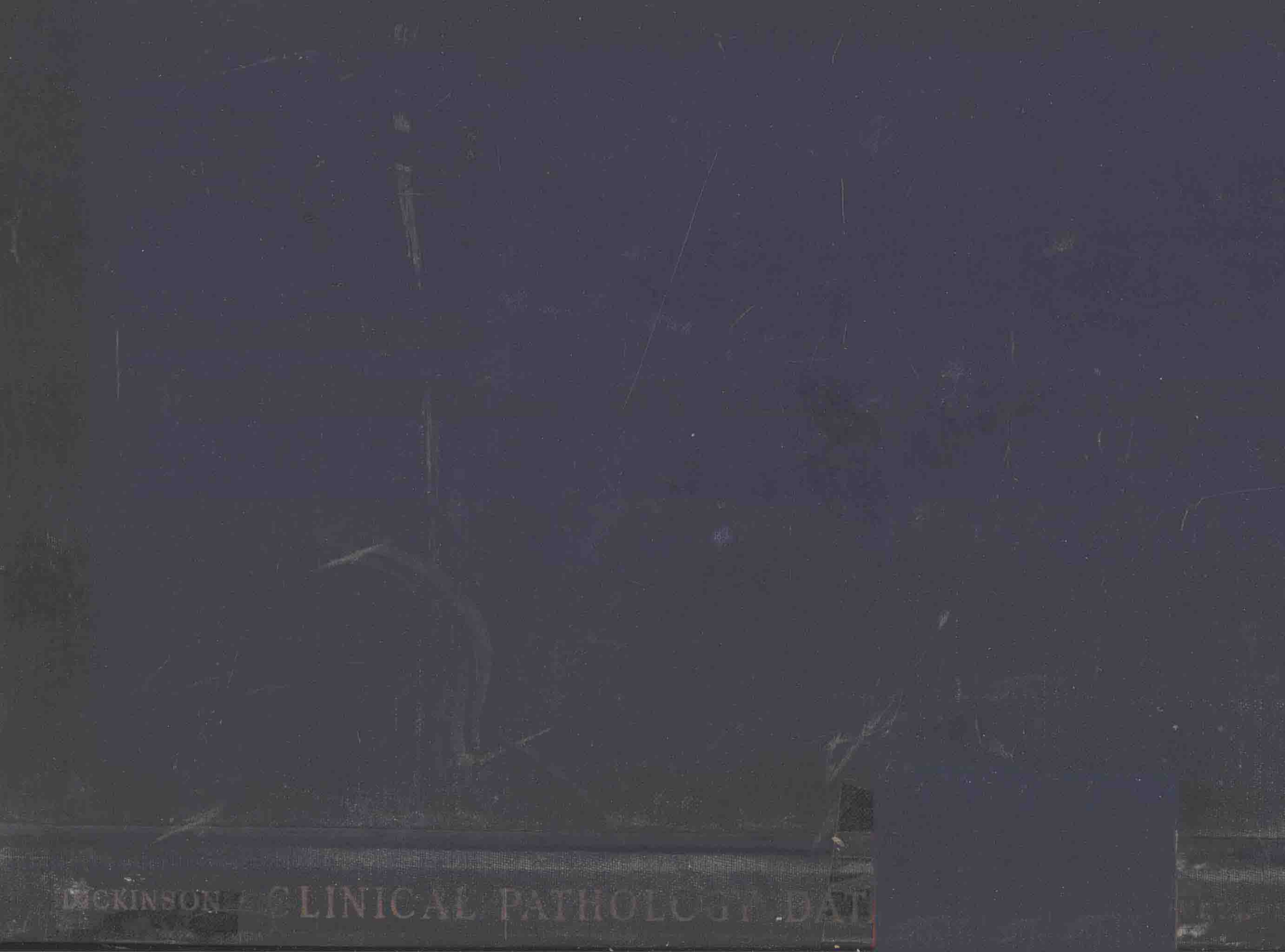
DICKINSON
CLINICAL PATHOLOGY DAY

CLINICAL PATHOLOGY DATA

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FOREWORD

I know that most doctors and medical students frequently ask themselves the questions 'what is the normal value for this?' or 'what may it mean when this or that value is raised or lowered?' The answer is usually only found as the result of a time-consuming visit to the library where some large standard text book must be consulted. In my Foreword to the first edition I described this little book as a handy pocket guide; and although it has grown considerably and has become rather less suitable for the pocket, it remains in essence the same. The same reservations still apply; and the library visit may still be necessary, for this book serves only to supplement and not to supplant standard works. I trust, therefore, that no one will be tempted to use the information given here without adequate consideration of all the clinical and other facts of the case, for in these circumstances positive harm might result. This would especially be the case with the student, cramming for exams, who might be tempted to memorize parts of it and to apply the information blindly. I think this risk has to be taken, since there is a real need for a small book of this type.

