antibody. They raise the question whether the "inhibitor" found in extracts of chicken sarcomas[5] may not be of similar nature.

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Decreased Tolerance of Mice to Intraperitoneal Glucose Injections in Certain Neurotropic Virus Infections.*

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Certain neurotropic virus infections of mice cause a definite decrease in the tolerance of these animals to intraperitoneally injected glucose.

Glucose was dissolved in distilled water and injected intraabdominally into white Swiss mice in constant volumes of 0.05 cc per gram of body weight. The concentrations of glucose employed varied from 45 to 10%. Viruses were inoculated intracerebrally and test injections of glucose were generally given during the early stage of disease symptoms, normal controls being included whenever virus-infected mice received dextrose. The viruses utilized were rabies fixed virus, a neurotropic strain of herpes, St. Louis encephalitis and equine encephalomyelitis (Western strain). The work included in Table I covers many small experiments, all of which pointed in the same direction.

Table I indicates that 25 and 20% glucose killed almost all virus-infected mice, whereas most corresponding controls survived. The injection of glucose, in the case of those mice that survived, had no effect on the subsequent course of the above virus diseases; the surviving virus-infected mice developed symptoms of increasing severity and eventually died.

Intraperitoneal injections of glucose often cause immediate symptoms of peritoneal irritation which quickly subside, after which the mice appear normal for 15 minutes or more. They then act irritable,

5 Sittenfeld, M. J., Johnson, B. A., and Jobling, J. W., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 517; Murphy, J. B., and Sturm, E., *Science*, 1931, **73**, 266; Claude, A., *Am. J. Cancer*, 1939, **37**, 59.

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TABLE I.
Fate of Mice Receiving Intraperitoneal Glucose.

% of glucose	Normal control mice		Mice Showing Symptoms of							
			Rabies		Herpes		St. Louis encephalitis		Equine encephalomyelitis	
	Died	Survived	Died	Survived	Died	Survived	Died	Survived	Died	Survived
45	6	0	—	—	—	—	—	—	—	—
40	17	1	1	0	—	—	2	0	—	—
35	14	4	1	0	1	0	—	—	—	—
30	9	11	4	0	2	0	6	0	2	0
25	2	19	8	1	2	0	6	1	2	1
20	1	21	19	0	2	2	7	1	2	1
15	0	7	6	3	0	2	4	1	0	2
10	0	5	3	4	—	—	—	—	—	—

— = No mice injected.
All mice received intraperitoneal glucose in volumes of 0.05 cc per gram of body weight.

their fur is ruffled, breathing becomes irregular, they show increasing cyanosis, tremors and convulsions develop and death ensues, usually within an hour. Sublethal doses of glucose may cause various symptoms of distress followed by recovery; still smaller doses produce no symptoms. Autopsy of both normal and virus-infected mice, that have died, shows a very constant picture. There is a considerable amount of free peritoneal fluid, sometimes blood-tinged. The abdominal viscera are hyperemic. Most extra-abdominal areas appear dehydrated and section through the chest causes little bleeding. The brain, however, exhibits marked gross hyperemia, a fact that was verified by several microscopic sections.

An important factor in explaining the decreased tolerance to intraperitoneal dextrose, that is shown by virus-infected mice, would appear to be the dehydration and presumably also demineralization that is produced by the osmotic effect of glucose in the peritoneal cavity. The following experiments involve only rabid and normal animals.

Mice that have developed symptoms of rabies stop drinking and rapidly become dehydrated. Intraperitoneal glucose produces considerable dehydration in normal mice and accentuates the dehydration that is already present in rabid animals. Red cell counts were performed on each of a number of mice to ascertain the amount of dehydration that had occurred. Blood was obtained by cutting the throats of the mice and collecting a few drops in a Petri dish; the animals were then immediately killed. The mean red cell count of 12 normal mice was 8,900,000 (limits 8,000,000 and 11,100,000), whereas the mean count of 12 rabid mice was 11,800,000 (limits 9,900,000 and 13,700,000). Six rabid mice, injected intraäbdominally with 20% glucose and bled during terminal convulsions, showed a mean count of 13,400,000 (limits 11,900,000 and 15,300,000). Six normal mice were injected with 20% glucose; they showed no symptoms but were bled one hour later, an interval roughly corresponding to the time required by rabid mice to die following intraperitoneal administration of 20% dextrose. Their mean count was 11,200,000 (limits 9,800,000 and 12,500,000). Six normal mice that received 40% glucose were bled during terminal convulsions. They showed a mean count of 11,400,000 (limits 10,500,000 and 12,000,000).

