metabolism of the lens. Small supplements of cystine used in some preliminary experiments (0, 1-0.25%) gave negative results. Subsequently larger amounts of cystine (1, 2, and 3%) have been employed and the higher levels do appear to have a slight inhibitory effect upon the cataract-producing action of a 25% galactose ration. Bellows' observation[5] of an inhibitory effect when 0.3% cystine was added to a 35% galactose ration is interesting but not convincing because his data are too few and his experiments insufficiently controlled in view of litter differences usually encountered.

The accompanying table is given by litters so that, by reading across, comparisons may be made between litter mates. Each litter was started on experimental rations at 25 days of age. The time differences in cataract development between litter mates on various rations are more striking than average differences. Only figures from litter mate controls have been used in computing averages as given. The phenomenon of cataract-resistant and cataract-susceptible litters, even within a given strain of rats, must be recognized and considered in planning and controlling this type of experiment.

From these data it is evident that a protein deficiency definitely hastens the development of galactose cataract. The relatively slight inhibitory effect of a 20-fold increase in the cystine content of the ration makes it doubtful whether cystine is the crucial factor and leaves the question open as to what other factors may play equal or even more important rôles in this respect.

9406

Serum Protein Changes Occurring in Degenerative Stages of Bright's Disease.

ELOISE JAMESON. (Introduced by T. Addis.)

From Stanford School of Medicine.

Many studies have been made of the changes in serum proteins during the degenerative stages of Bright's disease which are accompanied by edema and a high loss of protein in the urine. In general these studies have been confined to the total serum protein and the albumin-globulin ratio. The results have shown a low total protein and a lowered albumin to globulin ratio.

[5] Bellows, J., *Arch. Ophth.*, 1936, **16**, 762.

In the work reported here, it has been found that an albumin-globulin ratio does not show the principal changes which have taken place in the serum. Sera widely differing quantitatively and qualitatively as to their component proteins will give similar albumin-globulin ratios. It is necessary, then, to make whole salting out curves to study the differences which occur. These reveal the absence of certain fractions present in normal serum and the presence of another fraction not found in normal serum.

Experiments were carried out on very fresh serum separated from the clot by centrifuging. The serum was precipitated by potassium citrate at 0° and pH 6.8. Under these conditions a minimal amount of change in the serum took place and the results were entirely reproducible. The precipitate was separated from the liquid by filtration. The percents by weight of protein and potassium citrate in the filtrate were determined gravimetrically.

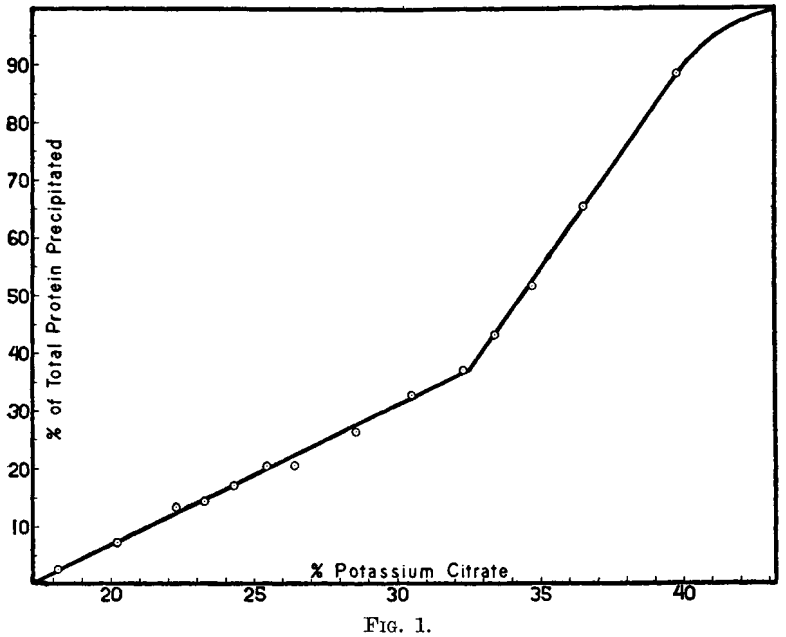

FIG. 1.
Normal human blood serum.