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INTRODUCTION

Since I compiled the first edition of these tables I have realized better than before some of their limitations and potential dangers. Nevertheless, I still believe that there is a place for a book of this sort, and that there always will be while modern medicine increases in complexity at its present rate. Normal values in clinical pathology are, of course, available in most books, though it is convenient to have a large number collected together. The tables indicating changes in disease are more controversial, and may lead to the accusation that I am trying to provide a 'penny-in-the-slot' medicine. I think this criticism could have been justifiably levelled against some parts of the first edition. In this one by grouping diseases under headings, with numerous cross references, I have tried to present the data in a more logical way and thus disarm some of the criticism. Plasma volume and blood pH, for example, are not often performed as a routine, in this country; but their inclusion, as well as being in line with advanced current American practice, allows useful cross references which help towards understanding principles rather than memorizing facts. In any case I feel that the size and comprehensiveness of the tables is now far too great to justify any charge of oversimplification. Second editions of medical books have an unfortunate habit of increasing in size, and this is no exception. It is almost four times the size of its former self, despite the ruthless elimination of any 'padding'.

After careful consideration I have included a very brief section on 'unnecessary tests'. Lest I should be accused of holding too arrogant opinions, I should explain that these opinions, though now my own, have been derived from conversations with a number of pathologists whose views I invited on unnecessary tests. I do not suppose that everyone will agree with my choice. There are many more that could be added. There is no doubt that an immense amount of extra work is created for clinical pathology departments by simple ignorance: not so much ignorance of the tests themselves, but rather ignorance of their accuracy and of their diagnostic value. The best corrective to this attitude is a close liaison between the clinician and the pathologist. This demands some humility from the clinician. Many feel that 'the lab. is there, anyway', and that ordering a battery of tests will do nothing worse than keep all the staff fully employed. Ultimately this attitude of mind leads to progressive expansion of departments, particularly biochemistry, and to increase of staff, which bring little extra benefit to the patient and add disproportionately to the cost of medical services. Too often the pathologist, through no fault of his own, is merely regarded as a super-technician who does the 'marrows' or the 'ions'—or even worse, as the man who signs the reports. Until clinicians are prepared to discuss clinical pathology problems with pathologists and are prepared to accept their advice there is unlikely to be much change. It is an unpalatable truth that a doctor today, particularly if he works in a hospital, is expected to have at his fingertips a mass of detailed knowledge which would have taxed the memory even of Dr. Johnson. Now that most doctors have ceased to treat radiologists' reports as impertinent interference the time has come for them to ask for and accept advice from clinical pathologists. It is no reflection on a doctor's professional competence if he sometimes calls in a colleague for advice on clinical matters. Nor is it nowadays an admission of ignorance to call in a clinical pathologist. However well informed the clinician there is one very good reason why he can never make the best use of clinical pathology data on his own. Only the man working in the laboratory knows how far each particular test performed in his laboratory can be relied on. Biochemical results often differ according to the technique used. Because of this, 'normal' values in tables such as these are only a guide. Everyone knows well that no two tables of normal values are the same. This is no doubt confusing; and when the results of tests are in any way equivocal it is always well to ask the pathologist what the normal range of values is in his laboratory, and what accuracy he normally gets. The range may be wrong by absolute standards, but if the error is consistent the test will not be misleading, providing the error is known to

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the clinician. Laboratories should point possible errors out, but seldom do. In general, estimations which are done frequently are more accurate than estimations which are only done rarely. All these different factors must be borne in mind when assessing the significance of any result, particularly one which is only slightly abnormal.