An attempt was made to alter the susceptibilities of normal and rabid mice to 20% intraperitoneal glucose. Fifteen normal mice were dehydrated by withholding water for 42 hours and were then injected with 20% glucose. Three died after typical convulsions. The remainder survived but all showed definite symptoms of distress

which often progressed as far as tremors and mild convulsions. Fifteen mice in early stages of rabies were given 4 cc of Ringer's solution (without glucose) subcutaneously, one evening, and received an additional 5 cc the next morning. This was followed in 2 hours by 20% intraperitoneal glucose. Five of these mice developed severe convulsions and died but the remainder, after showing symptoms of varying severity, survived. In this manner, by altering the factors of dehydration, it was possible to approximate the susceptibilities of rabid and normal mice to intraperitoneal injections of dextrose.

Many diseases may alter the host's ability to metabolize glucose, a fact that has been demonstrated in experimental poliomyelitis.[1] Such alterations in dextrose metabolism do not appear, however, to play a major rôle in accounting for the different susceptibilities of rabid and normal mice to intraperitoneal injections of glucose. Both groups have essentially the same tolerance for dextrose when it is given intravenously. Glucose was injected into the tail veins of both rabid and normal mice in volumes of 0.02 cc per gram body weight. Five normal mice received 45% glucose, a concentration which proved too high, all rapidly had severe convulsions and died. Forty percent glucose killed 3 out of 6 normal mice and 1 out of 4 rabid mice, while 35% glucose killed 1 out of 6 normal mice and 1 out of 5 rabid mice.

Determinations were made of the actual blood glucose levels obtained by intraperitoneal dextrose injections. The mice were anesthetized with nembutal, their throats were cut and blood was collected in a watch glass and mixed with crystals of potassium oxalate. The blood volumes employed were generally 0.1 cc and determinations were run by the micro Schaeffer-Hartmann method. Preliminary experiments showed that nembutal anesthesia had little effect on the blood glucose level. Six starved normal mice showed blood glucose levels ranging between 124 and 150 while 4 rabid mice varied from 90 to 134 mg per 100 cc. Five rabid mice received 20% glucose and blood was taken about 1 hour later during terminal convulsions; their mean blood glucose level was 766 mg per 100 cc (limits 594 and 864). Five normal mice, which also received 20% glucose and remained symptom-free up to one hour, were killed; their mean blood glucose was 722 (limits 668 and 800). It thus appears that 20% intraperitoneal glucose, although it killed rabid mice while producing no symptoms in normal animals, built up essentially the same blood glucose levels, in a constant time, in both groups.

Five normal mice received 40% glucose and were bled during

[1] Jungeblut, C. W., and Resnick, R., *Am. J. Dis. Child.*, 1936, **51**, 91.

terminal convulsions. These animals showed a mean blood glucose level of over 1420 mg per 100 cc (limits 1334 and 1500+), a level far exceeding that of the rabid mice which died following administration of 20% glucose. This level, although high, is presumably only one factor in causing the death of these normal animals, dehydration being another such factor. Wierzuchowski[2] has reported that the blood glucose level of dogs may be brought up to over 3500 mg per 100 cc before death occurs.

Summary. Mice in the symptomatic stages of various neurotropic virus infections are more susceptible than normal mice to the lethal effect of intraperitoneally injected glucose. The dehydration produced by intraperitoneal glucose appears to be a major factor in this differential susceptibility.

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Effect of Adrenalectomy on Fat Absorption Measured by Fat Excretion in the Stool.

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Contrary to the view of the Verzar group,[1, 2, 3] Barnes, *et al.*,[4] concluded that adrenalectomy has no significant effect on the absorption of fat in the form of corn oil or the methyl esters of the fatty acids of corn oil. The experiments comprising this report represent a corollary of the earlier work. In the experiments of Barnes and coworkers, fat absorption was measured in the usual way and in what might be termed an acute manner. A single large dose of fat was administered 4 days after adrenalectomy. In the present experiments, fat absorption was studied over a longer time, as a matter of fact, over a period of days, after removal of the glands and under ordinary conditions of nutrition through the simple expedient of following the excretion of fat in the stools in relation to the amount of

2 Wierzuchowsky, M., *J. Physiol.*, 1936, **87**, 311, 85 P.

1 Judovits, N., and Verzar, F., *Biochem. Z.*, 1937, **292**, 182.

2 Verzar, F., and Laszt, L., *Biochem. Z.*, 1935, **276**, 11.

3 Verzar, F., and McDougall, E. J., *Absorption from the Intestine*, Longmans, Green and Co., 1936.

4 Barnes, R. H., Wick, A. N., Miller, E. S., and MacKay, E. M., PROC. SOC. EXP. BIOL. AND MED., 1939, **40**, 651.