In Fig. 1 is given the normal curve representing the percent of the total protein precipitating, plotted against the percent of potassium citrate. One change in direction occurs, in this case at about 35% citrate. With less of the albumin fraction present in normal serum this point moves to the right. As may be seen, if the curve is cut at 31% citrate a normal 2-1 albumin-globulin ratio is found.

Fig. 2 shows a curve made from the pooled blood serum from 7 cases with glomerular nephritis in the degenerative stage. The total protein was 4.9%. Edema was present in all cases. The most apparent difference from the normal curve is seen from 28 to 31% citrate where a new fraction comes down precipitously. A lessened precipitation in both the extreme globulin and albumin ends is also visible. The albumin-globulin ratio is a little *less* than 1-1.

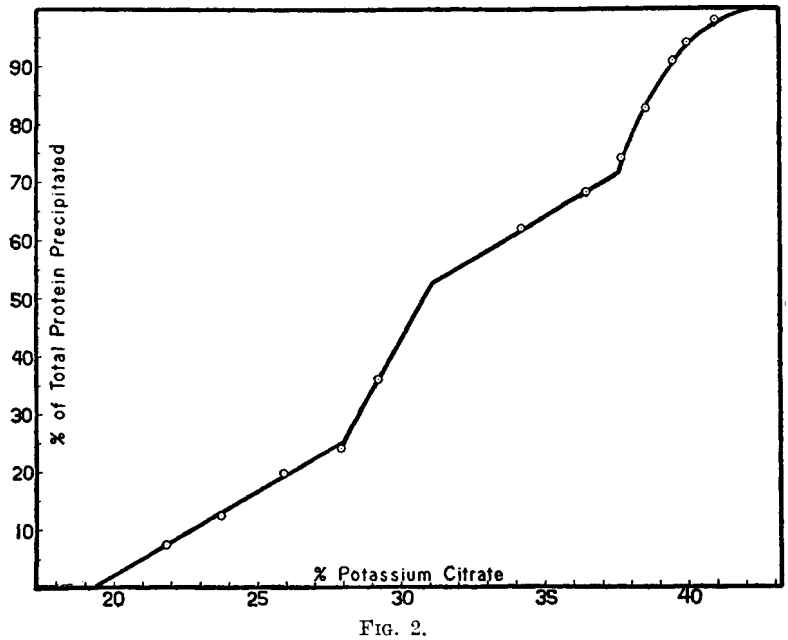

FIG. 2.

Pooled blood serum from 7 cases with glomerular nephritis in the degenerative stage.

The right hand line in Fig. 3 gives the curve from the serum of a case of degenerative Bright's disease during an acute infection (phlebitis). Considerable edema was present. There is a spectacular change both from the normal and from the curve in Fig. 2. The serum proteins are precipitated between 26 and 38% citrate. There is a complete absence of precipitation both in albumin and globulin ends. The albumin-globulin ratio is not far different from that of the serum represented in Fig. 2.

The left hand curve in Fig. 4 gives the results on serum from the same patient during recovery. Precipitation began at 21%. There was a great increase in the globulin end as well as a less but still definite increase in the albumin end. There still remained a large proportion of the fraction coming out precipitously from 27½ to

