Book Reviews

W. W. Socha, J. Ruffié Blood Groups of Primates

60 years of research on blood groups of nonhuman primates produced well over 400 articles and short reports but, until recently, not a single, comprehensive book. Everyone who wanted to follow developments in that field would have had to peruse volumes of journals representing disciplines as disparate as, to mention a few, physical anthropology, veterinary medicine, hematology, immunology, primatology, obstetrics, evolution, blood transfusion and blood banking, biochemistry, molecular biology, human genetics, etc. Fortunately, the book by Socha and Ruffié has rendered this laborious task unnecessary. This single, condensed volume traces the progress in the knowledge and applications of red cell antigens of apes and monkeys from the early studies initiated in the 1920s by the father of the human blood groups, Karl Landsteiner, to the most recent findings.

Addressed to a wide range of potential readers, among whom many may have only a vague idea of the world of monkeys, the book opens with three general chapters: on the place of primates in the animal kingdom, on taxonomy of nonhuman primates, and on the importance of primates for man and human research. Written in popular form these chapters may appear to experts as trivial and too anecdotic; the uninitiated, however, will undoubtedly read with interest this short and easy introduction into primatology.

The fourth chapter describes the history of the discovery of blood groups of monkeys and shows how research in this field was inspired by major discoveries in human blood groups and by the increasing interest in immunologic polymorphisms of living organisms.

Detailed discussion of blood groups of apes and monkeys, which fills the four central chapters of the book, is organized, basically, by blood group systems that span several large taxa of nonhuman primates. This approach emphasizes the comparative aspects of primate blood group research, but, by the same token, it causes certain bias in favor of species the closest to man on which the immunologic data are the most accessible. The fact that both authors are physicians with long-standing involvement in human blood group and blood transfusion research may also, to some extent, explain the anthropocentric bias of this book with some neglect of the species most remote from Homo sapiens, such as the New World monkeys or prosimians.

Among the major blood group systems of man also known to occur in nonhuman primates, the A-B-O system is the most investigated. Genes capable of coding for transferases that ensure the presence of A, B and H substances, or very closely related substances, can be traced to the very early evolutionary forms, such as bacteria. Yet, the establishment of an allelic relationship among A, B, O genes does not occur until the simian stage, namely, first at the level of the Plat-yrhini. In both New and Old World monkeys, as well as in most of anthropoid apes, a monomorphic regulatory gene Se assures regular presence of the A, B and H substances in tissues and body secretions. Only in rare orangutans and in 20% of human
beings a recessive allele se allows for the existence of nonsecretors of blood group substances.

Appearance of another pair of regulatory genes, Y and y, that bring about formation of A and B antigenic properties on the red cell surfaces, constitute the latest stage in the evolution of A-B-O groups. This embraces anthropoid apes and man. Among the former, gorillas present an intermediary form: the bulk of their blood group substance appears in their body fluids while very little is found on their red blood cells. Detected on red cells or in secretions, the A-B-O groups show good polymorphisms in most species of apes and monkeys and therefore, similarly to the situations in man, should be considered of importance as genetic markers or in various situations when antigenic compatibility enters into play.

Although the M-N polymorphism, unlike the A-B-O, is limited to mankind and its closest relatives – anthropoid apes –, comparative studies of the M-N antigens yielded interesting information as to the evolutionary pathways of this blood group system. Among others, it was established by biochemical stud-

118

ies that substitution of only two amino acids in the amino-terminal fragment of the glycophorin molecule lead to the transformation of chimpanzee red cell antigen into human M-N glycoproteins. The use of specific chimpanzee isoimmune reagents allowed identification of a complex blood group system, the V-A-B-D system, which was found to be an extension of the M-N system, specific to anthropoid apes’ red blood cells but absent from human blood. The V specificity, the central element of the V-A-B-D system, is closely related to the N antigen and is detectable on ape cells by means of chimpanzee isoimmune sera, chimpanzee anti-human sera, as well as by anti-N lectins.

The chapter on the Rh blood group system in non-human primates will, by all means, attract attention of knowledgeable readers since it was by means of anti-rhesus red cell reagents that the presence of the Rh factor was first established on the human erythrocytes. Although human anti-Rh sera do not detect, by direct tests, any Rh-like structures on monkey red cells, these same reagents regularly agglutinate red cells of most ape species giving reactions paralleling those obtained with some chimpanzee isoimmune sera. By simultaneous use of antisera of chimpanzee and human origins, an extremely complex blood group system, the so-called R-C-E-F system, was defined in various species of anthropoid apes. The principal specificity of this system, Rc, is almost identical with human Rh0(D), but other specificities of the R-C-E-F system are present only on the ape red cells. Thus, the latter appear as products of mutations that followed the separation of man and anthropoid apes from a common stock.

A short chapter discusses a class of blood group systems that appear only in Cercopithecoidea but not in any higher nor lower primate taxa. Here, an interesting serologic linkage established between the Bp blood group system of baboons and the so-called Drh system shared by many species of macaques replicates the relationships existing among human M-N and Rh systems and the ape V-A-B-D and R-C-E-F systems, respectively, pointing to the common origins of these pairs of serologic systems.

