Gastric Secretion

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PREFACE

Transport by the gastric mucosa involves secretion of ions such as H^+, Cl^-, and K^+, absorption of Na^+, and also secretion of proteins such as pepsinogen. Like the salivary glands and the pancreas, its secretion is under complex hormonal control.

This book reports the proceedings of a symposium held in Frankfurt, Germany, in July, 1971. The emphasis was placed on studies of gastric mechanisms *in vitro,* although correlation with *in vivo* findings is emphasized in several chapters. Fine structure of this tissue in the resting and secreting state is discussed as are the electrical properties of the organ. Metabolism, the role of ATP, and gastric ATPase are covered in considerable detail, reviewing what is known to date. In the final section of the book other acidification mechanisms are reviewed in organs such as kidney, bladder, pancreas, and human small intestine.

It is hoped that this volume represents the "state of the art" in this very important field.

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OPENING ADDRESS TO GASTRIC SYMPOSIUM
July 23, 1971
(Excerpts)

E. Heinz

Ladies and Gentlemen!

It is a great honor for me to welcome here the creme, so to say, of the gastric world to our symposium. This honor comes to me quite undeservedly, for at least two reasons. Even though I have been meddling with gastric acid formation in earlier years, I can no longer claim to be an active member of this group.

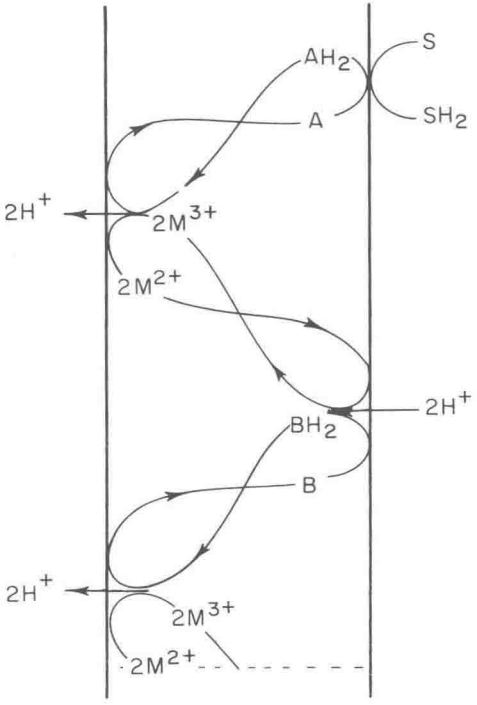
As an outsider who has previously been engaged in gastric acid research I shall follow this meeting with greatest interest. I feel tempted to look at the developments in the field during the last ten years after I left it, in particular to compare the main problems of the past with those on the agenda today, and to see what progress has been made. Ten years ago people were very impatient. I heard outsiders say that it were almost a shame of physiological and biochemical research, which has lately solved so many intricate problems, such as in genetics, etc., has not been able to solve such simple and straight forward a phenomenon as HCl formation. In a grant application, which was then made on my behalf, one of the leading gastric researchers called the state of gastric acid formation a "national crisis". (The grant went through). But in spite of many efforts made under such a strong moral pressure, I was as little as the other colleagues able to remedy this crisis, or even to prevent it from becoming an international one. Many of the problems in vogue ten years ago, seem to have disappeared, or lost their actuality. Some of them may have been solved by the efforts of many workers. Others seem to have taken care of themselves. For example, the origin of H-ions was then a much debated subject. Do they come from water or do they come from oxidized substrates, such as glucose? I do not feel that many people worry about this

nowaday. Apart from the fact that many of the so-called substrate hydrogens are ultimately coming from water, as follows from the intermediate metabolism of glucose, one of the major arguments formerly used may no longer be valid. At that time it was generally assumed that the stoichiometric ratio between substrate H-ions and O-molecules were strictly limited by the number of electrons that O_2 can accept, namely 4. More recently, however, Mitchell has devised a mechanism by which as many H-ions can be produced during the course of an electron between substrate and oxygen as there are loops, as may be illustrated by a slide. According to this model, the H^+/O_2-ratio, though limited by the amount of energy available from redox mechanism, could easily exceed 4. Hence the H^+/O_2 ratio should no longer be considered an indication as to whether the H-ions stem from substrate or from H_2O. Nor can it be used in the following argument of that time, which concerned the alternative between a redox-pump and an ATP-driven pump. A H^+/O_2-ratio greater than 4 does for the same reasons as given above not argue against a redox pump, in contrast to what was believed at that time. The older among us will still remember the controversies and polemics going through the literature on this point. This question, even if it does not seem to have been definitely answered, may have lost much of its actuality: In view of the close connection postulated for electron transport, H-ion transport, and oxydative phosphorylation, the chemo-osmotic hypothesis for mitochondria, we may even wonder whether a similar connection may not exist in gastric secretion, permitting both redox processes and ATPase reactions to operate in peaceful coexistence jointly while forming the gastric acid. I see that Dr. Hersey is present and can inform us about his recent observation with the dual wave-length spectrophotometer.

Apart from such problems, many others have come to the foreground, as we will see later. To mention a few: there is the function of bicarbonate-activated and CNS-inhibited ATPase, there is the possible role of cyclic AMP as a mediator of the stimulus for acid secretion and its place in the sequence: gastrin-histamine-acid formation. Special problems, which I hardly dare touch upon, concern the electric phenomena in the gastric mucosa. We still do not know whether the electric power generation of this tissue is an essential part of the acid forming mechanism, whether it is

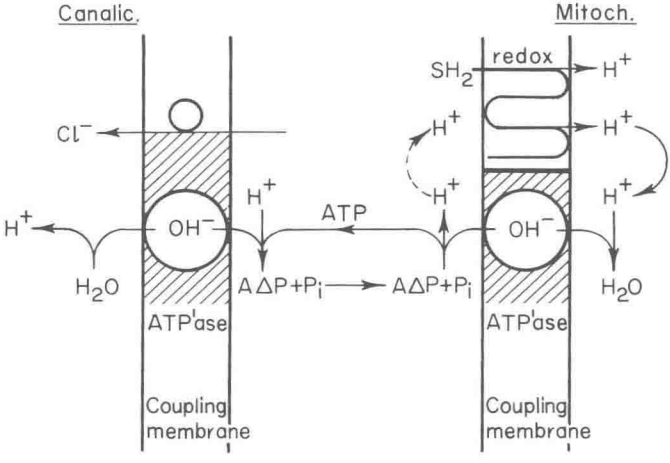
only involved in its regulation, whether it is a mere by-product of acid secretion or whether it has nothing to do at all within this process. I hope Dr. Rehm, the great expert in this field, will give us some new information.

These are some of the thoughts which come to my mind in the present moment, stimulated by remembrances of things passed. I should not take more time for them and not prevent the flow of new information. I therefore would like to ask the speaker to give his talk.



Redox pump for H^+

Figure 1



Redox – ATPase – Pump

Figure 2

GENERAL