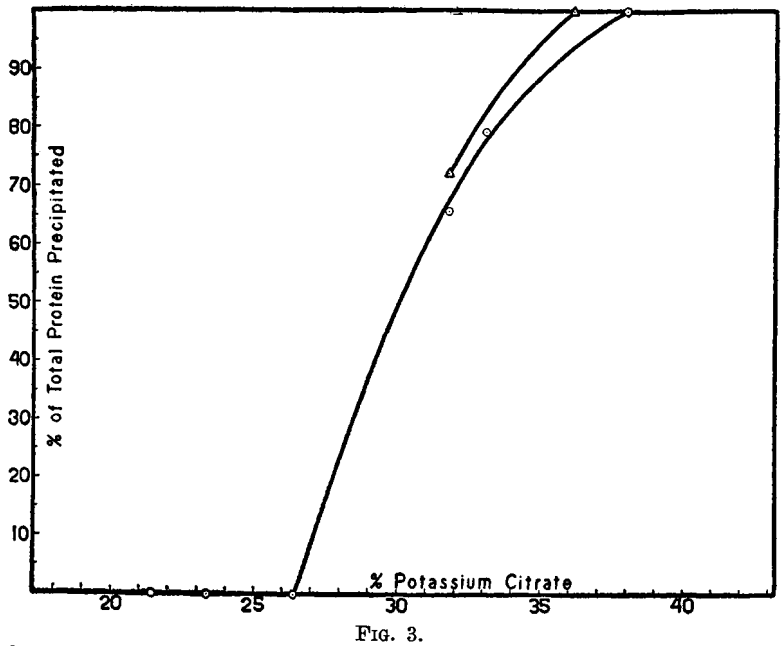

FIG. 3.
Sera from two cases of degenerative Bright's disease during acute infections.

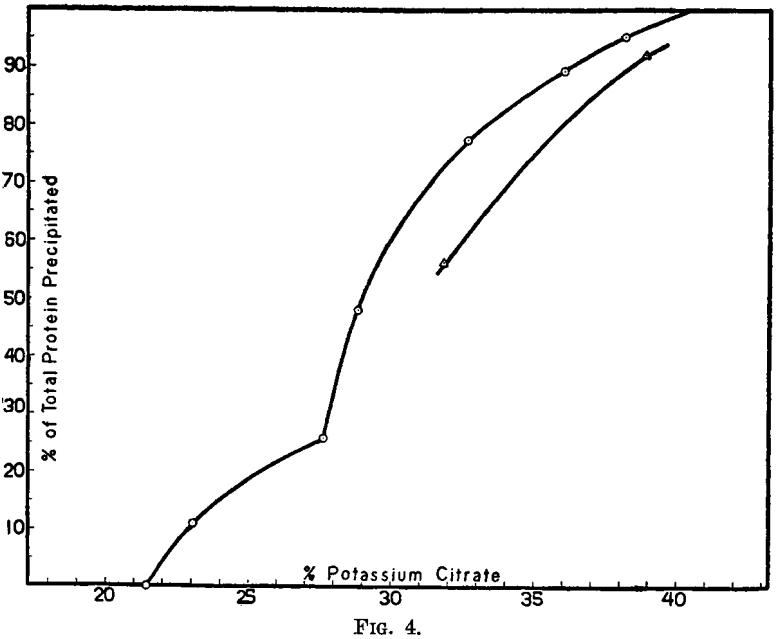

FIG. 4.
Sera from one of the cases of degenerative Bright's disease shown in Fig. 3, before the infection and during recovery.

32½% citrate. Recovery is very apparent although the albumin-globulin ratio is even less than that shown in Fig. 3.

The right hand curve in Fig. 4, made by precipitation of the serum 3 months before the acute infection, indicates that there had been a still greater amount of albumin as well as a greater albumin-globulin ratio at that time.

That the curve in Fig. 3 is not peculiar to one case may be seen from the left hand curve which represents another similar case during an acute infection.

Conclusions. There are 3 obvious changes in a salting out curve of serum of patients in the degenerative states of Bright's disease: (1) Decreased englobulin or absence of it. (2) Decreased albumin. (3) Presence of a fraction not occurring in normal serum. These changes are particularly pronounced where there is an acute infection. They can not be observed by making an albumin-globulin ratio.

9407 P

Importance of the Liver for the Antirachitic Efficacy of Vitamin D.

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The mode of action of vitamin D is at present unknown. A new hypothesis was suggested by Gerstenberger[1] which, on the basis of clinical observations, considered that the action of vitamin D was concerned with some function of the liver thus far unknown. The purpose of the investigation reported here was to approach this hypothesis in animal experiments, in order (1) to study the antirachitic efficacy of vitamin D in rachitic rats in which obstructive biliary cirrhosis had been induced or in which liver damage had been caused by the administration of carbon tetrachloride and (2) to learn whether the resulting decreased antirachitic potency of vitamin D was due to the injury to the liver itself or to other circumstances accompanying the experimental conditions.

Steenbock's rachitogenic Ration 2965 was given to rats 3 weeks of age. To induce cirrhosis of the liver, double ligation and transection of the common bile duct was performed 1 to 1½ weeks after

[1] Gerstenberger, H. J., *Monatschr. f. Kinderh.*, 1933, **56**, 217.