8.59
16.54	57.72	55.41	41.64	42.32	44.12	25.37	17.33

a. The fat in the cuts and organs analyzed.

The question really at issue is to find the total quantity of fat in the bodies of the slaughtered animals, and its distribution in the salable portions, the cuts. The first part of the question is of little practical importance and was not drawn within the circle of this investigation; the second can, unfortunately, not be answered with perfect correctness through an oversight of the assistant, in charge of the slaughtering, who failed to weigh the bones of each cut separately. While regretable, the error does not prevent practically correct conclusions as may be seen from the following considerations: If a certain ingredient is determined in two separate portions of material coming from two different bodies, the weights of the materials from which the four samples are taken must enter into the comparison of the aggregate values of the two bodies. Take, *f. e.*, two portions of flesh weighing respectively 10 and 100 pounds with respectively 10 and 20 per cent. of fat from one animal, and compare it with two portions of 100 and 10 pounds in weight and 10 and 20 per cent. of fat from another; the average per cent. of fat for the two portions of flesh from the two animals is, doubtless, 15, but their absolute value is by no means identical; for while the former animal contains in 110 pounds of flesh 21 pounds of fat, the latter contains in the same quantity only 12 pounds, or respectively 19.1 and 10.9 as the true percentages. The average value, therefore, when obtained in calculations by dividing the number of individual factors into their sum, is based upon a false principle and must necessarily convey a false impression, unless the proportionate weights of the portions, from which the samples are derived, are the same, or nearly the same, for all animals under comparison.

This, indeed, may be taken to be approximately the case here, whence the percentages of fat, as obtained in the table for all the cuts from one animal and for the same cuts from all animals, may be relied on as practically correct expressions of their composition in the aggregate.

The animals with one exception were healthy and vigorous; they were of nearly the same age and, in every respect, fed alike, treated alike and cared for alike; any difference in the quality, weight and composition of their flesh and organs could, therefore, be attributed to nothing else but individual or racial traits, by virtue of which the physical development assumes the forms which distinguish it and which eventually serve to characterize the breed. It is plain that differences between the individuals of one breed can not be as great nor as potential as those between the individuals of different breeds, and yet much trouble is experienced in telling where the former cease and the latter begin, in spite of the fact that a practical judge rarely errs in distinguishing correctly between them. The external characteristics, upon which this judgment rests, are, however, nothing but the expressions of internal organization, which this present paper makes an attempt to connect causally; let us, then, examine the proportion of fat in the cuts of the five groups of animals in the light of the following table:

TABLE XXX.

PER CENT. OF FAT IN THE CUTS OF THE FIVE GROUPS OF ANIMALS.

Shorthorn.	Hereford.	Angus.	Grades.	Scrubs.
34.94 34.51	42.06 45.68	39.71 35.75	32.42 35.87	34.47 38.94
69.45	87.74	75.46	68.29	73.41
34.72 avge. 0.58	43.87 avge. 9.73	37.73 avge. 3.59 [increase over lowest]	34.14 avge.	36.70 avge. 2.56

The percentages of fat in the organs are not so uniform; those of the stomachs of Nancy and Slocum are evidently too high, owing to the fact of their not having been freed from fat as completely as the directions demanded, nevertheless, the values are given for comparison:

TABLE XXXI.

PER CENT. OF FAT IN THE ORGANS OF THE FIVE GROUPS OF ANIMALS.

Shorthorn.	Hereford.	Angus.	Grades.	Scrubs.
6.41 5.73	6.35 7.07	6.36 6.38	6.57 8.14	6.03 6.88
12.14	13.42	12.74	15.71	12.91
6.07 avge.	6.71 avge.	6.37 avge.	7.85 avge.	6.45 avge.

