Human Blood Groups

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Foreword by Ruth Sanger

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Foreword to 1st edition

It is a particular pleasure for me to welcome this new book on human blood groups, the more so since it emanates from the Medical Research Council's Blood Group Unit. For 25 years this Unit devoted its energies to the search for new red cell antigens and the application of those already known to various problems, particularly to human genetics. During these years Rob Race and I produced six editions of *Blood Groups in Man*.

Dr Geoff Daniels joined the Unit in 1973 on Dr Race's retirement; soon after, concurrently with the Unit's move from the Lister Institute to University College, the scope of the Unit's interest was broadened.

Having been divorced from blood groups and otherwise occupied in 12 years of retirement, I am delighted and astonished at the rapid advances made in recent years. The number of blood group loci have increased to 23 and all except one have found their chromosomal home. The biochemical backgrounds of most of the corresponding antigens are defined and hence several high and low incidence antigens gathered into systems. The molecular basis of many red cell antigens has provided an explanation for some confusing serological relationships which were observed many years before.

Dr Daniels is to be congratulated on his stamina in producing a comprehensive text and reference book on human blood groups, for which many scientists will be grateful.

Ruth Sanger
December 1994

Preface to the third edition

The primary purpose of this book, like the first two editions, is to describe human blood group antigens and their inheritance, the antibodies that define them, the structure and functions of the red cell membrane macromolecules that carry them, and the genes that encode them or control their biosynthesis. In addition, this book provides information on the clinical relevance of blood groups and on the importance of blood group antibodies in transfusion medicine in particular.

The second edition of *Human Blood Groups* was published in 2002; this new edition will appear 11 years later. There have been many new findings in the blood group world over those years. In order to prevent the book from becoming too cumbersome, my goal has been to produce a third edition roughly the same size as the first two. I have tried to do this without eliminating anything too important, although this has not been easy, with so much new material to include. Since 2002, about 69 new blood group antigens and seven new blood group systems have been identified, and all of the 38 genes representing those systems have been cloned and sequenced.

In the preface of the sixth edition of *Blood Groups in Man*, the predecessor of *Human Blood Groups*, Race and Sanger wrote, 'Here is the last edition of this book: the subject has grown to need more than our two pencils'. Well, here is the last edition of *Human Blood Groups*; the subject is rapidly growing too vast to be contained in a textbook. In the previous two editions I strove to include all fully validated blood group antigens and genetic changes associated with their expression or loss of expression. This has proved impossible and pointless in this edition so, although the genetic bases of all the important blood group polymorphisms are described, in many cases the reader is directed to web sites for a more complete list of mutations, particularly those responsible for null phenotypes. In the next few years, next-generation sequencing will become readily available and affordable, and the number of genetic variations associated with red cell change will increase exponentially.

I wish to thank again all the people who helped me produce the first two editions, in particular Patricia Tippett, Carole Green, David Anstee, and Joan Daniels. I would like to add my thanks to Dr Nicholas Burton at the University of Bristol who provided many of the protein models for this edition. Finally I would like to thank all the numerous colleagues from around the world who have provided so much of the information in this book, in published or unpublished form, over so many years.

Geoff Daniels

Some abbreviations used

ADP	Adenosine diphosphate
ATP	Adenosine triphosphate
AET	2-aminoethylisothiourunium bromide
AIHA	Autoimmune haemolytic anaemia
bp	Base-pair
CDA	Congenital dyserythropoietic anaemia
cDNA	Complimentary DNA
CFU-E	Colony-forming unit-erythroid
Da	Daltons
DAT	Direct antiglobulin test
DNA	Deoxyribonucleic acid
DTT	Dithiothreitol
Gal	Galactose
GalNAc	*N*-acetylgalactosamine
GlcNAc	*N*-acetylglucosamine
GDP	Guanosine diphosphate
GPI	Glycosylphosphatidylinositol
GSL	Glycosphingolipid
GTA	A-transferase
GTB	B-transferase
HCF	Hydatid cyst fluid
HDFN	Haemolytic disease of the fetus and newborn
HTR	Haemolytic transfusion reaction
IAT	Indirect antiglobulin test
ISBT	International Society of Blood Transfusion (may refer to ISBT terminology)
kb	Kilo-bases
kDa	Kilo-Daltons
MAIEA	Monoclonal antibody immobilisation of erythrocyte antigens
mRNA	Messenger ribonucleic acid
MW	Molecular weight
PCR	Polymerase chain reaction
RFLP	Restriction fragment-length polymorphism
RNA	Ribonucleic acid
SDS PAGE	Sodium dodecyl sulphate polyacrylamide gel electrophoresis
SNP	Single nucleotide polymorphism