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THE DIGESTIVE TRACT

*A Radiological Study
of its Anatomy, Physiology,
and Pathology*

By

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To
MY WIFE

NATURE

Her one unswerving purpose is the fulfilment of her needs: in many different ways she attains her ends.

We watch the unwearying and persistent resource with which, setting precedent at naught, she strives to maintain effective service.

She disdains the formulae and standards of mass production, providing instead a kaleidoscopic panorama of balanced form and function.

She obeys the inexorable laws of science, yet is unfettered by their compelling force. She enslaves such science as we know.

Life, that unfathomable mystery that can make the dead bones of science live, life is her servant.

Of the mystery of life we know nothing, and, in all humility, we seek to learn the secrets.

A. E. B.

PREFACE TO THE SECOND EDITION

This new edition embodies a number of changes, especially in the addition and rearrangement of matter to keep abreast of the latest research. Some new work on the quantities of radiations to which the radiologist is exposed in diagnostic procedures has been added and, in the chapter on radiological risks, measurements in international *r* units have been substituted for those which were originally given in fractions of the Unit Skin Dose, the only method available at the time of the investigations. The figures approximate very closely to those of Zuppinger, which are given for comparison. Both sets of figures are reassuring and indicate that the operator and staff run very little risk in a well ordered and equipped department.

Cinematographic X-ray records have now become possible and a few observations based on this method of investigation have been included. Gastric peristalsis and the way in which the pylorus acts are reviewed in detail and the latest researches on the subject are summarised. When writing the first edition I still held that, although the majority of long stomachs were normal, yet I was willing to accept that there was such a condition as gastroptosis. Since then I have become convinced that there is no such thing as gastroptosis in the generally accepted sense, and give the reasons for this opinion.

The section on pathology has been extended and certain conditions which have recently received considerable attention are now included or extended, particularly hypertrophic stenosis of the pylorus and duodenitis.

Two new appendices have been added, the one on the photographic measurement of small intensities of radiations such as those to which the radiologist is exposed in the course of his work and another on the legal ownership of films.

A considerable number of new illustrations have been added and some old ones have been replaced.

There is a background for every serious endeavour. In this case it is a questioning of the authority of tradition. Many of the accepted fundamentals of student days have been found fallacious in practice. This note has unconsciously found its way into these pages and has called forth an answering chord not only in the letters of private correspondents but also in the reviews, which have been so generous. These include such phrases as: “the old clinical teachings”, “the old anatomical ‘facts’”, “the sometimes preposterous physiological explanations”,

“stimulus to further lines of research”. To accept the authority of tradition is a most comfortable way of passing through life, but it is not the way of progress. Radiology has made it possible to study the inner workings of living mechanisms, and we are no longer entirely dependent on pure hypotheses and deductions from experimental methods that may, or perhaps must, be subject to grave fallacies.

I maintain that the set descriptive type of anatomy and physiology is often merely a dangerous half-truth. Nature has no set forms, no fixed methods and no set formulae; she has many alternative ways of attaining the same results and these she balances according to her needs. One mechanism at a time may perhaps be described in set terms, but we must realise that, given any slight difficulty or alteration in conditions, she is capable of producing the same result in other ways that are still within what she regards as normal limits. We are far from finality in our knowledge of very large sections of both the anatomy and the physiology of the alimentary tract. This is particularly so as regards the fundamentals which are still unquestioningly accepted in spite of the introduction of new methods of investigation. Research workers have used these newer methods for turning over the virgin soil of relative details, rather than directing their endeavours to the less congenial task of questioning fundamentals that are strongly entrenched in tradition.

We are forced to recognise that Nature will not conform to cut and dried descriptions. We describe one form or one function as the normal, and Nature alters that form or that function on the most trivial of pretexts—a door bangs and the tone of the stomach alters and changes its shape; a fragment lodges in the vallecule, or there is a slight sore throat, and perhaps the whole complex mechanism of swallowing is altered. For every function in the digestive tract there are a number of mechanical and chemical forces available; each is a variable and Nature can balance these variables one against the other to produce the same result. The resource of Nature in order to overcome difficulty and perform function seems at times to be almost inexhaustible, and who shall say when the bounds of normality pass to the sphere of pathology? The borderland is indeed wide.

