TABLE V. Distribution of Intravenously Injected S^{35}-Sucaryl in the Tissues of Animals. Values in mg/g of tissue (wet wt).

Species	Rat					Rabbit	Dog
Dose	100 mg/kg					50 mg/kg	9.7 mg/kg
Time, hr	2.5	4	4	4	24	1	5
Tissue							
Blood	104	.18	.37	.7	.13	12.4	.92
Brain	1.5	.05	.05	—	.11	.6	.07
Kidney	50	1.4	3.13	3.5	.34	72	2.77
Liver	159	1.3	.38	—	.10	4.3	1.89
Heart	25	.82	.46	—	.10	—	.86
Lungs	17	.31	.43	—	.07	—	.94
Spleen	7	.30	.41	—	.29	—	.79
Intestine	9	2.70	.31	—	.31	—	.83
Skin	9	—	.25	—	.05	—	.54
Muscle	5	.20	.10	—	.22	11.5	.41
Bone	.3	1.35	.27	—	.37	—	1.11
Testicles	—	.80	—	—	.08	—	.97
Eyeballs	.3	—	—	—	—	—	—
Adrenals	.1	.52	.00	—	.00	—	—
Pancreas	—	—	—	—	—	—	.76
Cerebrospinal fluid	—	—	—	—	—	.5	—
Fetus	—	—	—	3.5	—	—	—

of cold isotope dilution and paperchromatographic methods, it was shown that in the rat at least 95% of the material was excreted unchanged. 3. Single doses up to 3.2 g/kg intraperitoneally were rapidly excreted by the rat in 24 hours. A dose of 1.4 g/kg was excreted with equal rapidity by normal and a unilaterally nephrectomized rat. 4. With repeated oral dosing in rats about two-thirds of the drug was excreted in the feces and one-third in the urine. No significant amounts of S^{35}-sucaryl were found to be stored in the body. 5. In the dog only 0.5% of the injected S^{35}-sucaryl was found in the bile 5 hours after an intravenous injection of 9.7 mg/kg. 6. With the exception of the kidney and perhaps the liver, there was no significant concentration of the drug in the various organs of the rat, rabbit, and the dog. Sucaryl penetrated into the brain with difficulty, but was found in the fetus of the rat.

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Serum Lipase (Tributyrinase) in Hypertension and Arteriosclerosis.* (19130)

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Changes in serum lipase activity have been observed in patients with disturbed pancreatic function and with carcinoma of the gastrointestinal tract(1-4). As far as we can ascertain, no detailed studies have been made of the lipolytic activity of the serum in persons with hypertension or arteriosclerosis. This paper records such a study in normal, hypertensive, and arteriosclerotic individuals.

Methods and materials. The technic em-

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1. Cherry, I. S., and Crandall, L. A., Jr., *Am. J. Physiol.*, 1932, v100, 226.

2. Comfort, M. W., *Am. J. Digest. Diseases and Nutrition*, 1937, v3, 817.

3. Goldner, M. G., and Morse, M., *J. Lab. and Clin. Med.*, 1949, v34, 858.

4. Nemir, P., Jr., Hawthorne, H. R., and Lecrone, B. L., *Arch. Surg.*, 1949, v59, 337.

TABLE I. Statistical Analysis of Serum Lipase (Tributyrinase) Activity of Human Serum.

Group	No. of cases	Range per 100 ml serum	Mean	Stand. dev.
		Male		
Normal	25	120-200	160.8	21.5
Hypertensive	28	70-185	133.8	26.1
Arteriosclerotic	31	90-195	137.4	28.7
		Female		
Normal	26	90-155	127.5	22.9
Hypertensive	15	90-205	139.6	33.6
Arteriosclerotic	25	85-155	120.9	19.7

ployed using aqueous tributyrin as the substrate, was that described by Goldstein, Epstein, and Roe(5), with the following modifications: a Waring Blender was used in the preparation of the emulsion, and the control tube was inactivated for ½ hour at 57°C. A tributyrinase unit is the amount of enzyme that will catalyze the hydrolysis of tributyrin with the release of 1 ml of 0.1 N fatty acid in one hour at 37°C, with an end point at pH 10.65. All results are given in terms of tributyrinase units per 100 ml of serum. In order to evaluate the method, determinations of serum tributyrinase were made on the same individual daily over a period of one week. The results were consistent and within the error of the method.

Results. Table I records the results of our studies of serum tributyrinase activity in normal, in hypertensive and in arteriosclerotic males and females. The normals were healthy laboratory workers, nurses, and internes. The age of this group ranged between 20 and 40 years for the males, and 19 to 35 for the females. The blood pressures varied between 90/50, and 130/80 mm of mercury. In normal females the serum tributyrinase concentration is definitely lower than that found in males, the age distribution being approximately the same. This observation confirms the work of other investigators(5,6).

