in the bushing B under the teeth of the nut to accommodate a 5/64-in. steel ball J with a coil spring placed under it. The ball enters the space between the teeth as the nut is turned, resulting in a definite click.

The instrument is held in the right hand and operated by turning the nut with the thumb or forefinger. The syringe holder is cut away so that the nut may be reached from underneath. The clip F and a coil spring hold the plunger in position against the screw rod. The rod G is firmly attached to the syringe holder and serves as a guide for the screw rod C through which it passes.

Two light coil springs H attached to the central portion and hooked over two prongs soldered to the outside of the holder serve to hold the syringe firmly in place. The springs are unhooked for removal of the syringe.

With a feed nut of 14 teeth and a 32-thread screw there are 448 clicks per in. of screw, or 997 clicks to the 1 cc occupying a distance of 56.5 mm. This is equivalent to 0.0009965 cc per click or, for all practical purposes, 1 µl. By proper selection of the number of threads per in. in the screw, the number of teeth in the gear of the nut, and the diameter of the syringe, various sizes of drops may be obtained. The quantity of dissolved or suspended materials for a given dose may be calculated on this basis.

A fine long needle of 25 or 27 gauge, cut off bluntly, has been used for the small drops fed to bees. For accuracy it is essential that all air be removed from the syringe and that the temperature remain constant.

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The Caries-producing Capacity of Starch, Glucose, and Sucrose Diets in the Syrian Hamster

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The reports of experiments with the cotton and albino rat, in which various carbohydrates were incorporated in the diets to determine their relative cariogenic effectiveness, are either inconclusive or inconsistent (*2, 6, 7, 8*).

It has been shown that the Syrian hamster on a high carbohydrate diet will readily develop gross lesions of the teeth which are comparable to human dental caries (*1, 4*), and the use of this animal seems to have several advantages over that of the rat (*5*). An experiment was designed, therefore, in which the hamster was used for testing the caries-producing capacity of a monosaccharide, a disaccharide, and a polysaccharide.

Sixty-two hamsters (36 males and 26 females) were divided into three main groups with as nearly equal sex and littermate distribution as possible. At the initiation of the experiment, the ages of the animals ranged between 31 and 34 days. Beginning at this age, each of the three groups received diets which varied in composition only in the type of carbohydrate present. Group I received the following diet: raw cornstarch, 61%; whole powdered milk, 35%; powdered alfalfa, 3%; sodium chloride, 1%. In the diet of group II, the 61% cornstarch was replaced by an equal quantity of powdered α-glucose, and in the diet of group III, the starch was replaced by sucrose in the form of confectioner's sugar.

TABLE 1

Caries Scores on Carbohydrate Diets

	No. of animals	Mean caries score	Standard deviation	Critical ratio Starch	Critical ratio Sucrose
Starch diet					
Males	12	2	7	..	9
Females ...	9	0	0	..	11
Glucose diet					
Males	12	72	35	7	5
Females ...	8	44	27	4	7
Sucrose diet					
Males	12	163	57	9	..
Females ...	9	170	42	11	..

After an experimental period of 111 days, the animals were sacrificed, the teeth examined under a dissecting microscope, and the carious lesions charted and scored according to the method of Keyes (*3*). The mean caries scores are shown in Table 1. The difference in mean caries scores of the males on the various diets, and also the difference in the mean caries scores of the females on the various diets, are of a high order of statistical significance.

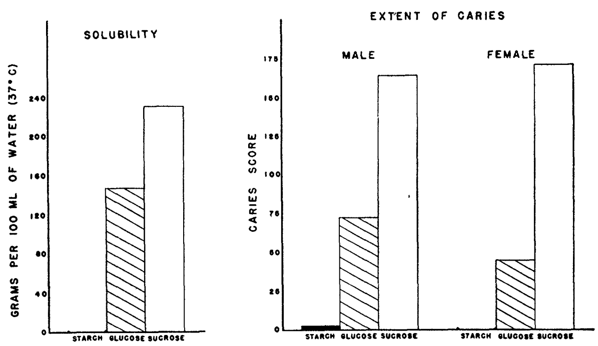

Fig. 1.

Thus it is seen that raw starch plays little if any significant role in the initiation of gross dental caries in the Syrian hamster. The feeding of a diet high in sucrose results in the highest caries scores, whereas a diet high in glucose results in caries scores intermediate between the starch and sucrose groups. Although the severity of dental caries in these three groups is roughly proportional to the solubility in water of the three carbohydrates (Fig. 1), it must not be inferred that solubility is the controlling factor in this experiment. No evidence is available except that cited above and no conclusions

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can be drawn at the present time. Further studies are now in progress using a larger number of carbohydrates of different solubility to determine whether such findings hold true in every instance.

