in normal gallbladder bile led to the excretion of a rather small volume of bile with a bile acid concentration of 4.44%. The total bile acid output was 9.92 gm.

It has been shown by various investigators[3, 4] that the liver often responds to injury by the excretion of a very large volume of dilute bile. As the function of the liver improves, the bile becomes more concentrated and decreases in volume. When such an index of efficiency in the hepatic excretion of bile acids is used, *i. e.*, the largest excretion of bile acids in the smallest volume of bile, it would appear that the various bile acids used can be grouped in the following order of decreasing efficiency: canine bile acids, ox bile salts, glycocholic acid, cholic acid, desoxycholic acid, dehydrocholic acid.

Summary. Oral administration of large amounts of the various bile acids to dogs with a common duct fistula indicate that, from the point of view of largest excretion of bile acids in most concentrated form, the natural bile acids of the dog were probably the most efficient. Under the conditions of these experiments pure ox bile salts and glycocholic acid were found to be more efficient than the unconjugated cholic and desoxycholic acids. The natural bile acids (cholic and desoxycholic acids, and their various conjugated forms) were more effective than dehydrocholic acid.

9360

Hemolytic Streptococcus Toxins and Antitoxins. VI. A Strain of Hemolytic Streptococcus of High Toxicogenicity.

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During an investigation dealing with the titration of hemolytic streptococcus toxins by the flocculation reaction,[1] one strain was found to produce unusually potent toxin. This strain was received from Dr. Alice C. Evans of the National Institute of Health, who designated it as "Streptococcus 594".* The interest of Doctor

[3] Walters, W., Greene, C. H., and Fredrickson, C. H., *Ann. Surg.*, **91**.

[4] Bergareche, J., *Arch. de med., cir. y especialid*, 1933, **36**, 189.

[1] Rane, L., and Wyman, L., *J. Immunol.*, 1937, **32**, 321.

* "Streptococcus 594 was received from Dr. Krause of the Franz-Josefspital, Vienna, Austria. It was isolated from a case of scarlet fever." *Public Health Rep.*, 1934, **49**, 1385.

Evans in this organism was limited, however, to its phagological activity.

While the Dochez NY 5 strain of hemolytic streptococcus has long been considered one of high toxicogenicity, we have shown that the toxin as usually prepared is comparable to weak diphtheria toxins in requiring a long period of incubation to flocculate. Only after concentration does it flocculate as rapidly as strong diphtheria toxins. The toxin of strain 594, on the other hand, is of such potency that rapid flocculation is obtained directly without concentration.

Toxins of strain 594, with values ranging from 10 Lf to 80 Lf,† were prepared in a variety of infusion and infusion-free media.[1] In infusion-free media the brand and even the particular batch of peptone appreciably affects the Lf value. With this strain a toxin of higher potency is produced when purified maltose rather than dextrose or dextrose plus maltose is used as the source of carbohydrate, a fact which may be explainable in part by the slower utilization of maltose. The gradual addition of the sugar as a sterile 50% solution up to a concentration of 2% is advantageous. During the growth of the organism it is essential to neutralize the acid formed with sterile 5N NaOH added aseptically.

When the original culture was plated out, 2 types of colonies were apparent. One was smooth and glistening; the other, somewhat rough and dull. The latter appeared to produce toxin of higher potency than the former.

The toxin was lethal for chinchilla rabbits. Five cc. (180 Lf), given subcutaneously, killed rabbits weighing at least 5 pounds usually within 48 hours. With an increase in the Lf value, the M.L.D. was considerably lower. The rabbits could be protected by the use of antitoxin. Rabbits weighing about one pound were relatively immune and could tolerate many times the dose lethal for adult rabbits. Other breeds of rabbits were not as susceptible as the chinchilla.

Swiss mice, ordinary albino mice, chinchilla mice, guinea pigs and chicks were not affected by the concentrated toxin in doses of 1.0 cc. for the mice, 5.0 cc. for guinea pigs, 1.0 cc. for 7-8-day-old chicks, although 1.0 cc. was fatal to adult chinchilla rabbits.

The crude toxin combined and rapidly flocculated with antitoxin prepared in horses by the injection of the Dochez NY 5 toxin (Table I).

In horses the toxin has proved highly antigenic. With less than

† 1 Lf as obtained by flocculation is equal to approximately 60,000 S.T.D. as determined by the intracutaneous rabbit test.

TABLE I.
Antitoxic Content of Horse Serums.

Horse No.	Units Indicated by Flocculation of: Concentrated NY 5 Toxin 28.8 Lf	Concentrated NY 5 Toxin 37.2 Lf	Unconcentrated 594 Toxin 36 Lf
623	230	232	225
629	240	232	232
633	144	146	144
638	160	162	156
666	113	113	112

50 cc. of toxin (36 Lf/cc.) two horses developed over 25 units of antitoxin within 3 weeks. This antitoxin readily neutralized NY 5 toxin both *in vivo* and *in vitro*. In all cases the same unit values were obtained with the NY 5 toxin and the homologous 594 toxin.

Summary. The highly toxicogenic property of a strain of hemolytic streptococcus is described. The general employment of this toxin for antitoxin production must await the results of additional research on the multivalency of the antitoxin.

9361 P

Sodium-d-Lactate Blood Clearance as a Test of Liver Function.*

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We have described[1, 2] the metabolism of sodium-d-lactate in normal individuals and in patients with acute diffuse parenchymal disease of the liver. The results obtained suggested the possibility of the use of this substance as a test for liver function. It should be emphasized that the metabolism of sodium-d-lactate is quite different from that of the racemic or the l-salt with which all previous work has been done.

The test is performed before breakfast, and consists of the intravenous injection of 75 mg. per kilo of body weight of a 10 to 14%

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1 Soffer, L. J., Dantes, D. A., Newburger, R., and Sobotka, H., *Arch. Int. Med.* In press.

2 Soffer, L. J., Dantes, D. A., and Sobotka, H., *Arch. Int. Med.* In press.