The lowest individual difference in the percentage of fat between the two animals of each group is 0.43 per cent. for the shorthorns, a vanishing quantity, indeed, and seeming to indicate a well fixed type in the breed, whose origin and history the lack of library facilities does, unfortunately, not permit me to bring in support of the view advanced; if correct, then Hereford and Angus with individual differences of 3.62 and 3.96 per cent. of fat, would be less ancient, and have the different strains of blood that converge in a breed less thoroughly blended; they might even yet comprise each two distinct families, which accident represented in the animals under experiment. The grades would of necessity follow the more potent stock, Shorthorn Grade the Shorthorn and Angus Grade the Angus, while Scrubs, the offspring of the most varied and heterogenous blood, would exhibit the greatest differences. The facts seem to bear out the statements.

Making allowance, then, for individual differences, the conclusion seems justified, *that in the quantity of fat produced in the feeding of cattle breed exerts an influence*, and, looking at the question from a commercial standpoint, *that Shorthorns and their grades are superior and more profitable than other cattle.*

This fact will be more and more emphasized in future. One-half of our population lives in cities, engaged in industries and professions that call for physical exertions only to the extent of properly supporting mental activities; they do not need an excessive fat diet, and, in fact, such is rather detrimental to their best efforts than otherwise. Waste in the consumption of food is thereby engendered, which leads to certain, though it may be slow, punishment. Does not the present condition of society already point to this grave national fault in a manner to make blind-

ness or indifference to it an economic crime, which is sure to be punished by great national misfortunes?

The flesh offered for consumption should contain less fat, and the fat be better distributed; not so large a proportion of it in lumps and masses as is revealed by table XIX. It is true, intelligence might direct the purchase of food for the construction of proper dietaries in which waste would be reduced to a minimum, and to facilitate this the cuts with their fat contents are arranged in groups:

No. 3	16.54	per cent.	of fat.
No. 14	17.33	"	"
No. 13	25.37	"	"
No. 1	35.51	"	"
No. 9	41.64	"	"
No. 2	41.84	"	"
No. 10	42.32	"	"
No. 12	44.12	"	"
No. 8	55.41	"	"
No. 7	57.72	"	"

Other points readily suggest themselves for additional consideration; the percentages of fat in the organs analyzed, considered simply as articles of food or in their physiological relation to each other, and the organism of each animal as a whole invite attention; but as a subsequent bulletin will deal with all those matters not touched upon here, it is thought best to defer them and to call attention only to so much as will be necessary to a comprehension of the question. As concerns fat, then, reference is made to the next paragraph.

b. The water in the tissues of cuts and organs.

The greater the amount of fat the smaller the amount of water in an animal substance is a truism stated only for the purpose of permitting the writer to draw certain conclusions which possess a practical as

well as scientific interest. The well known properties of fat prevent its combining or uniting in any way with water. Deposited in formless masses in certain cells of the animal body, it distends and enlarges them to such a degree as to reduce the organized nitrogenous tissues, in which they are imbedded, to mere filmy networks, which constitute but a small fraction of the whole. This tissue, whether connective or other, is the real seat of the water and holds it, doubtless, in such manner as to subserve the proper performance of its physiological functions, so that a falling of it below, or rising above, a certain proportionate amount results in disturbance and ill health to the individual. It may be assumed with much probability that the limit of deviation which nature permits above and below the normal is narrow, and that the percentage of water in the various forms of nitrogenous tissue occurring in flesh is uniform and nearly the same for all. Now, while the water found in flesh does not wholly belong to the tissue, as some must keep salts and unorganized nitrogenous substances in solution, and while the proportion between these two quantities is at present unknown, yet the conditions of living cells must be so uniform in animals of the same or related species as to permit a fairly comparative estimate of the quality and composition of flesh by assigning the whole of the water to the proteids, found in the usual course of chemical analysis and computation; if this be done and the result expressed percentically, certain interesting relations plainly reveal themselves. To point these out more readily the following additional tables are compiled and inserted here.

TABLE XXXII.