The almost 70 pages long chapter on methodology will be appreciated by those who are familiar with human blood grouping practices but have no experience with special requirements of the ape and monkey blood testing. The first part of the chapter describes in
detail the use of reagents of human origins of A-B-O, M-N, Rh-Hr, Lewis, I-i and other ‘human-type’ specificities in tests with the red cells and secretions of nonhuman primates. The second part deals with the use of typing reagents specifically produced by immunization of primate animals. It describes, in detail, the techniques of immunization offering as examples actual immunization protocols of chimpanzees and rhesus monkeys. Separate sections discuss the production of specific antiglobulin reagents and the most efficient ways of harvesting the antisera by the technique of plasmapheresis. A step-by-step description of standardization procedures explains how a row antiserum is converted into a well-defined typing reagent by frac-tionation-absorptions, comparative titrations, etc. Finally, prospects of the use of monoclonal antibodies for blood grouping primate animals are shortly discussed.

Tests on the blood of nonhuman primates usually also include screening of the sera for the presence of the so-called spontaneous antibodies. These tests as well as nature and importance of spontaneous antibodies (which occur in between 10 and 20% of monkey sera tested, and may be of importance in blood transfusion and in experimental organ and tissue transplantation carried out in nonhuman primates) are the subject of a separate chapter.

Serological affinities among blood groups of various members of the order of primates point not only to common pathways of molecular evolution, but also to similar biological significance of red cell antigens in human and nonhuman primates. That this is so is amply shown in the chapter entitled ‘Practical Application of Blood Group Studies in Nonhuman Primates’, in which the following topics are discussed: serological maternofetal incompatibility, homo- and heterologous transfusions, transplantation, blood groups as genetic markers, seroprimatology and possible use of primate isoimmune sera for human blood typing.

The role of blood group incompatibility is persuasively demonstrated in detailed description of causes of erythroblastosis fetalis in chimpanzees and orangutans, as well as in experiments in which rhesus monkeys and baboons were intentionally transfused with large volumes of mismatched blood of the same species. Despite the absence of acute transfusion reactions, instant removal from the circulation of radiola-beled incompatible red blood cells clearly indicated that the antigenic differences between donor and recipient blood had direct bearing on the outcome of transfusion. Usefulness of blood grouping tests in paternity investigations is discussed and illustrated by

Book Reviews
119

real cases in which exclusions of paternity by blood groups helped to establish pedigrees of captive chimpanzees.

Seroprimatology is another domain of the use of blood groups as genetic markers: sets of antigenic red cell characteristics are useful taxonomic tools for distinguishing among closely related species. A convincing example of such application is a comparison of blood groups of the common and pygmy chimpanzees. The degree of differences in blood groups observed between Pan troglodytes and P. paniscus is such as to imply their separation into two genera. In the absence of solid morphologic criteria of classification, assessment of even a single red cell antigen, as for example A), may prove sufficient for deciding whether the animal is the common type or the pygmy chimpanzee.
The closing chapter, a purely speculative one, uses the example of blood groups to discuss the general classification of antigenic differences among living organisms, the question of polymorphism and speciation and mechanisms that maintain the polymorphism throughout the evolution.

The bibliography lists over 300 items that cover the subject from the early 1920s to 1983. It avoids redundancies but also misses a few significant publications, mostly in the German language, from the late 20s and early 30s.

In summary, this book provides a useful picture of past and present primate blood group serology and contributes a unique, comprehensive source of practical information for all those whose professional activities or scientific curiosity have brought them into contact with this not too popular branch of immunology.

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Meredith F. Small Female Primates
Studies by Women Primatologists Monographs in Primatology, vol. 4 Liss, New York 1984
IX + 272 pp.; E 44.00 ISBN 0-8451-3403-5

I began reading this book with the same reservations that many scientists share about ‘women’s’ studies: would this collection comprise a feminists’ rave, or do women scientists really share a perspective that can shed new light on the social sciences? In the case of Female Primates, the latter seems to be true. In fact, I believe that any primatologist who wishes to ‘keep current’ cannot afford to ignore this book. This edited volume includes articles on various species of Old World monkeys (Berman; Dolhinow and Krusko; Scott; Whitten; Wolfe; Chism et al.; Teas; Small), and New World monkeys (Wright; Clarke and Glander; Crockett), but only one article each examines prosimians (Jolly) and pongids (Galdikas). The book, which is divided into three interesting sections: (I) Mothers, Infants and Adolescents; (II) Female Reproductive Strategies, and (III) Patterns of Female Behavior, is well organized and illustrated with graphic materials. The Introductions to the volume (Lancaster) and Section II (Hrdy) are highlights of the book.

In article after article, data derived from field studies using traditional scientific methodology are marshaled in order to assess the female primate’s role in primate society. As Lancaster points out, stereotypes of male and female behavior are frequently overturned. Among other interesting facts, we learn that females of some species: can be dominance-oriented competitors, may change social groups more often than males, are sexually aggressive, usually prefer to copulate with middle-ranking rather than high-ranking males, will sometimes exhibit a good deal of homosexual behavior, and are capable of masturbating to climax.

A central theme of this volume entails the role of female as mother versus that of male as inseminator. If I have one criticism of this collection, it is that many of the analyses are rooted uncritically in the tenets of sociobiology. Although it is interesting to interpret primate behavior from a sociobiological perspective, this is not the only level at which behavioral data can be structured and analyzed. Sometimes it works and sometimes it does not. However, some of the contributors seem too ready to reify sociobiological theory. (For example, questionable assumptions are made about conscious thought in monkeys when it is suggested that males of certain species of New World monkeys seek confidence in their paternity.) I suspect that this seemingly uncritical incorporation of sociobiological theory reflects more on the current state of primatology than it does on its female practitioners.
The articles which discuss reproductive behavior of baboons (Scott), competition among female vervets (Whitten), female heterosexual and homosexual behavior in macaques (Wolfe) and (especially) sociality in female orangutans (Galdikas) are particularly interesting.

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