



Immunohematology

PRINCIPLES & PRACTICE

THIRD
EDITION

Eva D. Quinley



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Immunohematology

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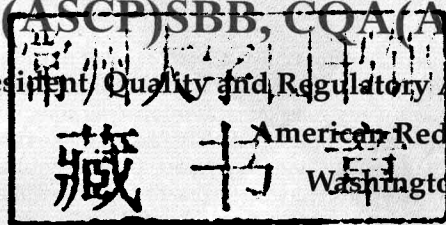
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*This edition of **Immunohematology: Principles and Practice** is dedicated to my family for their support and encouragement, to all the wonderful individuals who work in this great profession, and with special thoughts of Dr. Breannndan Moore, one of the finest blood bankers and most wonderful human beings I have ever known.*

*I*mmunohematology has always been one of the most fascinating and challenging fields in clinical laboratory medicine. *Immunohematology: Principles and Practice* provides clinical laboratory scientists and other health care professionals with a working knowledge of immunohematology. Because the information is presented in a clear and concise manner and is comprehensive and thorough, the text is a useful reference for any individual who desires knowledge of current immunohematology theory.

The third edition of *Immunohematology: Principles and Practice* incorporates the successful elements of the first two editions while expanding on them. Each chapter includes learning objectives, key words, boxes highlighting important concepts, and review questions. A comprehensive glossary and a section of color plates are included for reference as well. These elements serve as aids to increase understanding of the material presented, benefiting both the learner and the instructor.

As with the previous editions, it is the desire of the editor and contributors of this book to provide an excellent resource for those who seek knowledge in immunohematology—one that is written in a manner that is readable, interesting, and easily understood. It is also our hope that the pages of this text will become well worn, having been used time and time again by students, practicing blood bankers, and others who want to know more about this fascinating subject.

ORGANIZATIONAL PHILOSOPHY

This edition of *Immunohematology: Principles and Practice* begins with an overview of blood collection and component practices in Unit 1, "Blood and Blood Components." This unit includes a chapter devoted to apheresis (Chapter 2), one of the fastest growing and most promising methods of blood collection and component harvesting. In Unit 2, "Genetic and Immunologic Principles," chapters on basic concepts of genetics (Chapter 4) and immunology (Chapter 5) provide a foundation for understanding antibody detection and identification (Chapter 6) and the blood group systems (discussed in Unit 4, Chapters 9 through 12).

A thorough discussion of current transfusion practices in Unit 5 (Chapter 13) allows the reader to understand the indications and contraindications for transfusion of various blood components. In Unit 6, "Clinical Conditions Associated with Immunohematology," the importance of transfusion-transmitted diseases is presented (Chapter 15), including etiologic agents, prevalence, pathology, testing, and prevention. This section also includes specific pathologic conditions in which blood banking practices play an important role, such as hemolytic disease of the newborn (Chapter 16) and autoimmune hemolytic anemias (Chapter 17), so that the reader can understand the pathology involved and the interventional role the blood bank plays.

Because regulatory issues have become one of the most important topics in the field of blood banking, Unit 7, "Quality Assurance and Regulatory Issues," includes a chapter devoted to quality assurance and safety issues (Chapter 18) and a chapter on issues related to regulation and accreditation of blood banks (Chapter 19). Unit 8, "Additional Topics of Interest," includes two chapters that are new to this edition: Information Technology (Chapter 20) and Principles of Project Management (Chapter 22). The chapter on process management (Chapter 21) has been expanded to discuss Six Sigma and Lean Principles.

ADDITIONAL RESOURCES

Immunohematology: Principles and Practice, Third Edition, includes additional resources that are available on the book's companion website at thePoint.lww.com/Quinley3e. Students who have purchased the book have access to an online study guide, which includes basic to advanced case studies and questions that are organized to be used as supplements to each chapter. Written with a practical working knowledge of immunohematology, the case studies provide the opportunity to put learned information into practice.

