This work was supported in part by a grant from the National Communicable Disease Center, US Public Health Service.

GEORGE M. HAPP

Department of Biology,
New York University,
Bronx, New York 10453.

Received December 31, 1968; revised February 24, 1969.

[1] Butler, C. G., *Biol. Rev.*, **42**, 42 (1967).
[2] Wood, D. L., and Bushing, R. W., *Canad. Entomol.*, **95**, 1066 (1963).
[3] Eisner, T., and Kafatos, F. C., *Psyche*, Cambridge, **69**, 53 (1962).
[4] Yinon, U., and Schuler, A., *Entomol. Exp. and Appl.*, **10**, 453 (1967).
[5] Alpin, R. T., and Birch, M. C., *Nature*, **217**, 1167 (1968).
[6] Valentine, J. M., *J. Exp. Zool.*, **58**, 161 (1931).
[7] Tschinkel, W., Willson, C., and Bern, H., *J. Exp. Zool.*, **164**, 81 (1967).
[8] Happ, G. M., and Wheeler, J. W., *Ann. Entomol. Soc. Amer.* (in the press).
[9] Berkson, J., *J. Amer. Statistical Assoc.*, **485**, 565 (1963).
[10] Schlager, G., *Ann. Entomol. Soc. Amer.*, **53**, 557 (1960).

Lethal Effect of Feeding Rats on Galactose–Ethanol

GALACTOSE is a physiological substance which is usually well tolerated provided its breakdown is normal. In patients with galactosaemia, who lack the enzyme galactose-1-phosphate uridyl transferase, galactose is toxic, causing cataract and brain and liver damage, presumably because of the accumulation of galactose-1-phosphate[1]. The exact mechanism involved is not known, however, and extensive studies have been hampered by the lack of an experimental model.

The elimination of galactose can be depressed experimentally by ethanol, which inhibits uridine diphosphate galactose 4-epimerase by increasing the ratio of $NADH_2$ to NAD[2]. The transferase reaction which precedes the epimerase step is reversible[3] and the phosphorylation of galactose is irreversible[4], so that inhibition of the epimerase by ethanol may have the same consequences as the lack of transferase activity. We have investigated this question by giving rats a diet rich in galactose and ethanol.

Albino rats of identical breed, weighing about 100 g, were kept in separate cages and received nothing but a liquid diet containing 1 calorie/ml. given freely. The body weight and the quantity of diet consumed were recorded daily. Four types of liquid diet (Table 1) were used and each was given to five male and five female rats. Vitamins were added to all the diets. Animals surviving 29 days on the diet were decapitated. Liver, brain and eyes were removed for histological examination in all animals as soon after death as possible.

Table 1 shows that animals receiving ethanol or galactose lost weight, but those on the combined ethanol–galactose diet lost far more weight. After a few days on the ethanol–galactose diet they looked sick and apathetic, and they all died between the tenth and the twenty-second day. Histological examination of liver and brain revealed no marked differences between groups. The eyes from all animals receiving galactose had cataract; the changes were most pronounced in the ethanol–galactose group.

The results indicate a toxic effect of combined ethanol–galactose feeding in rats. Ethanol given in equal amounts

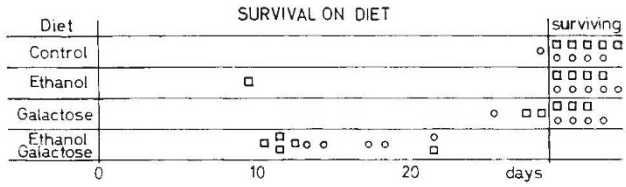

Fig. 1. The effect of liquid diets on the survival of rats. For composition of diets see Table 1. □, Male rat; ○, female rat.

to rats[5] has produced fatty infiltration in the liver during 24 days. Rats receiving a diet containing 81 per cent galactose died in a week[6], and in experiments with a 50 per cent galactose diet slight degenerative changes were seen in the liver after 23 days, small necroses after 50 days, and after 108 days degenerative, sudanophilic material was present in the white matter of the cerebellum[7].

The rather acute lethal effect of combined ethanol–galactose feeding cannot be explained by the addition of an ethanol effect and a galactose effect. One of the substances can be assumed to modify the metabolism of the other in a harmful way. The established inhibitory effect of ethanol on galactose metabolism is the most probable clue to the problem. If that is so, ethanol–galactose feeding may provide a much needed experimental model of the toxic effects of galactose in patients with galactosaemia.

This work was supported by the "Novo" Foundation and the Danish State Research Foundation.

N. TYGSTRUP
S. KEIDING

Division of Hepatology,
Medical Department A,
University Hospital of Copenhagen.

Received January 20, 1969.

[1] Schwarz, V., Golberg, L., Komrower, G. M., and Holzel, A., *Biochem. J.*, **62**, 34 (1956).
[2] Isselbacher, K. J., and Krane, S. M., *J. Biol. Chem.*, **236**, 2394 (1961).
[3] Leloir, L. F., *Arch. Biochem.*, **33**, 186 (1951).
[4] Cuatrecasas, P., and Segal, S., *J. Biol. Chem.*, **240**, 2382 (1965).
[5] Lieber, C. S., Jones, D. P., and DeCarli, L. M., *J. Clin. Invest.*, **44**, 1009 (1965).
[6] Handler, P., *J. Nutrit.*, **33**, 221 (1947).
[7] Duckett, S., and Pearse, A. G. E., *Rev. Canad. Biol.*, **25**, 149 (1966).

Australia Antigen detected in the Nuclei of Liver Cells of Patients with Viral Hepatitis by the Fluorescent Antibody Technique

OUR suspicion that the Australia antigen associated with acute and chronic hepatitis is a virus and is the cause of the disease has been supported by examination of material from affected patients. Au(1) was first detected in the serum of an Australian aborigine[1], and the geographic distribution, disease association, genetics and physical and chemical characteristics of this unusual antigen have been described[2–4]. One of the most startling findings in

Table 1. EFFECT OF LIQUID DIETS ON BODY WEIGHT AND INTAKE OF CALORIES (MEAN AND *S.E.M.*) OF MALE (M) AND FEMALE (F) RATS

Diet (Percentage of calories)					Sex	Body weight at start (g)	Average change in weight (g/24 h)	Average intake of calories (cal/24 h)	Body weight at end (g)
Casein	Fat	Sucrose	Ethanol	Galactose					
14	26	60	0	0	M	106 (±1·0)	0·59 (±0·23)	48 (±3·0)	118 (±6·5)
					F	98 (±2·5)	0·00 (±0·13)	39 (±1·0)	98 (±4·2)
14	26	30	30	0	M	107 (±2·6)	−0·49 (±0·34)	36 (±1·8)	99 (±5·3)
					F	103 (±2·6)	−0·16 (±0·05)	33 (±1·0)	93 (±4·1)
14	26	30	0	30	M	104 (±2·5)	−0·26 (±0·20)	51 (±2·2)	96 (±4·4)
					F	98 (±1·2)	−0·37 (±0·11)	39 (±1·3)	86 (±3·5)
14	26	0	30	30	M	102 (±2·6)	−2·88 (±0·13)	30 (±1·5)	67 (±1·7)
					F	99 (±1·9)	−2·37 (±0·18)	25 (±1·2)	58 (±2·5)

Each group consisted of five animals.