fistulous opening was raw egg white (25 cc.), raw egg white (25 cc.) suspended in 200 cc. of distilled water and a mixture of raw egg white (25 cc.) desiccated ox bile (Difco 1 gm.) suspended in 100 cc. of distilled water. The accompanying graph gives the average gastric acid secreting response to these substances. Stomach contents (1 or 2 cc.) were removed at half hour intervals and titrated in the usual manner.

These experiments combined with those reported by Bateman[5] and by Arnold[4] tend to place raw egg white in a unique position as a protein food. The lack of gastric response and the increased permeability of the small intestine has caused us to investigate the possibility of the utilization of egg white and bile mixtures as vehicles for vaccines for oral administration. Human experiments are now in progress.

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Liver Autolysis in Vivo.

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The experimental work of Mason[1] called our attention to the extremely toxic reaction produced by the implantation of liver into the abdominal cavity of animals. Ellis and Dragstedt[2] showed that death of these animals was not strictly due to toxemia but there was a constant finding of large numbers of organisms of the *B. welchii* group in the abdominal cavity and drew attention to the fact that this *B. welchii* organism was a normal inhabitant of the livers of dogs. They implanted fetal liver into the abdomens of dogs and also adult livers which had been previously autoclaved and found that no toxic reaction ensued. Our experiments were undertaken with a view to establishing the mechanism of death in peritonitis due to liver autolysis. It was found earlier in the course of these experiments that if the liver was ground and allowed to autolyse and then sterilized that its implantation into the abdomen caused the same picture of an overwhelming *B. welchii* peritonitis as when the infected liver had been used. The seeming contradiction in the work of Ellis and Dragstedt is probably due to the fact that in their experiments the hard

[1] Mason, E. C., *et al., J. Lab. and Clin. Med.*, 1924, x, 622.

[2] Ellis, J. C., and Dragstedt, L. R., *Arch. Surg.*, 1930, xx, 8.

cooked mass of liver had less exposed surface and did not undergo autolysis so promptly. There is, therefore, some mechanism at work by which the ordinary flora of the intestine as represented by the Welch bacilli are allowed to make their way through the intestinal wall and infect these masses of autolysed liver which are shown to have been previously sterile by culture.

The following attempts were made to isolate the toxic factor in this reaction. 100 gm. specimens of liver were ground and incubated for 24 hours and then extracted with large amounts of water. They were boiled for several hours, filtered repeatedly and watery extracts concentrated down to 25 cc. These extracts were shown to be capable of producing the same typical autolytic peritonitis. Similarly extracts of liver which are ground and boiled promptly after removal have the same or almost the same toxic power.

In another series of experiments the livers were extracted repeatedly in large amounts of boiling water for several days followed by repeated extraction by boiling chloroform and alcohol and ether mixtures. The remaining substances, principally coagulated proteins, implanted within the abdomens of normal dogs were bringing about death within 24 hours from autolytic peritonitis.

The extracts of these livers were shown not to contain bile salts in sufficient amounts to produce any symptoms whatsoever, as shown by the work of Rewbridge recently reported here. These extracts give a strong reaction with Biuret test indicative of the presence of large amounts of peptones and proteoses. Extracts which have been subject to prolonged boiling in weak alkali solution no longer give the proteose violet Biuret reaction but only the red color of peptones and such extracts are no longer toxic. If to the strong solutions of these liver extracts chloroform be added there is a heavy precipitate of whitish material which can be separately removed in the separatory funnel, the chloroform extract evaporated in the water bath to dryness, and redissolved in water. This solution gives a strong Biuret reaction of the proteose type and the amount recovered from an extract of 100 gm. of liver will produce the autolytic peritonitis.

It is evident, therefore, that even the purified liver proteins on autolysis in the abdomen are capable of giving rise to this toxic factor. Extracts of autolysed liver were dialized from celloidin bags against large amounts of water and in this series of experiments the animals survived in most cases so that the toxin was dializable only with great difficulty.