In addition, purchasers of the text can access the searchable Full Text On-line by going to the *Immunohematology: Principles and Practice*, Third Edition website at thePoint.lww.com/Quinley3e. See the inside front cover of this text for more details, including the passcode you will need to gain access to the website.

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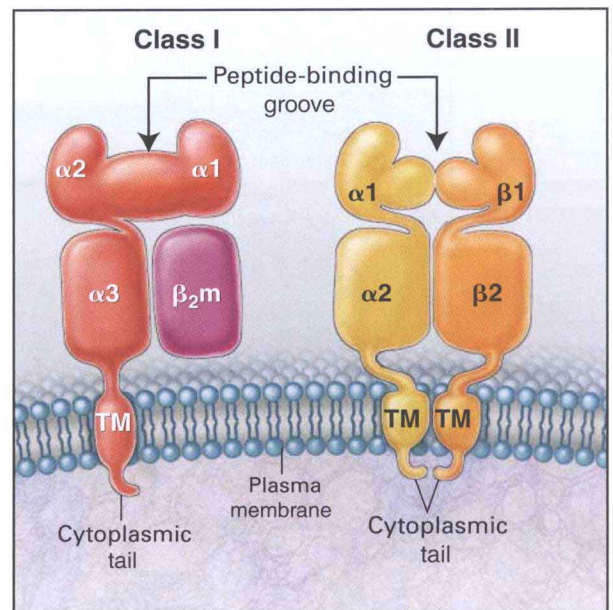
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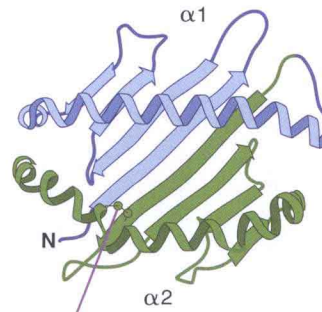
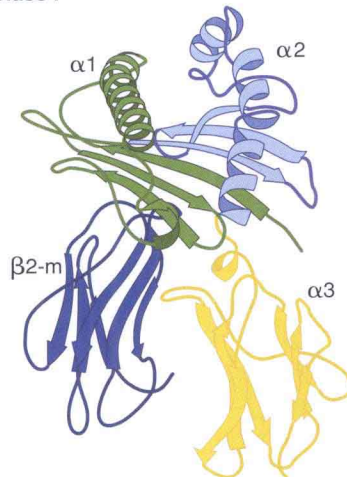
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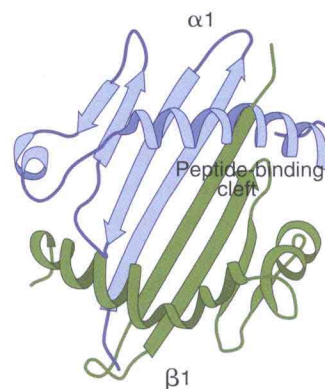
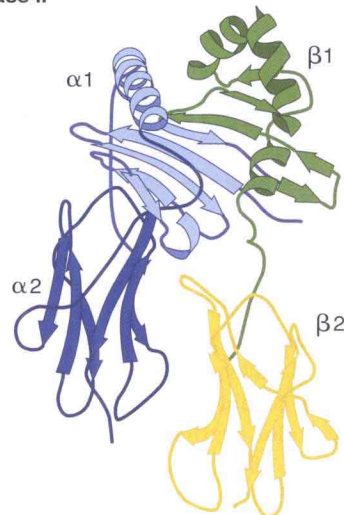
COLOR PLATE C-1 Structures of HLA class I and class II molecules. β_2 -Microglobulin (β_2m) is the light chain of the class I molecule. The α chain of the class I molecule has two peptide-binding domains ($\alpha 1$ and $\alpha 2$), an immunoglobulin-like domain ($\alpha 3$), the transmembrane region (TM), and the cytoplasmic tail. Each of the class II α and β chains has four domains: the peptide-binding domain ($\alpha 1$ or $\beta 1$), the immunoglobulin-like domain ($\alpha 2$ or $\beta 2$), the transmembrane region, and the cytoplasmic tail. (Reproduced with permission from Klein J, Sato A. The HLA system: first of two parts. *N Engl J Med.* 2000;343:704.)



