AMERICAN LECTURE SERIES

CHEMISTRY OF DIGESTIVE DISEASES

By

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and

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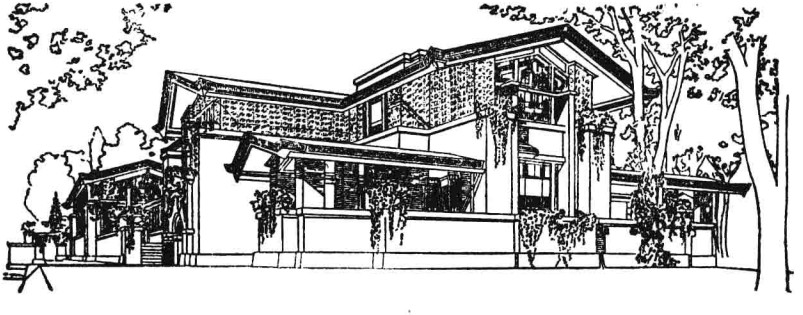

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FOREWORD

OUR LIVING CHEMISTRY SERIES was conceived by Editor and Publisher to advance the newer knowledge of chemical medicine in the cause of clinical practice. The interdependence of chemistry and medicine is so great that physicians are turning to chemistry, and chemists to medicine in order to understand the underlying basis of life processes in health and disease. Once chemical truths, proofs and convictions become sound foundations for clinical phenomena, key hybrid investigators clarify the bewildering panorama of biochemical progress for application to everyday practice, stimulation of experimental research and extension of postgraduate instruction. Each of our monographs thus unravels the chemical mechanisms and clinical management of many diseases that have remained relatively static in the minds of medical men for three thousand years. Our new Series is charged with the *nisus élan* of chemical wisdom, supreme in choice of international authors, optimal in standards of chemical scholarship, provocative in imagination for experimental research, comprehensive in discussions of scientific medicine, and authoritative in chemical perspectives of human disorders.

Dr. Wilbur and Dr. Gamble of San Francisco present the newer chemical knowledge of digestive diseases applicable to everyday clinical practice. The troublesome gastrointestinal tract is the equilibrial intermediary system between external and internal forces responsible for the factional conflicts of digestive cells divided against themselves in disease. Each component of the alimentary tract represents a local modification of a tube which is practically the same throughout in both structure and function, hence a disease affecting one part is essentially the same as that affecting any other part, except for the biochemical lesions in absorption, secretion and motility. The chemical mechanisms

of these functional derangements in the intact man have been unravelled by the methodological development of ingenious procedures, especially isotope studies, cybernetics, intraluminar pressure measurements, fluorocinematography, thereby substituting facts for appearances, and demonstrations for impressions. The authors discuss the oldest of the new and newest of the old research giving novelty to that which was old, condensation to that which was diffuse, perspicuity to that which was obscure and currency to that which was recondite about the alimentary system. All the recent chemical pioneering and its digestive ramifications are correlated with clarity of thought despite the severity of science. The monograph is thus designed as an introduction to alimentary research and a chemical guide to medical practice for real understanding of digestive disease in the patient.

I. NEWTON KUGELMASS, M.D., PH.D., SCD., *Editor*

INTRODUCTION

THE BASIC SCIENCES of physiology and biochemistry applied to the gastrointestinal tract have made rapid advances in the last few years. Clinical use of this knowledge has not always kept pace. At the present time we are on the threshold of even more remarkable advances in gastroenterology as the biochemist, the physiologist, the anatomist and the electron microscopist apply their efforts to this field. A synthesis of their work is essential to enable the clinician to understand the present state of knowledge.

It becomes apparent in reviewing any medical subject today that to limit application to "chemistry" or to "anatomy" is arbitrary and virtually impossible. The biochemist often studies pathologic physiology to confirm his deductions regarding abnormal enzymes; the anatomist resorts to biochemistry to explain the changes seen in the electron microscope. Thus, the medical scientist of today must know fields other than his own in order to reach a valid conclusion. The basic scientist of the future may not be an anatomist, a biochemist or a physiologist, but, rather, one who combines these varied disciplines limiting his interest to a single system of the body, such as the gastrointestinal tract. The clinician has generally found it necessary to limit his interests, since his problem has been one of comprehending not only recent progress in certain diseases and their treatment, but the advances made in basic research and their application to a particular system of the body. It has been our purpose to portray the present advances in basic gastroenterologic research so that a comprehensible picture results for the clinician. We have not included diseases of the liver or the pancreas since they are subjects of other monographs in this series.

Rapid developments produced by the intensive research in progress in gastroenterology have made some subjects discussed

controversial. An attempt has been made to show where the controversy exists and the arguments used by the proponents of each. New evidence which appears almost daily will make some of this review obsolete.

Arthur Bloomfield has said concerning the ideal review: "It is obvious then that the reviewer must carefully select the useful and important contributions; he must weave these into something of a coherent whole. . . . It is his task to synthesize the important advances in a subject in such fashion that a vivid story captures the reader's interest . . . no mere catalogue of titles will suffice." We have attempted to do this.

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J.R.G.
D.L.W.

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SECTION I

DISTURBANCES OF GASTRIC CHEMISTRY

Chapter I

GASTRIC SECRETION AND DIGESTION

INTRODUCTION

FROM A CHEMICAL viewpoint the function of the stomach is one of secretion of enzymes, mucin and intrinsic factor; digestion of food occurs secondarily, and absorption is of little consequence. Fundamentals of secretory mechanism must be reviewed in order to understand aberrations which result in clinical disease states.

As in any other carefully studied field of biochemistry, increasing knowledge serves to complicate and change concepts formerly thought to be simple. The study of the production of HCl and pepsin exemplifies this well. Knowledge concerning secretion of the mucins by the stomach is extremely limited.

Confusion exists concerning nomenclature of functional divisions of the stomach in terms of secretory activity. The secretory divisions have identifying histological features but the gross anatomic zones are poorly delineated. Even the limits of the histologic zones are not sharply defined. We follow the suggestion of Grossman (1958) who has proposed that the terms *oxyntic gland area* and *pyloric gland area* be used.

To understand the methods of certain experimental work, the operative procedures used on dogs and other animals are presented in diagram in Figure 1. Figure 1A shows diagrammatically the normal stomach and its parts. The Heidenhain pouch (Figure 1C) was the first pouch described (1878). It consists of complete separation of a portion of the fundus from the body of the stomach so that a denervated pouch is formed which derives its blood supply from the splenic artery. A cannula permits collection of secretions of pure gastric juice in response to various stimuli.

The Pavlov pouch (Figure 1B) differs from the Heidenhain