PER CENT. COMPOSITION OF MEAT

	No. 1.	No. 2.
Cuts of Sanborn:		
Albuminoids	22.41	23.94
Water	77.59	76.06
	100.	100.
Cuts of Gov. Francis:		
Albuminoids	22.84	22.00
Water	77.16	78.00
	100.	100.
Cuts of Zeno:		
Albuminoids	23.83	23.43
Water	76.17	76.57
	100.	100.
Cuts of Curley:		
Albuminoids	23.56	22.37
Water	76.44	77.63
	100.	100.
Cuts of Bear:		
Albuminoids	25.63	23.57
Water	74.37	76.43
	100.	100.
Cuts of Bonnie:		
Albuminoids	21.95	23.57
Water	78.05	76.43
	100.	100.
Cuts of Joe:		
Albuminoids	22.07	22.82
Water	77.93	77.18
	100.	100.
Cuts of Nancy:		
Albuminoids	23.44	23.37
Water	76.56	76.63
	100.	100.
Cuts of Jack:		
Albuminoids	25.80	23.67
Water	74.20	76.33
	100.	100.
Cuts of Slocum:		
Albuminoids	23.69	23.24
Water	76.31	76.76
	100.	100.

TABLE XXXII.—CONTINUED.

FIBRE (LEAN MEAT) OF CUTS.

No. 3.	No. 7.	No. 8.	No. 9.	No. 10.	No. 12.	No. 13.	No. 14.
22.22	not re'd.	24.43	24.13	23.73	22.85	22.88	22.16
77.78		75.57	75.87	76.27	77.15	77.12	77.84
100.		100.	100.	100.	100.	100.	100.
21.18	22.25	24.65	22.70	24.45	23.26	22.35	22.45
78.82	77.75	75.35	77.30	75.55	76.74	77.65	77.55
100.	100.	100.	100.	100.	100.	100.	100.
23.70	23.31	23.97	24.00	22.07	22.81	24.17	22.27
76.30	76.69	76.03	76.00	77.93	77.19	75.83	77.73
100.	100.	100.	100.	100.	100.	100.	100.
23.19	23.62	23.38	22.38	23.82	23.27	23.15	22.57
76.81	76.38	76.62	77.62	76.18	76.73	76.85	77.43
100.	100.	100.	100.	100.	100.	100.	100.
23.77	25.43	22.72	21.30	22.25	22.40	21.69	21.01
76.23	74.57	77.28	78.70	77.75	77.60	78.31	78.99
100.	100.	100.	100.	100.	100.	100.	100.
24.25	21.92	23.83	21.81	22.42	23.33	23.15	22.34
75.75	78.08	76.17	78.19	77.58	76.67	76.85	77.66
100.	100.	100.	100.	100.	100.	100.	100.
24.84	23.52	23.44	23.59	20.83	not red.	23.62	21.28
75.16	76.48	76.56	76.41	79.17		76.38	75.72
100.	100.	100.	100.	100.		100.	400.
23.66	23.29	23.56	22.04	22.95	23.16	23.67	22.53
76.34	76.71	76.44	77.96	77.04	76.84	76.33	77.47
100.	100.	100.	100.	100.	100.	100.	100.
23.94	25.15	24.82	24.02	23.35	23.16	23.22	23.09
76.06	74.85	75.18	75.98	76.65	76.84	76.78	76.91
100.	100.	100.	100.	100.	100.	100.	100.
22.44	23.31	24.29	23.46	24.58	23.56	22.70	22.70
77.56	76.69	75.71	76.54	75.42	76.44	77.30	77.30
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXXIII.

PER CENT. COMPOSITION OF MEAT

	Sanborn	Gov. Francis.
Fibre of heart:		
Albuminoids	18.05	16.75
Water	81.95	83.25
	100.	100.
Fibre of lungs:		
Albuminoids	16.59	17.89
Water	83.41	82.11
	100.	100.
Fibre of liver:		
Albuminoids	20.65	20.21
Water	79.35	79.79
	100.	100.
Fibre of spleen:		
Albuminoids	18.52	17.58
Water	81.48	82.42
	100.	100.
Fibre of kidney:		
Albuminoids	14.40	17.68
Water	85.60	82.32
	100.	100.
Fibre of brain:		
Albuminoids	11.58	11.72
Water	88.42	88.28
	100.	100.
Fibre of stomach:		
Albuminoids	12.38	13.09
Water	87.62	86.91
	100.	100.
Fibre of intestine:		
Albuminoids	14.37	11.46
Water	85.63	88.54
	100.	100.

