

# BLOOD GROUPS IN MAN

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and

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WITH A FOREWORD BY

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THIRD EDITION

BLACKWELL  
SCIENTIFIC PUBLICATIONS  
OXFORD

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*Published simultaneously in the United States of America by Charles C Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Illinois.*

*Published simultaneously in Canada by The Ryerson Press, Queen Street West, Toronto 2.*

First printed in 1950

Second Edition, 1954

Third Edition, 1958

Spanish Edition, 1952

German Edition in preparation

## PREFACE TO THE FIRST EDITION

SINCE the last edition in 1943 of Wiener's excellent text-book *Blood Groups and Transfusion* (Thomas, Springfield), the number of known blood group systems has doubled. This advance is due mainly to the attention of necessity given to blood groups in the huge wartime transfusion services, and to the investigation of innumerable blood samples for the Rh groups.

The present book concerns itself with the blood groups and with their inheritance. Other volumes shortly to follow in the same series will deal with the ethnological and clinical aspects of the subject. While attempting to give a reasonably full account of all the groups the emphasis is on the work done since 1940.

The authors regret that they have felt themselves quite unfitted to write of the chemistry of the ABO groups. The subject needs a book to itself.

The deep debt which the authors owe to Professor Fisher is apparent throughout this book. Wherever the sun of genius may have illuminated the English blood group work it has been of Fisher's shining.

The authors wish to thank Miss Sandra Flett for the very large part she played in preparing the manuscript for the press; they are also greatly indebted to Mr. J. D. Race (the father of the senior author) who has devoted much time to the reading of proofs and to the preparation of the author's index; and to Miss Helene A. Holt who has given much thought to the difficult problem of the subject index.

Both the authors have, for some time, been indebted to Dr. A. E. Mourant of the Ministry of Health (now Medical Research Council) Blood Group Reference Laboratory for most of the antisera used in their work.

We would like here to acknowledge the kindness of Dr. L. K. Diamond in making it possible for the junior author to work for some fruitful months at the Blood Grouping Laboratory, Boston.

We are indebted to innumerable authors and publishers for permission to quote published work, acknowledgement of which has been made in the text, but we would like here particularly to

thank the Editors of *Annals of Eugenics* and of *Heredity*, and the publishers, the Cambridge University Press and Messrs. Oliver & Boyd, for the loan of several blocks.

Finally we would like to record our appreciation of the skill and good humour of our publishers and printers in face of rather fearful odds.

## PREFACE TO THE SECOND EDITION

SINCE the first publication of this book a ninth blood group system has been discovered and clearly defined, contributions have been made to the knowledge of the other eight systems, and there have been notable successes in the application of blood groups to genetics and to medicine. Because of all this each chapter has been added to and two new ones have been written—on the *Kidd* groups and on linkage.

Now that there are so many systems of blood groups we find that some rigid parochial order of recording them is essential: in pedigrees and lists we write them in the order of their discovery and in this way also the chapters have been arranged.

We thought that a table showing the distribution of  $\chi^2$  would be useful and we are very grateful to Professor Sir Ronald Fisher, of Cambridge, to Dr. Frank Yates, of Rothamsted, and to Messrs. Oliver & Boyd, Ltd., of Edinburgh, for permission to reprint Table IV from *Statistical Tables for Biological, Agricultural and Medical Research*.

We would like to thank those responsible for the most useful bibliographies in *Blood Group News* (Copenhagen), in the *Revue d'Hématologie* and in the *American Journal of Human Genetics*. Other acknowledgements will be found above in the Preface to the first edition.

## PREFACE TO THE THIRD EDITION

BLOOD groups grow in interest every year: since the last edition of this book something fresh has been learnt about all of them, and the knowledge is being applied with increasing success to human genetics and to medicine. To make room for the newer work we have left out some of the older; but where this has been done most of the references have been kept, in the hope that through them the reader may ultimately be able to find what he needs.

Following the advice of Dr. E. B. Ford we have confined the use of italics to genes and genotypes. We have not adopted Dr. Ford's uniform notation for blood groups because we think that workers in the field should not, just yet, be troubled with a change of notation. We feel that during the next few years such advances will be made in the understanding of the structure of blood group genes that there is no certainty that any notation that can now be designed will fit them. It is not that newer discoveries are contradicting what was known before, but they are showing the pattern to be more elaborate.

Though, in 1950, 'Blood Groups' was appropriate in the title of a book dealing almost entirely with antigens of the red cells, we now feel that we owe an apology to those who have discovered other inherited groups in blood, scarcely mentioned in this book, such as the various haemoglobins, the haptoglobins, the Gm serum groups and the so splendidly complicated antigens of the white cells.

## FOREWORD

I AM extremely glad that Race and Sanger have been induced to undertake the heavy labour of preparing a modern book on the blood groups, giving especial attention to their inheritance. The need for an exact and comprehensive text-book has been increasingly evident during the rapid progress of the last decade, and no authors could be better qualified for the task. Both are, however, fully occupied by new researches in the fields which they themselves have to a great extent opened up, and great self-discipline was surely needed to bring themselves to sacrifice so much of their time as this book needed.

Research people are usually so conscious of how much remains to be done that they sometimes underrate the extent of what has been already accomplished. In particular this seems to be the case with respect to the future use of blood-grouping as the principal tool of a comprehensive study of the human germ plasm. To have established, in a short time, nine usable marked loci is surely to have gone a long way towards establishing that 'basic triangulation' by which in due time the whole will be surveyed. There are in man only twenty-three autosomes, and to have at least one good marker on nine of these puts the future study of the numerous Mendelian factors known in man, through the transmission of rare anomalies, in a position very advantageous compared with that when I left the Galton Laboratory. Many new linkages must be already within reach of detection, when family studies can be combined with comprehensive serological tests.

On matters once controversial (and still so occasionally) the senior author has exercised a commendable restraint. No one would judge from the text how often his personal contributions have been ignored, and when verified have been published without acknowledgement of his priority. Our present understanding of the complex *Rh* situation owes much to the good temper with which, in spite of irritants, he steadily pushed on with his own problems.

It is fortunate that the authors can command a simple and lucid style, for much that is to be expounded is really intricate. Those

who have followed the work during its development will often be surprised at the simplicity with which an adequate account can now be given. They may also be amused at the 'evasive action' occasionally taken by the authors when anything heavy in the way of mathematics seems imminent.

R. A. FISHER

Department of Genetics, Cambridge

*May 17, 1950*



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