Hypertension. The criterion used for determining hypertension was a systolic pressure of 150 mm of mercury or over with a diastolic pressure of 90 mm of mercury or over(7). In 28 hypertensive males between the ages of 44 and 83 years, the tributyrinase activity was lower than that of the normotensive male individuals, while the values obtained in hypertensive females with the same age distribution showed no difference from the normal. When compared with the normals, the p value of the male hypertensive was statistically significant, while that of the female hypertensive group showed no difference(8). There was no definite relationship between the serum tributyrinase activity and the age or blood pressure of the patients studied.

Arteriosclerosis. In 31 males between the age of 39 and 83 years showing clinical evidence of arteriosclerosis, but without an increase in blood pressure, the serum tributyrinase concentration was lower than that of the male normotensive group. Again the p value was statistically significant when compared with the normals. The serum tributyrinase concentration in female arteriosclerotic patients showed no difference from the female normal group.

Discussion. The results obtained seem to indicate that there are increases in the serum tributyrinase activity of hypertensive and arteriosclerotic males and not in the females. The p values of both groups of males when compared with the normals are statistically significant, while those of the females are not.

A comparison of the means of the female hypertensive and arteriosclerotic groups with that of the normal showed no difference, however, a significant statistical difference was observed, when the means of the hypertensive and arteriosclerotic groups are compared. A similar comparison of the means of the male hypertensive and arteriosclerotic groups did not reveal such differences.

Summary and conclusions. A study of the tributyrinase activity of the serum of normotensive, hypertensive, and arteriosclerotic male and female adults is presented. There

5. Goldstein, N. D., Epstein, J. H., and Roe, J. H., *J. Lab. and Clin. Med.*, 1948, v33, 1047.

6. Tuba, J., and Hoare, R., *J. Lab. and Clin. Med.*, 1951, v38, 308.

7. Actuarial Society of America and Association of Life Insurance Medical Directors, 1939.

8. Fischer, R. S., *Statistical Methods for Research Workers*, Edinburgh, 9th Edition, 1944, 122.

was a decrease in the tributyrinase of the serum of hypertensive and arteriosclerotic males as compared with the normal, while the serum of the females shows no difference from the normal.

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Growth-Promoting Activity of L-Lyxoflavin.*† (19131)

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Pallares and Garza(1) isolated L-lyxoflavin from the heart myocardium. These workers did not suggest any biological significance of this finding, but recently Emerson and Folkers(2) found that lyxoflavin stimulated the growth of rats on a hyperthyroid soybean ration, equal to the response given by an insoluble liver fraction.

A chick assay for unidentified factors has been described by Bruins *et al.*(3). Briefly, the diet is an isolated soybean protein-sucrose diet, properly supplemented with salts, known vitamins and aureomycin. Thiamine is supplied by injection. It seemed desirable to test the activity of L-lyxoflavin under these conditions; accordingly studies were initiated in April, 1951.

Results and Discussion. A summary of the results of 5 experiments with chicks is given in Table I. These results show that lyxoflavin consistently elicits a growth response, alone and in combination with dried whey, wheat bran and liver residue. The magnitude of this response is not large, being of the order of a 10% increase. Certainly, it does not represent all of the unidentified factor activity involved.

In fact, these results do not clearly show what crude supplements might owe their activity to their content of lyxoflavin. As a working hypothesis, it was earlier believed that whey, being a good source of riboflavin, might fall into this class, but that has not been demonstrated in these trials since lyxoflavin complements a level of whey which is believed to be sufficient to supply the "whey factor"(4).

The mode of action of this compound is not elucidated by these trials. It will be noted in Experiment 5 that lyxoflavin does not have riboflaviin activity for the chick, even though these compounds differ only in the configuration about C_4 of the side chain. Emerson and Folkers reported similar results for the rat.

Snell *et al.*(5) showed that lyxoflavin similarly is without riboflavin activity for microorganisms, although its addition in appropriate quantities does stimulate growth of *Lactobacillus casei* when riboflavin is limiting. At high concentrations, lyxoflavin inhibits growth of this microorganism, acting as an antimetabolite of riboflavin.

The possibility exists that the growth-promoting action of lyxoflavin for chicks might be due to a similar "antibiotic" activity. However, no action of this sort is indicated since the basal ration contains 50 mg/kg of aureomycin, a level more than adequate to promote maximum antibiotic response. That combinations of antibiotics might stimulate growth

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‡ Now with the University of Texas, Austin, Texas.

1. Pallares, E. S., and Garza, H. M., *Arch. Biochem.*, 1949, v22, 63.

2. Emerson, C. A., and Folkers, K., *J. Am. Chem. Soc.*, 1951, v73, 2398.

3. Bruins, H. W., Sunde, M. L., Cravens, W. W., and Snell, E. E., in press.

4. Hill, F. W., *Poultry Sci.*, 1948, v27, 536.

5. Snell, E. E., to be published.