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Synthesis of Amino Acids in the Rumen

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In 1891 Zuntz (*6*) presented the view that bacteria in the rumen of animals utilize nonprotein nitrogenous compounds to form protein, which in turn was used by the animals. In recent years it has been conclusively shown that protein is formed in the rumen from dietary urea and ammonium salts. The protein thus formed appears to be of relatively low biological value (*3–5*) but, to our knowledge, no attempt has been made to measure the amino acid composition of protein synthesized in the rumen.

In the course of studies designed to determine the amino acid requirements of farm animals, samples of diets, rumen material, and excreta obtained from three sheep and two goats fed a purified diet containing urea as the nitrogen source were analyzed for the ten essential amino acids. The animals were fed a diet containing corn sugar, 25%; cornstarch, 42%; cellophane, 20%; minerals, 5%; lard, 4%; and urea, 4%. Vitamins A and D were fed separately each day, but the B vitamins were not supplied because most of them have been shown to be synthesized in ruminants. After the animals had been on a constant amount of the diet for at least 20 days, collections of urine and feces were made for a 10-day period. Samples of rumen material were obtained by stomach tube at the end of the collection periods.

Lambs fed the urea-containing diet gained an average of 0.23 lb per day, as compared with 0.30 lb for similar lambs fed concurrently a ration containing casein. All animals were in positive nitrogen balance. As an average they stored 1.18 g of nitrogen each day. Biological values, calculated from the nitrogen balance data obtained from these animals and figures reported in the literature (*2*) for metabolic and endogenous nitrogen gave values of 56 for the diet containing urea and 82 for the casein ration.

The amino acids were determined in the purified diet, rumen material, and excreta by the microbiological technique after hydrolysis.

Hydrolysis was carried out in the autoclave in sealed tubes. Acid (10% HCl) was used for all amino acids except tryptophan. Alkali (5 N NaOH) was used for the latter. Organisms, obtained from the American Type Culture Collection, Georgetown University, Washington, D. C., were used for assay of the different amino acids as follows: *Streptococcus faecalis* #9790 for arginine, threonine, tryptophan, and valine; *Leuconostoc mesenteroides* P-60 #8042 for histidine, lysine, methionine, and phenylalanine; and *Lactobacillus arabinosus* 17–5 #8014 for isoleucine and leucine. The basal medium was the same as that reported in the literature for each organism, with the exception of slight modifications to be reported later (*1*).

In the analysis of rumen material, inhibition of growth of microorganisms was noted at the higher assay levels. This is being investigated further. The values for synthesis of amino acids in the rumen therefore are minimal.

TABLE 1

AMINO ACID CONTENTS OF RUMEN, FECES, AND URINE SAMPLES; AND DAILY AMINO ACID BALANCE OF SHEEP AND GOATS FED UREA DIET

Amino acid	Amino acid content (g/16 g N)				Apparent daily amino acid in g				
	Diet	Rumen material	Feces	Urine	Intake from		Losses in		Retention
					Diet	Rumen*	Feces	Urine	
Arginine	0.47	3.09	3.43	0.32	0.19	1.27	0.48	0.06	0.73
Histidine	0.13	1.44	1.27	0.12	0.05	0.59	0.18	0.02	0.39
Isoleucine	0.00	3.38	3.72	0.31	0.00	1.38	0.52	0.06	0.80
Leucine	0.36	4.96	4.35	0.43	0.15	2.04	0.61	0.08	1.35
Lysine	0.63	5.71	5.09	0.61	0.24	2.34	0.71	0.12	1.51
Methionine	0.08	1.62	1.48	0.09	0.03	0.66	0.21	0.02	0.43
Phenylalanine	0.13	2.47	3.39	0.22	0.05	1.01	0.48	0.04	0.49
Threonine	0.16	3.98	4.77	0.32	0.07	1.63	0.67	0.06	0.90
Tryptophan	0.04	0.61	0.94	0.04	0.01	0.25	0.13	0.01	0.11
Valine	0.34	3.82	4.89	0.38	0.14	1.57	0.69	0.08	0.80

* These values were calculated by multiplying the daily nitrogen intakes by the amino acid contents of the rumen material.