I wish to urge that we cannot stereotype a description of any mechanism as Nature’s normal method; there is an average mechanism that is usually employed, but it may vary not only in each individual but also with the slightest alteration in conditions. To one the prospect of a race or of an interview brings an acceleration of intestinal movement and even diarrhoea, while in the majority it induces a loss of visceral tone that results in a sinking sensation and marked diminution of intestinal activity. In yet others no disturbance is noted.

Many anatomical and physiological conceptions, even the most plausible, may be open to question. Take, for instance, the evidence of tissue culture. If a small

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nest of undifferentiated cells representing that part of a chicken embryo which should develop into the femur is allowed to grow in suitable media, a perfectly-formed miniature bone is produced. This artificially-nurtured bone shows those prominences, curves, and internal architecture that have been regarded as the results of imparted strains and stresses. Yet this little bone has never experienced any of these stresses. We have perhaps too readily accepted the apparently obvious explanations that have been put forward—it is easier to accept than to disprove such things.

The subject is of far more than academic interest, for in my view it has led to some of the most disastrous chapters in the chequered history of medicine. We may smile at the indiscriminate blood-letting of our grandfathers, but that phase was relatively harmless compared with the much more recent operative procedures that were undertaken on the assumption that the descriptive teaching of anatomy and physiology represented the truth, the whole truth and nothing but the truth.

Up to the time of Lister the accepted anatomy was that of the dead body, and it was assumed that when the abdomen was opened the viscera would be exposed according to the text-book pictures. The pre-Listerian surface markings are still current in most text-books and in some of the schools of anatomy. Yet what do we see in the operating theatre? An incision is made, the bleeding is stopped, the peritoneum is opened. Then with calculated thoroughness the experienced surgeon examines the presenting viscera. Not till he has identified these does he think of proceeding with his operation. He knows that he can take nothing for granted. The last thing he is justified in accepting is that he will find the viscera arranged according to the surface markings. The living anatomy that he exposes is as foreign to the descriptive anatomy of the dissecting-room as is the flexibility of the Chinese ideography to the set rectitude of the Roman alphabet. On the other hand, the inexperienced operator has not this knowledge and has to learn in the school of experience. Much of what he has seen in the dead subject in the dissecting-room is useless and very definitely misleading. Many mistakes have been made by inexperienced surgeons who had not yet realised the facts, and some of the cases of the war period bore painful testimony to this.

Some thirty or forty years ago there was a school of thought, voiced by Glénard and many others, which attributed symptoms to looseness and displacements of viscera. Visceroptosis had become a fashionable complaint, gastropptosis was a very definite condition, and later on loose kidneys and the mobile proximal colon came into the limelight as sources of symptoms. The teaching of the physicians, based on their recollections of the anatomy of the dead subject, was definite. They palpated and percussed out the air that happened to be in the stomach and, naturally, had no idea of the fallacies on which they were relying.

They were dogmatic, for nobody could gainsay them—the patient had certain symptoms and these were due to ptosis. Then it became possible to open the abdomen with relative safety. The only anatomy that the surgeon knew was that of the dead subject, for he had no experience of what was and what was not normal in the living abdomen, and he looked to see whether the viscera occupied the positions described in the text-books. If the patient had symptoms that seemed to originate from some organ and he found it mobile, that organ ought to be fixed. He tried all sorts of devices to fix the viscera into a pattern such as he had been taught to consider the one and only normal. He found a long stomach: that must be gastropptosis, and he hitched it up or even excised a portion. This phase did not last long, because the results were so disastrous. Then symptoms were attributed to the kidneys that were loose, the proximal colon that was mobile, and the caecum that was sloppy. One remembers the various ligatures that were tried—silk, silkworm gut, catgut, kangaroo tendon, metal wire—but none of them was effective. Eventually it was realised that fixation resulted only when sufficient local damage was done to produce adhesions.

But the results! What a tale of tragedy it all was—surgeons persistently attempting year after year to make the viscera conform to the pattern of the dead and not realising that what they were attempting was diametrically opposed to the conditions that Nature insistently demands: absolute freedom of movement and an entire absence of fixed points. It was a long time before it was realised that in these operations the one thing to be feared was the production of adhesions, fixed points. It was not till the experience had been bought, at the price of human suffering, that it was realised it was not only futile but wrong practice to make the living anatomy conform to the dead pattern. The clinical result was only too often a failure, the last state being infinitely worse than the first.