TABLE XXXIII.—CONTINUED.

FIBRE (LEAN MEAT) OF ORGANS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
19.76	18.51	16.68	17.36	17.62	17.78	17.40	18.72
80.24	81.49	83.32	82.64	82.38	82.22	82.60	81.28
100.	100.	100.	100.	100.	100.	100.	100.
17.81	17.72	16.92	16.23	17.64	17.71	18.15	17.90
82.19	82.28	83.08	83.77	82.36	82.29	81.85	82.10
100.	100.	100.	100.	100.	100.	100.	100.
21.04	22.05	20.56	20.69	20.52	21.47	20.65	21.32
78.96	77.95	79.44	79.31	79.48	78 53	79.35	78.68
100.	100.	100.	100.	100.	100.	100.	100.
17.80	18.11	18.87	17.46	18.74	18.46	18.66	19.37
82.20	81.89	81.13	82.54	81.26	81.54	81.34	80.63
100.	100.	100.	100.	100.	100.	100.	100.
14.96	16.66	16.68	15.27	16.74	19.67	17.52	16.04
85.04	83.34	83.32	84.73	83.26	80.33	82.48	83.96
100.	100.	100.	100.	100.	100.	100.	100.
12.69	10.94	11.41	12.69	13.17	10.60	12.92	13.25
87.31	89.06	88.59	87.31	86.83	89.40	87.08	86.75
100.	100.	100.	100.	100.	100.	100.	100.
13.15	14.26	12.89	13.38	14.72	14.08	13 62	13.02
86.85	85.74	87.11	86.62	85.28	85.92	86.38	86.98
100.	100.	100.	100.	100.	100.	100.	100.
12.64	12.25	12.45	12.58	15.40	13.32	14.28	13.78
87.36	87.75	87.55	87.42	84.60	86.68	85.72	86.22
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXXIV.

PER CENT. COMPOSITION OF MEAT FIBRE (LEAN MEAT)

	Sanb'rn.	Gov. Francis.
Per cent. of Albuminoids.....No. 1..	22 41	22.84
" " .....No. 2..	23.94	22.00
" " .....No. 3..	22.22	21.18
" " .....No. 7..	.....	22.25
" " .....No. 8..	24.43	24.65
" " .....No. 9..	24.13	22.70
" " .....No. 10..	23.73	24.45
" " .....No. 12..	22.85	23.26
" " .....No. 13..	22.88	22.35
" " .....No. 14..	22.16	22.45
Total.....	208.75	228.13
Average per cent. of albuminoids.....	23.19	22.81
Average per cent. of water.....	76.81	77.19
	100.	100.
	No. 1	No. 2
Per cent. of albuminoids.....Sanborn.....	22.41	23.94
" " .....Gov. Francis..	22.84	22.00
" " .....Zeno.....	23.83	23.43
" " .....Curley.....	23.56	22.37
" " .....Bear.....	25.36	23.57
" " .....Bonnie.....	21.95	23.57
" " .....Joe.....	22.07	22.82
" " .....Nancy.....	23.44	23.37
" " .....Jack.....	25.80	23.67
" " .....Slocum.....	23.69	23.24
Total.....	234.95	231.98
Average per cent. of albuminoids.....	23.49	23.20
Average per cent. of water.....	76.51	76.80
	100.	100.

TABLE XXXIV.—CONTINUED.

