Among phenomena of digestion, almost all has been elucidated especially for characteristics of digestive enzymes in favor of remarkable development of enzyme chemistry. Although absorption has been understood as common, new methods and the development of new technology compel to reevaluate the knowledges which had been common and made it possible to investigate the absorption in detail.

The speaker checked the intestine of rabbit microscopically along with scanning electron microscopically following the administration of several detergents into the intestine in order to investigate the absorption in the disease state.

The actions of detergents were classified into the following 3 actions after the microscopical checks:

1. Hypersecretion of mucin from goblet cells
2. Desquamation of epithelial cells
3. Necrosis of mucous membrane

The action of pluronic F68 which has the action (1) was investigated further with scanning electron microscopy after its administration into murine intestine, and it was demonstrated that superficially coated mucin was removed and eventually absorbing cells and goblet cells gave apparently the clearer images.

The absorption of glucose was checked after the administration of detergents into the canine intestine. Pluronic F68 accelerated the absorption of glucose, while sodium lauryl sulfate remarkably inhibited the absorption. The former one has action (1) and the other has action (3). These findings are hopefully useful for the experimental model of diseased intestine in the future.

Along with the absorption of glucose, commercially available enzyme of which molecular weight was about 20,000 was determined to be absorbed into portal blood circulation. Polyvinylpyrrolidone (M.W. 40,000) which has no biological activity was also absorbed from intestine after its oral administration, and the storage of it was demonstrated in the liver.

Finally the speaker reported that the acute gastric and duodenal ulcer was made experimentally with electroshock after reserpine administration, and the speaker emphasized its importance to investigate such problems clinically and also biochemically.
Special lecture II

Contributions of Ammonia to Pathogenesis of Hepatic Coma*

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The term hepatic coma or, better, hepatic encephalopathy embraces all of the alterations of consciousness from precoma to coma which result from disease of the liver or abnormalities in its circulation.

In 1877, Nicolai Eck first produced what we now call Eck's fistula in dogs and it was found that, even though the dogs recovered from the operation, they soon became ataxic, stuporous, suffered convulsions and died. Even at that time, it was suggested that faulty metabolism of ammonia might be a contributing factor. In the early decades of the twentieth century, the workers at the Mayo Clinic in Minnesota perfected the operation of total hepatectomy in dogs, found the absolute requirement of the liver for blood glucose maintenance and noted that, when this was maintained by exogenous glucose, even then the animals subsequently went on to develop coma and died. Abnormalities in amino acid metabolism were suggested at that time.

The early stages of hepatic encephalopathy in man were described by Adams and Foley and their colleagues at the Boston City Hospital. These included asterixis, mental confusion and reproducible, although nonspecific, changes in the electroencephalogram. It was then possible to confirm the work of Kirk by a group of us at the Boston City Hospital with the finding that impending coma or precoma could be induced by the oral administration of ammonium salts and by protein feeding. A rise in blood ammonium was an accompanying phenomenon in this situation. A similar syndrome was found by McDermott and Adams in a patient in whom an Eck fistula was done. Now, 100 years after Nicolai Eck's work and 25 years since our confirmation of the relationship to ammonia, it is well to take stock of recent knowledge and consider it in conjunction with older information.

First, we will review some of the older work from the Thorndike Memorial Laboratory showing that the oral administration of ammonium salts will, in susceptible patients, induce the syndrome of impending hepatic coma. Withdrawal of the impending ammonium salts is rapidly followed by a return to normal consciousness. Induction of the syndrome in these patients may be done repetitively and is usually, but not always, followed by a considerable rise in the blood ammonium concentration. We then found that increased protein in the diet would likewise reproduce the same syndrome and also was usually associated with a rise in blood ammonium concentration. Here again, reduction in dietary protein induced a reversal to a normal state of consciousness in these patients. Subsequently, Fisher and Faloon and then many others determined that the oral administration of broad spectrum antibiotics were effective in reversing the protein-induced hepatic encephalopathy. These antibiotics have now become the mainstay of the treatment for hepatic encephalopathy, so that it is not necessary in many patients to reduce the protein intake, protein being so important for the healing of the liver disease itself, it is believed.

The precise action of ammonium on the brain is not known, but is probably related to its metabolism and removal. The effect of ammonium on the brain has been widely studied. Because of the central