BIOMEMBRANES

Volume 4B

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BIOMEMBRANES, Volume 4B

INTESTINAL ABSORPTION

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Preface

It might be asked if there is a need for yet another large review on Intestinal Absorption, and the answer is that this is still a rapidly expanding field of interest both from the medical and scientific points of view. There is ample evidence for this in the number of papers which continue to be published, and the bulletin on Intestinal Absorption issued by the Biomedical Information Project of the University of Sheffield lists about 150 titles per month, and there is still no sign of any diminution in this rate. There are in fact so many papers that those interested in intestinal absorption have to be specialists in one particular field, but must at the same time be aware of the general developments in the subject as a whole. The last major review was the excellent volume in the American Handbook published in 1968, already six years ago, and indeed a number of the contributors to that volume have taken part in the present work.

Some observations made in the introduction to a volume of the British Medical Bulletin on Intestinal Absorption some years ago are still pertinent. Progress in the experimental sciences is not continuous, but proceeds in phases of rapid expansion alternating with periods of slower growth. This is partly because of a fundamental law governing the progress in experimental science which states that if you think of anything easy to do which has not been done before, further investigation shows either that it is not easy, or that it has been done before. One way of escaping from the grip of this law is to avoid finding out or to ignore what has been done before. This book is not intended for those seeking this solution. But this rigorous law is periodically relaxed, and this happens when a new technique is discovered. There is then a sudden surge of publications to exploit the new technique. It is easy to date the present tide of advance in intestinal absorption to the introduction of an effective *in vitro* technique by R. B. Fisher and D. S. Parsons in 1949, followed

by the development of the everted sac by T. H. Wilson and G. Wiseman in 1954. While these workers popularized *in vitro* techniques, they did not in fact introduce them, and this was done more than fifty years ago by Weymouth Reid, whose remarkable work seems to have escaped serious notice by the physiologists of the day.

But perhaps the real credit for *in vitro* intestinal studies and indeed *in vitro* studies in everything should go to Sidney Ringer, who first introduced the idea of replacing the life-giving blood with a salt solution and hence led the way for the highly unphysiological *in vitro* experiments. It was indeed the introduction of salt solutions for keeping isolated tissues alive that made modern physiology and biochemistry possible, and it is well that Ringer should be remembered chiefly by Ringer solution rather than by the experiments he did with it, important though they were. Ringer's most famous lineal scientific descendant is Hans Krebs, whose name, although associated with at least two major discoveries in biochemistry, is still probably most widely used in referring to Krebs' solution, and indeed it is Krebs' bicarbonate saline which has mainly been used for the *in vitro* intestine. In the early days of the *in vitro* intestine a great many things were said about the unphysiological nature of the preparation and particularly when it was exposed to the insult of being turned inside out in the everted sac technique. But unphysiological approaches are paradoxically the way to advances in physiological knowledge, and most major advances in our knowledge of how living tissues work have come from using living tissues in conditions very different from their normal ones. Ringer was the great apostle of unphysiological experiments, and his disciples do not need to make apologies for continuing his tradition.

Early studies of the intestine emphasize the important role of the cells lining the gut, and Hiedenheim spoke of the 'Triebkraft' or driving force of these cells. Hiedenheim was involved in the old controversy on vitalism, and his unfashionable vitalistic term perhaps prevented full recognition of the importance of his ideas on the intestinal cell. A later generation was explaining the movement of fluid in terms of classical osmosis, and did not require the Triebkraft of the epithelial cell. Modern work has fully substantiated Heidenheim's idea and we now know that movement of water depends on forces generated by the activity

of the living cell. The undesirable connotation of vital forces of Latin derivation (vita = life) has been neatly avoided by substituting biophysical forces of Greek derivation (βίος = life) to everyone's complete satisfaction.

The study of intestinal absorption offers opportunities to people of very widely different skills, varying from those who try to formulate the problems in terms of irreversible thermodynamics to those who think in terms of the clinical problems of the person unable to absorb enough of the nutrient substances he requires. Between these are the large number who think of one aspect of the absorptive process, and try to formulate the problems in such terms as is possible by their limited knowledge of fundamental science and their awareness of the dangers in making too many approximations and assumptions to make biological observations fit mathematical expressions. These volumes contain therefore many different approaches to the problems of the intestine. It purposely does not include detailed discussion of clinical problems, as these have been the subject of many symposia and many discussions in recent years. If it encourages its readers to broaden their interests and make an effort to come to grips with new and unfamiliar expertise, it will have served its purpose.

D. H. Smyth

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