OF CUTS ARRANGED BY ANIMALS AND BY CUTS.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
23.83	23.56	25.36	21.95	22.07	23.44	25.80	23.69
23.43	22.37	23.57	23.57	22.82	23.37	23.67	23.24
23.70	23.19	23.77	24.25	24.84	23.66	23.94	22.44
23.31	23.62	25.43	21.92	23.52	23.29	25.15	23.31
23.97	23.38	22.72	23.83	23.44	23.56	24.82	24.29
24.00	22.38	21.30	21.81	23.59	22.04	24.02	23.46
22.07	23.82	22.25	22.42	20.83	22.95	23.35	24.58
22.81	23.27	22.40	23.33	.....	23.16	23.16	23.56
24.17	23.15	21.69	23.15	23.62	23.67	23.22	22.70
22.27	22.57	21.01	22.34	24.28	22.53	23.09	22.70
233.56	231.31	229.50	228.57	209.01	231.67	240.22	233.97
23.36	23.13	22.95	22.86	23.22	23.17	24.02	23.40
76.64	76.87	77.05	77.14	76.78	76.83	75.98	76.60
100.	100.	100.	100.	100.	100.	100.	100.
No. 3	No. 7	No. 8	No. 9	No. 10	No. 12	No. 13	No. 14
22.22	.....	24.43	24.13	23.73	22.85	22.88	22.16
21.18	22.25	24.65	22.70	24.45	23.26	22.35	22.45
23.70	23.31	23.97	24.00	22.07	22.81	24.17	22.27
23.19	23.62	23.38	22.38	23.82	23.27	23.15	22.57
23.77	25.43	22.72	21.30	22.25	22.40	21 69	21.01
24.25	21.92	23.83	21.81	22.42	23.33	23.15	22.34
24.84	23.52	23.44	23.59	20.83	.....	23.62	24.28
23.66	23.29	23.56	22.04	22.95	23.16	23.67	22.53
23.94	25.15	24 82	24.02	23.35	23.16	23.22	23.09
22.44	23 31	24.29	23.46	24.58	23.56	22 70	22.70
239.19	211.80	239.09	229.43	230.45	207.80	230.60	225.40
23.92	23.53	23.91	22.94	23.04	23.09	23.06	22.54
76.08	76.47	76.09	77.06	76.96	76.91	76.94	77.46
100.	100.	100.	100.	100.	100.	100.	100.

TABLE XXXV.

PER CENT. COMPOSITION OF MEAT FIBRE (LEAN

	Heart.	Lungs.
Per cent. of albuminoids—Sanborn	18.05	16.59
" " —Gov. Francis	16.75	17.89
" " —Zeno	19.76	17.81
" " —Curley	18.51	17.72
" " —Bear	16.68	16.92
" " —Bonnie	17.36	16.23
" " —Joe	17.62	17.64
" " —Nancy	17.78	17.71
" " —Jack	17.40	18.15
" " —Slocum	18.72	17.90
Total	178.63	174.56
Average per cent. of albuminoids	17.86	17.46
Average per cent. of water	82.14	82.54
	100.	100.

TABLE XXXVI.

AVERAGE COMPOSITION OF MEAT FIBRE (LEAN

	Sanborn	Gov. Francis
Albuminoids	12.65	12.64
Water	87.35	87.36
	100.	100.

TABLE XXXV.—CONTINUED.

MEAT) OF ORGANS, ARRANGED BY ORGANS.

Liver.	Spleen.	Kidney.	Brain.	Stomach	Intes-tines.
20.65	18.52	14.40	11.58	12.38	14.37
20.21	17.58	17.68	11.72	13.09	11.46
21.04	17.80	14 96	12.69	13.15	12.64
22.05	18.11	16.66	10.94	14.26	12.25
20.56	18.87	16.68	11.41	12.89	12.45
20.69	17.46	15.27	12.69	13.38	12.58
20.52	18.74	16.74	13.17	14.72	15.40
21.47	18.46	19.67	10.60	14.08	13.32
20.65	18.66	17.52	12.92	13.62	14.28
21.32	19.37	16.04	13.25	13.02	13.78
209.16	183.57	165.62	120.97	134.59	132.53
20.92	18.36	16.56	12.10	13.46	13.25
79.08	81.64	83.44	87.90	86.54	86.75
100.	100.	100.	100.	100.	100.

TABLE XXXVI.—CONTINUED.

MEAT) OF ALL ORGANS OF EACH ANIMAL.

Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
12.98	13.05	12.65	12.57	13.45	13.31	13.33	13.34
87.02	86.95	87.35	87.43	86.55	86.69	86.67	86.66
100.	100.	100.	100.	100.	100.	100.	100.

One practical side of the enquiry is to determine whether American beef, as is often asserted, is more watery than English beef; theoretically this may be denied, but as the statement is sometimes made by men of intelligence, properly authenticated facts alone will decide it. The present investigation brings them forward on one side and awaits their presentation on the other. It is apparent from foregoing statements that the comparison, to be valid, can not be based on the direct analyses of samples of flesh, but must be along some such line as is here adopted. Direct comparison would only lead to contradictory and incomprehensible conclusions.

In arranging the cuts of *all* the animals, thereby to eliminate or neutralize any possible errors, in accordance with their percentages of water, the following order results:

No. 3 .....76.08 per cent. water	No. 12.....76.91 per cent. water
No. 8.....76.09 per cent. water	No. 13. ...76.94 per cent. water
No. 7.....76.47 per cent. water	No. 10.....76.96 per cent. water
No. 1..... 76.51 per cent. water	No. 9 .....77.06 per cent. water
No. 2.....76.80 per cent. water	No. 14.....77.46 per cent. water

This is different, as will be noticed, from the order of cuts arranged for fat and proves, if anything, that water and fat have no functional relation to each other. The difference between the lowest and highest is also not great, but since it results from a comparison of values, each one of which is the resultant of 10 separate analyses, it is in all probability real and must have a cause. Can it be, that muscles performing more work and thereby undergoing more rapid physiological changes, that would result in the production and accumulation of greater quantities of metabolic products, imbibe a greater quantity of water for the preservation of their functional activity? If true, the fact

might be proved by an examination of the muscles, that constitute the cuts and the work which each is called upon to do in sustaining the weight of the body or otherwise. This is left, however, to others and reference only made to the diagram on page 56 for guidance.

Clearer still would the *organs* of the body reveal the fact, since their activity during life never ceases for a moment, and indeed, each of them contains an amount of water much greater than the cuts, though the order in which they range fails to place the heart, as might be expected, at the end of the list, for which anomaly, perhaps, an explanation might suggest itself without difficulty.

Liver. ..79.88 per cent. of water	Kidney....83.44 per cent. of water
Spleen ..81.64 per cent. of water	Stomach...86.54 per cent. of water
Heart. .82.14 per cent. of water	Intestines .86.75 per cent. of water
Lungs...82.54 per cent. of water	Brain.... .87.90 per cent. of water

As to the water contents of the whole animals, derived from the two series of facts ascertained, the order is as follows:

BY CUTS	BY ORGANS	BY BOTH
Per cent. of water.	Per cent. of water.	Per cent. of water.
Scrubs..... 76.29	Grades..... ...86.62	Scrubs..... .81.47
Hereford 76.75	Scrubs 86.66	Grades..... ...81.71
Grades..... ..76.80	Shorthorn 87.35	Hereford..... .81.86
Shorthorn.... 77.00	Angus 87.39	Shorthorn 82.17
Angus..... ...77.10	Hereford 86.98	Angus..... ...82.24

It is worth mentioning in this connection that the agreement in the percentages of water for the two animals of each group, both in cuts and organs, is remarkable and insures confidence in the trustworthiness of the factors. The differences between the water contents of the groups are small, but, if resting on race traits, of influence upon the quality of the flesh as an

article of food. Barring individual peculiarities *it places in point of palatability, or rather juiciness of flesh, Angus and Shorthorns ahead of Grades and Herefords and these again ahead of Scrubs*, which experience as judged by public demand seems to justify.

c. The loss recorded. The organs.

Animal flesh contains, besides fat, water and proteid bodies, mineral salts and metabolic products; the proteid bodies are not all alike and the metabolic products quite numerous, both being rich in nitrogen; but while the former contain, practically, equal amounts of this element, the latter vary and exceed it in quantity. Thus an element of uncertainty is introduced in the estimation of proteids, when obtained in the usual way of multiplying the nitrogen by 6.25.

