

of the intrasinusoidal pressure develop watery vacuoles in this organ. Inasmuch as the liver in a rat dying from effects of pyridine becomes hydrated, especially during the last hours of life, it seems logical to assume that this is due basically to a decrease in the rate of oxidation in the cells.

Summary. Pyridine alone or pyridine supplemented with either choline, cystine, methionine, nicotinamide or beta-picoline was fed to young rats on a high protein diet. Livers from rats dying from the effects of pyridine are enlarged and always exhibit a marked

increase in water content. Livers from apparently healthy animals which have been on a pyridine diet show a nearly normal water content and are enlarged. Cystine and methionine afford protection against the effects of pyridine. The feeding of quinoline alone or quinoline supplemented with either choline, cystine, or methionine produced enlarged livers. Cystine and methionine increased survival time. Choline showed some protective effect. Cystine or methionine prevented the accumulation of water in the livers of rats fed quinoline. Choline had no effect.

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Quantitative Detection of Minute Concentrations of Digitoxin.*

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The detection of a digitalis glycoside, Lanatoside C, in various media by means of the embryonic duck heart preparation has been reported in previous studies.¹⁻³ It was found in these same studies that not only could extremely minute amounts of the glycoside (less than 0.1 μg per cc) be detected by this preparation, but also quantitative estimations of the actual amount of glycoside in Tyrode's solution or serum could be determined.

However, the sensitivity of the embryonic duck heart to the digitalis glucoside, digitoxin, had not been determined. Accordingly, studies were made of the effect of various concentrations of digitoxin upon the duck heart immersed in (1) Tyrode's solution, (2) rat serum, and (3) human serum. The method of quantitation employed was the

same as that described previously.^{1,3} It was found that the embryonic duck heart was not only extraordinarily sensitive to minute quantities of digitoxin but also offered a means whereby the concentration of digitoxin could be assessed in a quantitative fashion.

Results. As Table I demonstrates, the embryonic heart preparation was able to detect the presence of 0.005 μg of digitoxin in one cc of Tyrode's solution. Moreover, with increasing concentrations of the drug, there was a progressive reduction in the time taken for the occurrence of the digitalis effect.

The action of digitoxin in rat serum was found to be much less effective than in Tyrode's solution. Thus (Table I) only quantities of 0.2 μg or more of digitoxin per cc could be detected. Human serum was even more inhibitory (Table I) in that only quantities of 0.60 μg or more of digitoxin per cc could be detected. This action of serum upon the action of digitoxin also has been demonstrated by previous observers.^{4,5} Lanatoside C, how-

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¹ Friedman, M., and Binc, R., Jr., *Proc. Soc. Exp. Biol. and Med.*, 1947, **64**, 162.

² Friedman, M., and Bine, R., Jr., *Am. J. Med. Sci.*, 1947, **214**, 633.

³ Bine, R., Jr., and Friedman, M., *Am. J. Med. Sci.*, 1948, **216**, 534.

⁴ Fawaz, G., and Farah, A., *J. Pharm. and Exp. Therap.*, 1944, **80**, 193.

⁵ Suter, E., *Helvet. Physiol. et Pharmacol. Acta*, 1944, **2**, 2.

TABLE I.
The Detection of Digitoxin in (1) Tyrode's Solution, (2) Rat Serum, and (3) Human Serum by the Embryonic Duck Heart Preparation.

Conc. of digitoxin ($\mu\text{g}/\text{cc}$)	Tyrode's solution			Rat serum			Human serum		
	Avg. time "dig. effect" (min.)	Stand. error of mean (min.)	No. hts.	Avg. time "dig. effect" (min.)	Stand. error of mean (min.)	No. hts.	Avg. time "dig. effect" (min.)	Stand. error of mean (min.)	No. hts.
.001	ND		10	ND		12	ND		10
.005	48	3.0	15	ND		10	ND		10
.010	41	1.6	21	ND		10	ND		10
.05	23	1.5	33	ND		10	ND		10
.10	12	0.8	20	ND		10	ND		10
.20	—	—	—	62	1.3	18	ND		15
.40	—	—	—	38	1.7	18	ND		15
.60	6	0.2	20	24	0.5	36	49	2.0	23
.80	—	—	—	21	0.8	20	34	1.6	24
1.00	4	0.2	29	11	0.4	22	21	1.1	28

ND indicates that no glycoside could be detected by occurrence of "digitalis effect" in embryonic heart preparation.

ever, was not found³ to be inhibited similarly by serum.

Conclusions. 1. Quantitative assay of extremely minute amounts of digitoxin in

Tyrode's solution and in rat and human serum was found to be possible by means of the embryonic duck heart preparation.

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Peculiar Enlargement of Eyeballs in Chicks Caused by Feeding a High Level of Glycine.*

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Previous reports^{1,2} from this laboratory have shown that glycine is highly "pellagra-genic" when fed to chicks receiving a nicotinic acid-low diet. On the other hand, the chick tolerated unusually high levels of glycine (4 to 6%), provided a sufficient amount of nicotinic acid was contained in the diet.²

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1 Briggs, G. M., Groschke, A. C., and Lillie, R. J., *J. Nutrition*, 1946, **32**, 659.

2 Groschke, A. C., and Briggs, G. M., *J. Biol. Chem.*, 1946, **165**, 739.

The latter observation was somewhat surprising for it had been reported earlier that more than 2% of glycine was toxic to the young chicken³ and that 4 g of glycine per day were harmful to hens.⁴

Because of this discrepancy, an investigation was undertaken to determine the minimum toxic level of glycine and the extent to which this level could be influenced by nicotinic acid feeding. The present report describes a peculiar overgrowth of the eyeballs and other conditions observed in chicks resulting from feeding a highly purified diet con-

3 Almquist, H. J., Stokstad, E. L. R., Meechi, E., and Manning, P. D. V., *J. Biol. Chem.*, 1940, **134**, 213.

4 Patton, A. R., *Poultry Sci.*, 1939, **18**, 31.