This type of operation has not even yet completely died out, and from time to time one comes across the tragic results of this sad conception in surgery. The procedures adopted were perfectly logical but the foundations of the anatomy on which they were based were those of the dead and not of the living.

Physiology was to blame for another equally tragic and almost as widespread, but shorter-lived, phase of surgery: the colectomy and short-circuiting operations. The text-books suggested that the caecum and colon were merely cesspools, relics of antiquity, for “the absorption is practically complete by the time that the food has arrived at the lower end of the ileum”. If these organs were of this type, surely toxic absorption must occur, and, naturally, a search was made for possible effects. Some radiologists took a very leading part in this phase of medicine and there are many descriptions of stasis in various parts and of the “kinks” said to be responsible for it. Looking back, one sees a substratum of truth and an overwhelming superstructure of hypothesis erected on it. One remembers particularly the cases of ileal stasis and the symptoms attributed to

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it. Yet the chief exponents of these theories admitted that the radiological appearance of ileal stasis disappeared if the patient took a purgative. He could only show ileal stasis radiologically if he withheld purgatives! Almost any condition might be due to stasis: amongst other supposed effects of this hypothetical toxic absorption, many will remember trying to detect the “precancerous” breast condition that was described. The argument was carried to extremes, logical but misguided extremes, and the colon was short-circuited, or, with extraordinary technical skill, removed.

The story of this phase of surgery with its appalling mortality and the wreckage of so many of those who survived, is still fresh in the memory. It does not concern the present argument except in that it emphasises the lesson that it would have been better not to teach anything of the physiology of the colon, to admit ignorance in fact, rather than to mislead those who were responsible for its clinical application. We still know very little about the physiology of the colon. There is nothing so dangerous in medicine as a half-truth that is capable of neither proof nor disproof. It was on physiological half-truths that the fixation and colectomy operations were designed.

In other spheres, as in that of the abdominal surface markings, accepted teaching is now obviously contrary to facts, and we are asked, “But if this teaching is not correct, what is the explanation? What must I teach?” It is better to teach nothing at all, or even to acknowledge complete ignorance, rather than propagate that which is unproven or even definitely wrong. Yet if the teacher takes this line, examiners may not share these views and will blame him for the apparent ignorance of the candidates. That this is so is shown by the fact that the old abdominal surface markings have survived a quarter of a century of known fallacy. To accept them is the line of least resistance, for it is easy to teach the descriptive anatomy of the dead abdomen but extraordinarily difficult to give students an adequate idea of the fluid anatomy of the living subject. And how can an examiner find out whether a student knows his subject when almost any answer may be correct? To take an extreme instance: a perfectly normal, healthy medical student happens to have a long stomach that extends to the level of the symphysis pubis, and that student, on being questioned, answers quite correctly that his own stomach is perfectly normal (just as his long nose is perfectly normal), and that in the standing position it is in relationship with the caecum, bladder, and perhaps the sigmoid!

It cannot be overemphasised that Nature has no set forms and no standardised functions. She has at command a variety of forms that merge one into the other and, in function, the bewildering way in which she is able to balance up the many factors she uses, even in a simple act, makes standardised descriptions merely half-truths. The more we see of Nature’s ways the more misleading and dangerous are these half-truths.

But, clearly, students must be taught something, for they must have pegs on which to hang their knowledge. How are they to be given an understanding of the fluid character of the anatomy and physiology of the living subject? The only solution, a makeshift, is to increase X-ray demonstrations and X-ray cinematograph lectures so that the students can endow the pictures they see in the text-books and in the dissecting-room with the attributes of life, as is being attempted in some schools. Incidentally, those who demonstrate in the X-ray room must be as familiar with the radiographic appearances as they are with the shrivelled, toneless caricatures of the living which they demonstrate in the dissecting-room. For obvious reasons it is a great mistake to send an untrained demonstrator of anatomy into the X-ray department and expect him to demonstrate the living subject, for (*a*) he is ignorant of the risks of X-ray work and how they can be avoided; (*b*) he will not be familiar with either the methods or technique; (*c*) he will be inexperienced in the wide variations that are compatible with normality.