The metabolic products form, however, only a small fraction of the weight of the flesh, so that the error committed is small and, in addition, uniform, and need be considered only in judging the loss reported in the analyses. This consists chiefly of mineral salts and non-nitrogenous extractive matters and gives a fairly correct expression of their quantities, excepting in a few instances where the samples had turned mouldy before analysis; these need not be specially mentioned at present. In the analyses of liver the loss includes glycogen and sugar, of which a considerable quantity must be present.

The statement is ventured that under normal conditions blood, heart and lungs bear to each other a proportionate relationship and are really dependent upon each other; a great heart means great lungs and much blood and *vice versa*; conceding a certain power of compensation the three together may be taken as a fair indication of an animal's vital power, not alone in

reference to work but also as concerns bulk and ability to attain it. It would likewise, then, bear a distinct relationship to live weight, a fact which has already received attention in table XXVIII. This dependence, however, of the one upon the other is yet better brought out by referring the weight of the three organs not to live weight, but to what may be called body weight, the live weight less the weights of the contents of stomach and guts, which for this purpose may be looked upon as mere accidental incumbrances.

Unfortunately the weights of the empty stomachs of three of the animals were not taken at the time of slaughter and the deficiency must be supplied by assuming them to be the same as those of their fellows; this, doubtless close approximation, gives the following results, to which for better comparison the previously printed table is added:

TABLE XXXVII.

PER CENT. OF HEART, BLOOD AND LUNGS TO

BODY WEIGHT		and to	LIVE WEIGHT.	
Short Horn	4.81 p. c. 4.81 p. c.	Short Horn	4.45 p. c. 4.39 p. c.	
Angus	4.77 p. c. 4.71 p. c.	Angus	4.43 p. c. 4.35 p. c.	
Grades	4.70 p. c. 4.68 p. c.	Grades	4.54 p. c. 4.40 p. c.	
Scrub	4.68 p. c. 4.87 p. c.	Scrub	4.33 p. c. 4.56 p. c.	(?)
Hereford	4.53 p. c. 4.14 p. c.	Hereford	4.22 p. c. 3.87 p. c.	(?)

If the views expressed are correct, and they certainly have much in their favor, then with the greatest percentage of heart, blood and lungs to body weight, *Shorthorns stand first in the power of beef production, with the other breeds following in the order of the table.*

d. Composition of the blood of the experimental animals.

If vitality, as measured by the proportionate weight of heart, blood and lungs to that of body, is causally connected with growth or, as put here, beef production, a comparison of the analyses of the blood from the experimental animals would be of general and great interest. Fortunately the writer was able to complete this work while the Bulletin was in press, and before the last form was printed.

As previously stated, the examination of the blood of the various animals was part of the proposed plan of investigation, but had to be given up for the reasons mentioned. Fibrine and total solids were determined in the various samples of blood from the first animal killed (*). In the case of the others only one sample of about half a pint of blood was requested, which was placed in a Mason jar, sealed and put aside for an hour, when it was carried with due care to the Laboratory. It had then congealed, completely so, at the end of two hours, so that the glass could be inverted without starting a single drop of fluid. A sample was then taken by pushing a wide and clean cork borer through the mass to the bottom of the jar, moving it gently from side to side and dexterously lifting out the section upon a watch glass; this was immediately weighed and dried to constant weight at, finally, 105 degrees C. This was the raw material upon which the subsequent work was executed. In two instances, the samples were received after the lapse of several hours when serum began already to exude from the cake; these are marked.

The idea underlying was, that if quantity of blood was a factor in determining vitality, quality would be a

(*) Joe, with duplicate determinations of 0.33 and 0.51 per cent. of fibrine in the original blood.

no less effective one. Growth and stability of the animal body, meaning thereby nothing but increase or maintenance of body weight, depend upon the quantity and quality of blood that courses through it; it furnishes the material out of which the body builds itself up and, as this building up is a work involving wear and tear, it also carries away the *debris*. This latter, consisting of a multitude of bodies more or less detrimental to the organism itself, bears a certain relation to the embolemic oxygen borne along by the red blood corpuscles; abundance of these means, therefore, abundance of oxygen, and abundance of oxygen means healthful change, normal metabolism, bodily vigor, and superabundant physical development during the period of youth.

