fourth day with enlarged lymph nodes. Spleen and liver thickly studded with nodules.

Guinea pig 2. Inoculated with peritoneal fluid of muskrat; died on the fourth day, showing enlarged inguinal nodes, with spleen and liver thickly studded with nodules.

Muskrat 3. Inoculated 5-29-28, subcutaneously, with spleen of guinea pig dying from tularemia; died on the sixth day. Necropsy showed inguinal nodes on both sides enlarged. Liver and spleen were studded with typical nodules of tularemia.

Muskrat 4. Inoculated 5-29-28 with spleen of guinea pig, dead from tularemia. Inoculation was made by scarifying the skin and rubbing an emulsion of the infective tissue into the abrasion. Died on the sixth day, showing inguinal nodes on both sides very much enlarged. Spleen and liver were thickly studded with nodules which were confluent to such an extent that there were large areas of necrosis in the liver.

Muskrat 5. Inoculated 5-29-28, by rubbing spleen of guinea pig into an abrasion of the skin. Died on the sixth day. Inguinal nodes enlarged; spleen and liver thickly studded with nodules.

It appears that the muskrat is very susceptible to an experimental infection with *B. tularense*. The pathology produced by the infection is similar to that seen in rabbits and guinea pigs, but the lesions in the muskrat are apt to be more marked. It is indicated that tularemia may occur in nature as a disease of muskrats.

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Fundamental Food Requirements for Growth of Rat. V. Influence of Fat in Diet.*

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Evans and Burr[1] have postulated the existence of a new vitamin, (F), revealed in part by subnormal growth of rats fed synthetic diets extremely low in fat, and containing sucrose as the source of carbohydrate. Although the first report of their work indicates

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[1] Evans, H. M., and Burr, G. O., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 740; *ibid.*, 1928, xxv, 390.

that the casein and sucrose employed as sources of protein and energy require special purification in order to demonstrate the existence of the new vitamin, later, more detailed, reports show that little improvement is secured with commercial casein and sucrose. However, great improvement in growth is noted when fat is included in the diet or when liver or lettuce is fed in addition to the usual supplements of yeast and cod liver oil. Evans and Lepkovsky[2] have offered a partial explanation of these results in the hypothesis of a sparing action of fat on the antineuritic vitamin requirement for growth, but this view does not explain the beneficial effects of the lettuce and liver.

We present here the results of several experiments with rats fed diets containing various proportions of fat without lettuce or liver supplements. Data are given for both sexes. The casein was in all cases the highly purified product described elsewhere.[3] Commercial sucrose was used in the sugar diets. The dextrin was tapioca autoclaved at 260° F. for at least 6 hours. All the fat diets contained at least 9% butterfat, the remainder of the fat being crisco or lard. Salt mixture, either McCollum's No. 185 or Osborne and Mendel's, comprised 4% of the diets. Except for Groups No. 4 and No. 9 each rat received separately each day pure dry yeast (Northwestern Yeast Company) and cod liver oil. The daily quantity of yeast was 600 mg. for Groups Nos. 2, 3, 5, 6, 8, and 10, 400 mg. for Group No. 9, 250 mg. for Group No. 1. The quantity of cod liver oil fed was 160 mg. for Groups Nos. 2, 3, 5, 6, 8, and 10, and 500 mg. for Group No. 9. In Group No. 1 the fat-free portion of the diet was irradiated for 30 minutes with a Hanovia Alpine Sun Lamp. Groups Nos. 4 and 9 received no special source of vitamin D, and the antineuritic and antipellagrous vitamins were supplied by alcoholic extract of wheat embryo, equivalent to 30% of the ether-extracted material in the diet.

All the rats were on screens (3 mesh per inch) except Groups Nos. 3 and 6.

For comparison our results are reported in the same tabular form used by Evans and Burr. We also report the additional data of average food consumption (dry matter) per rat between the 28th and 90th days of life, when the rats were on the experimental diets, as well as the efficiency with which the food consumed was used for gain in weight for the first 6 weeks of the experimental period. Evans and Burr do not report any food consumptions except for the special supplements.