The lot of an examiner dealing with these problems is indeed hard, for he cannot look for the cut-and-dried answers to questions that have been current through the centuries. How is he to determine the standard of knowledge a student has attained if almost any answer to a question on the form, position, and relationships of the viscera may be correct? Nevertheless, it is more important that the student should realise the truth than that the ways of the teacher and examiner should be smooth.

OXFORD

1936

ACKNOWLEDGMENTS

My debt to fellow-workers is immeasurable, for, apart from direct contributions and quotations from their writings, one constantly absorbs ideas, and frequently the source of the inspiration is forgotten. It is with the intention of acknowledging this in some small measure that I have invited some of my friends to allow me to reproduce illustrations of phases of the work with which their names are associated. Naturally this is a very incomplete and unsatisfactory way of acknowledging my debt; it is nothing more than a gesture. Moreover, some—notably Russell D. Carman, Preston M. Hickey, Martin Haudek, Guido Holzknecht and Albers Schönberg—have passed away from us. I must, however, especially acknowledge the inspiration of such men as my friends A. F. Hurst, W. C. Alvarez, Gösta Forssell, Hans Berg, A. W. George, L. G. Cole, F. Haenisch and F. M. Groedel.

I owe much to the encouragement I have always received from my surgical and medical colleagues in Manchester, particularly A. H. Burgess and George Murray, and especially to those closely associated with me in the radiological department: J. M. Woodburn Morison, R. S. Paterson, E. W. Twining, E. D. Gray, J. F. Bromley, J. B. Higgins; and also to H. M. Meyrick-Jones, who has worked with me in Cambridge. They have helped me in many ways, but especially with the illustrations.

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My thanks are due to the editors of *The Quarterly Journal of Medicine* and the Oxford University Press for the use of most of the illustrations in Chapters VI, VII and VIII; to the editor of *Acta Radiologica* for figures illustrating the mechanism of swallowing; to Messrs Sherratt and Hughes for supplying blocks which were used in my early book *The Alimentary Tract*; to Oxford Medical Publications for supplying the two colour plates from Hurst and Stewart, and to *The Lancet* for illustrations which have appeared in that journal.

Much of the material incorporated in this volume has been published in

journals, particularly in *The British Journal of Radiology* and its predecessor, *The Archives of the Roentgen Ray*; *The British Medical Journal*; *The Lancet*; *The Quarterly Journal of Medicine*; *The British Journal of Surgery*; *Acta Radiologica*; *The American Journal of Roentgenology*; *Radiology*; and elsewhere.

All except a very small number of radiographs are untouched. The few that have been reinforced are from blocks that have been used in journals in which art paper was not available and in which this procedure was necessary to show the details. Some of the radiographs are very old; many are pre-war and are not up to modern standards of technique, but they are retained because they illustrate my meaning. The line drawings are mostly direct tracings from actual radiographs.

Mr D. H. Kitchin and Dr Kathleen Kitchin have acted as editors and have been very largely responsible for bringing scattered material into ordered form. They have also verified the references and compiled the index. It gives me much pleasure to record my appreciation of their services. The support of the Syndics of the University Press, and the painstaking co-operation of the staff of the University Printer, have made the labour of producing the book a pleasure.

Finally, the volume is dedicated to my wife in acknowledgment of her un-failing helpfulness and co-operation in my work, particularly in the laborious task of proof-reading.

In the preparation of this second edition I have received assistance from many colleagues, particularly E. W. Twining, whose work on hypertrophic stenosis of the pylorus is included, and S. C. Shanks, who has allowed me to publish his findings in 150 consecutive cases of gastro-enterostomy. The appendix on the photographic measurement of small intensities of radiations is from the work of G. E. Bell of the National Physical Laboratory and that on the legal ownership of films has been contributed by D. H. Kitchin, a member of the bar who has made a special study of the law relating to medical practice.

Finally I must acknowledge and thank those who have reviewed the first edition for the way in which they received it. Their commendations have been an inspiration to further endeavour, as have been the many letters I have had from friends all over the world.

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