The layout of the book remains the same, though a number of new sections have been added. Blood and plasma have been reconstituted, and divided into four sub-sections: physical properties, tests of clotting and bleeding disorders, cellular constituents and chemistry. New sections have been added on diseases of porphyrin metabolism, analysis of effusion fluids, semen analysis and serological tests for syphilis. All the other sections have been greatly expanded and special sections allotted for tests of adrenal-pituitary, kidney and liver function. In a few cases these duplicate tests mentioned elsewhere, to suit convenience of reference. The section on special tests has been considerably altered. It now includes several recent tests which are beginning to prove their value. For many of the changes, which involve the elimination of out-dated tests, I have to thank the many reviewers of the first edition, who made a number of very helpful suggestions. It has been possible to implement almost all of them and I shall welcome any further suggestions for improvement in the future. The final section on practical notes has also been enlarged, and a brief note made about emergency blood grouping. I have been careful to warn about the dangers of blood grouping in an introductory paragraph to this section.

Once again I must emphasize that the normal values quoted here are not the extreme limits of normal, although in cases where I had a choice I have generally selected the wider rather than the narrower range. I hope this will lead to less confusion in interpreting results. It is obvious from the tables, even though they are not completely comprehensive, that almost no test in clinical pathology is diagnostic in itself. One of the simplest ways to realize this is to check from the tables other conditions which may produce the same abnormality: indeed, this is one of the principle *raisons d'être* of this book. An asterisk against any test in the first fourteen sections indicates that practical details of the test may be found in Section 15 (X) at the end. Bold type has been used to indicate the more important conditions under each heading, and those conditions in which, in very approximate terms, an abnormal result is found in at least 50 per cent of cases. Less important or frequent findings are in ordinary type, and occasional and inconsistent findings are shown in square brackets. Comments and general headings appear in italics.

I have the pleasant task of thanking many of those who have helped me to check the accuracy and to improve the presentation of this edition. Professor Dent has checked most of the chemical data; and Miss E. M. Graves most of the haematological data. Dr. Ian Bailey has read the whole manuscript and has made many helpful suggestions. Dr. E. J. King, Professor of Chemical Pathology at the London Postgraduate Medical School, has also looked through the final draft; but I must thank him perhaps more for giving me moral support and encouragement with the first edition, which were very much appreciated. Professor C. Rimington has been kind enough to check the section on diseases of porphyrin metabolism, and Dr. Moran Campbell the sections on acid-base balance. Mr. Per Saugman, of Blackwell Scientific Publications, has been most patient and helpful in preparing the manuscript for the press. This has been a difficult task, and his help has been invaluable.

I am also grateful to the Director General, Army Medical Services, for permission to publish.

C. J. DICKINSON

UNNECESSARY TESTS

Certain tests, some commonly requested, others less commonly requested, often provide information which scarcely justifies the time and energy expended by the laboratory. The brief notes which follow draw attention to some of these, although there are many others:

Red cell count:

This is normally an inaccurate measurement. The indices calculated from it are correspondingly inaccurate, unless the counting is done carefully by a reliable observer In general it is only necessary for the full assessment of obscure severe anaemias. Iron deficiency can be diagnosed simply by the mean corpuscular haemoglobin concentration (MCHC) with very few reservations. A haematologist's opinion on red cell appearances in a film is much more useful than the red cell count. The count adds nothing in most cases to haemoglobin estimation, which is far more accurate; and it should never be requested in routine surgical practice. The more unnecessary red cell counts which are done the less will be the accuracy of the red cell counts which *are* important.

Red cell sedimentation rate:

Ideally, this should seldom be required. Since a normal ESR cannot exclude serious disease it should not be used for this purpose. If normal it may give a false sense of security. Its main value is in following progress in certain conditions and in assessing treatment. It adds little, for example, to the clinical assessment of a patient with an acute febrile illness, with chronic renal failure or with a proved duodenal ulcer. It is true that occasionally an unexpectedly high reading may check too hasty a psychiatric diagnosis, but more harm than good is done by requesting a routine ESR on every hospital patient. It tends to give a false sense of security; and it creates much unnecessary laboratory work.

Ascorbic acid saturation test, and ascorbic acid levels in blood and urine:

Serious degrees of ascorbic acid deficiency are exceedingly rare in civilized countries, except in old people living alone. These tests are therefore seldom required. The capillary resistance test should always be performed first (see B9): if this is normal there is unlikely to be a clinically significant degree of deficiency.