A determination of iron in blood might thus enable us to calculate its equivalent in haemoglobin (*), and this again its proportionate weight of red blood corpuscles (†). We would thereby obtain an expression of the embolemic power of blood, which in turn would bear a definite relation to the vital power or beef production of the individual. This relation, however, seems not to be a simple one, as a glance at the table will show, and, since the points involved are neither clearly elaborated nor as yet well understood, it is deemed best to give the facts and await their explanation at some future time.

(*) Hammarsten, English translation, page 69, haemoglobin from ox contains 0.40 per cent of iron.

(†) *Ibid.*–Page 83, red blood corpuscles contain in 1000 parts of dried substance for human blood 868–943, and for dog's blood 865 parts of haemoglobin.

TABLE XXXVIII.

COMPOSITION OF BLOOD OF EXPERIMENTAL ANIMALS.

Name of animal.	Sanborn.	Gov. Francis.	Zeno.	Curley.	Bear.	Bonnie.	Joe.	Nancy.	Jack.	Slocum.
Weight of blood in pounds	60.5	59.5	51.5	50.0	59.5	50.5	59.3	56 0	52.0	46.5
Weight of blood taken for analysis (grams)	77.55	65.75	96.70	68.78	73.69	83.95	11.81	93.38	70.05	72.96
Per cent. of solids in blood	21.20	21.72	20.63(*)	21.08	21.58(*)	23.00	23.69	21.25	21.80	20.09
Per cent. of fat in solids	0.58	0.32	0.40	0.42	0.33	0.26		0.48	0.60	0.38
" proteids in solids	86.71	86.84	91.98	92.60	89.77	88.69		90.04	85.44	84.93
" ash in solids.	3.77	3.52	3.37	3.31	3.58	3.55		3.75	3.55	3.61
" loss in solids	8.94	9.32	4.25	3.67	6.32	7.50		5.73	10.41	11.08
	100.	100.	100.	100.	100.	100.		100.	100.	100.
Per cent. of iron (Fe.) in ash	6.26	6.13	6.71	7.28	7.15	7.07		7.12	7.30	7.12
Per cent. of iron (Fe.) in solids	0.236	0.216	0.226	0.241	0.256	0.251		0.267	0.259	0.257
Per cent. of ash in blood	0.7992	0.7645	0.6952	0.6977	0.7726	0.8165		0.7969	0.7739	0.7252
Per cent. of iron (Fe.) in blood	0.0500	0.0469	0.0466	0.0508	0.0552	0.0577		0.0567	0.0565	0.0516
Per cent. of haemoglobin in blood	12.50	11.72	11.65	12.70	13.80	14.42		14.17	14.12	12.90
Per cent. of red blood corpuscles in blood	14.53	13.63	13.55	14.77	16.04	16.67		16.48	16.42	15.00

(*) Samples not in good condition.

A number of additional points invite attention; but as the concluding part of the investigation, to be published in a separate bulletin, will afford the proper opportunity to discuss them, they are deferred.

I express to Mr. C. P. Fox, who has done all the preliminary and the larger part of the analytical work and to Mr. S. Dinsmoor my obligation for their patience and fidelity in following directions, and close with this:

8. RESTATEMENT OF THE CONCLUSIONS REACHED:

1. That, in the quantity of fat produced in the feeding of cattle, breed exerts an influence, and, looking at the question from a commercial standpoint, that Shorthorns and their grades are superior and more profitable than other breeds of cattle.

2. That, in point of palatability, or rather juiciness of flesh, Angus and Shorthorns are ahead of Grades and Herefords, and these again ahead of Scrubs.

3. That Shorthorns stand first in the power of beef production with Angus, Grades, Scrubs, and Herefords, following in the order given.

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