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[2] Evans, H. M., and Lepkovsky, S., *Science*, 1928, lxviii, 298.

[3] Palmer, L. S., and Kennedy, C., *J. Biol. Chem.*, 1927, lxxiv, 597.

Our experiments show no relationship between the growth attained and the fat content of the diet. In this respect they confirm the early findings of Osborne and Mendel[4] and Drummond and Coward,[5] who obtained normal growth of rats on diets extremely poor in or "devoid of true fats." The best growth for both sexes was secured with the fat-free-sugar diets which are supposed by

TABLE I.

Growth and food utilization on diets containing various proportions of fat.

Group No.	Characteristics of Rations			Sex	No. of rats	Range in final wt.	Mean wt. at 90 days of age	Dry matter eaten during exp. per rat	Efficiency of food utilization*
	Fat	Protein	Kind of Carbohydrate						
	%	%				gm.	gm.	gm.	
1	24	35	dextrin	♂	6	170-240	210	512	1.50
2	0	25	sucrose	♂	4	228-238	232	635	2.79
3	0	25	sucrose	♂	2	254-266	262	704	2.34
Evans and Burr	0	25	sucrose	♂	—	—	100	—	—
4	15	18	dextrin	♀	6	140-176	152	430	5.16
5	0	25	sucrose	♀	2	150-186	168	508	4.23
6	0	25	sucrose	♀	2	158-180	169	477	3.44
7	24	35	dextrin	♀	6	154-184	173	470	3.10
8	9	25	sucrose	♀	4	176-194	185	534	3.92
9	15	18	sucrose	♀	6	174-226	194	583	3.64
10	0	25	sucrose	♀	2	206-212	209	576	2.54
Evans and Burr	0	25	sucrose	♀	21	108-162	138	—	—
Evans and Burr	5-22	25	sucrose	♀	51	140-220	171	—	—

*Food (dry matter) consumed per gm. gain per 100 gm. body weight for the first 6 weeks of the experimental feeding, beginning at 60 gm. body weight; (food ÷ gain) ÷ mean wt. during experiment.

[4] Osborne, T. B., and Mendel, L. B., *J. Biol. Chem.*, 1920, xlv, 145.
[5] Drummond, J. C., and Coward, K. H., *The Lancet*, 1921, ii, 698.

Evans and Burr to depress the growth rate. All of our rats that had not attained their normal mature weight were still growing at a regular rate at 90 days of age. In addition, none of them exhibited any visible external bodily defects or lesions. They would have been judged as normal in every way by the most critical observer. All of our female rats on the fat-free-sugar diets were as heavy as the average of Evans' and Burr's rats on their fat-containing diets. Most of them were heavier. This comparison is valid inasmuch as the mean mature weight of the females of our stock is the same as that of Evans and Burr.

Among the male rats a comparison of Group No. 2 (screens) and Group No. 3 (sawdust) indicates some advantage of free access to feces. However, among the female rats Group No. 6 (sawdust) was no better than Group No. 5 (screens).

The food consumption and food utilization data give the explanation of the differences in growth among the different groups. For both males and females the increasingly greater growth rate of the groups as arranged in the table is associated with either increased food consumption or greater efficiency of food utilization or by both of these factors. There is no evidence that the presence of fat in the diet contributed in any way to the changes in food intake or its utilization for growth.

It seems to us that there are no convincing data at hand to warrant the postulation of an essential growth vitamin F associated with fat. We venture the opinion that the differences observed by Evans and Burr could be readily explained on the same bases as our own, if the data were available.

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Induction of Menstruation in Women by Use of Ovarian Hormone.*

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In cooperation with Claire Conklin, it was found that the basal metabolism of half the women students examined was low and was about 15% below the Aub-Dubois standard. Some of these were

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