Blood cholesterol:

It is a foregone conclusion that blood cholesterol will be raised in the nephrotic syndrome and in advanced myxoedema. Unless the estimation is essential for following the response to treatment, which it seldom is, or is wanted for statistical research purposes, it adds little to accuracy of diagnosis or treatment.

Blood glucose:

A single 'random' blood glucose estimation is almost useless if the urine remains sugar-free consistently. It may be useful in checking diabetic control at certain specific times of day, and also in diagnosing hypoglycaemic coma retrospectively. Since severe hypoglycaemic coma is rapidly fatal the test cannot be used for immediate diagnosis. If proved glycosuria is present a full glucose tolerance test will usually be necessary.

Blood pyruvate and pyruvate metabolism test:

This test is technically difficult and time consuming; therefore, its use should be reserved for really essential diagnostic problems.

Serum protein electrophoresis:

Laboratories which provide this facility are quickly swamped by requests for serum protein electrophoresis, despite the fact that it is only very rarely that formal separation of protein fractions adds much to the information which can anyway be obtained from the conventional liver function tests.

Urinary chlorides and urinary potassium:

These estimations are too variable to give a reliable indication about changes in ionic balance in the body. Chlorides are affected by renal function and by acid-base balance; and the excretion of potassium is largely independent of serum levels.

Urea concentration test:

If protein and sugar are absent from the urine this test gives little more information than is got from a carefully performed urine concentration test, since specific gravity normally depends largely on the concentration of urea.

Basal metabolic rate:

This is not a very satisfactory test for the differential diagnosis of hyperthyroidism and anxiety state. It is somewhat inaccurate; and the B.M.R. is often raised in severe anxiety states. Its principle uses lie in the diagnosis of myxoedema, and the assessment of severity of hyperthyroidism. Ideally it should be supplemented by radio-iodine uptake and serum protein-bound iodine estimations where appropriate.

Sputum culture:

Sputum culture is often requested in cases of not very serious upper respiratory infections. Unless clinical or X-ray signs suggest a specific pneumonia, the sputum contains 'normal flora'. Indiscriminate requests for sputum culture waste a great deal of time in a bacteriological department.

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B1 Plasma volume	35-45 ml./kg. 16-20 ml./lb. body weight 1300-1800 ml./sq. metre body surface *Approx. 3 litres in an average adult* *Approx. the same in men and women*	**Water intoxication** (artificial, or in diabetes insipidus) Secondary anaemias (with low PCV) *Also in oedematous patients for a short time after giving hypertonic solutions — until diuresis occurs* (*Changes in plasma volume are reflected by opposite changes in packed-cell volume* (*B15*) *and in haemoglobin* (*B14*), *providing there has been neither blood loss nor previous anaemia*)	**Haemoconcentration** (prolonged water restriction or water loss from vomiting, diarrhoea, sweating, very high external temperatures, intestinal fistulae, prolonged tube aspiration of the stomach; after burns; 'crush' syndrome) **Shock syndrome** (by simple transudation of fluid, as above; and by stagnation of blood in the splanchnic bed with reduction of effective circulating blood and plasma volume) **'Low salt syndrome'** (when plasma volume is low in spite of oedema: occurs mainly in congestive heart failure, nephrosis and cirrhosis when low salt diets, ion-exchange resins, and mercurial diuretics are used in excess, or when abdominal paracentesis is done when ascites is rapidly accumulating; see B37 and B54 also) **Diabetic ketosis** (and any state of prolonged acidosis — see B29 — particularly when associated with water loss as well) **Addison's disease** After anaesthesia, particularly with ether *Chronic hypoproteinaemia* (*see B52b*)
B2 Total blood volume	65-80 ml./kg. 30-36 ml./lb. body weight 2500-3200 ml./sq. metre body surface *Approx. 6 litres in an average man* *Values are 7% higher in men than in women*	*As above, also:* 1. *With high PCV* (*see B15*) **Polycythaemia,** primary and secondary 2. *With normal PCV:* **Overtransfusion with blood,** Secondary polycythaemia (see B14) due to chronic anoxaemia, when associated with fluid increase (e.g. in congestive heart failure and arteriovenous fistula), Hyperthyroidism 3. *With low PCV:* **Pregnancy** (even in the absence of an actual deficit in total red cell volume)	*As above, also:* **For a short time immediately after severe blood loss** Chronic nephritis with oedema [Pernicious anaemia]

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