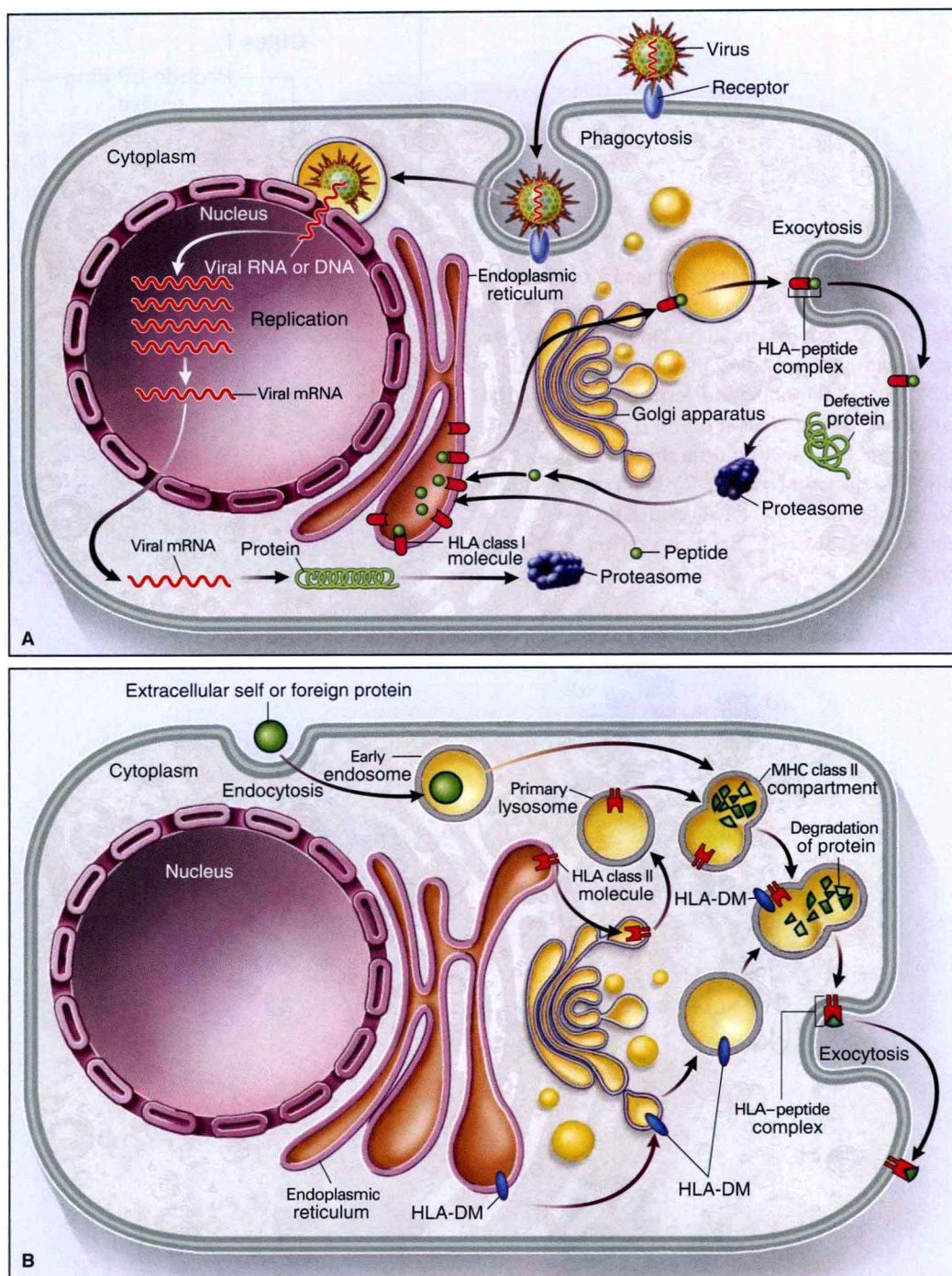
Class I



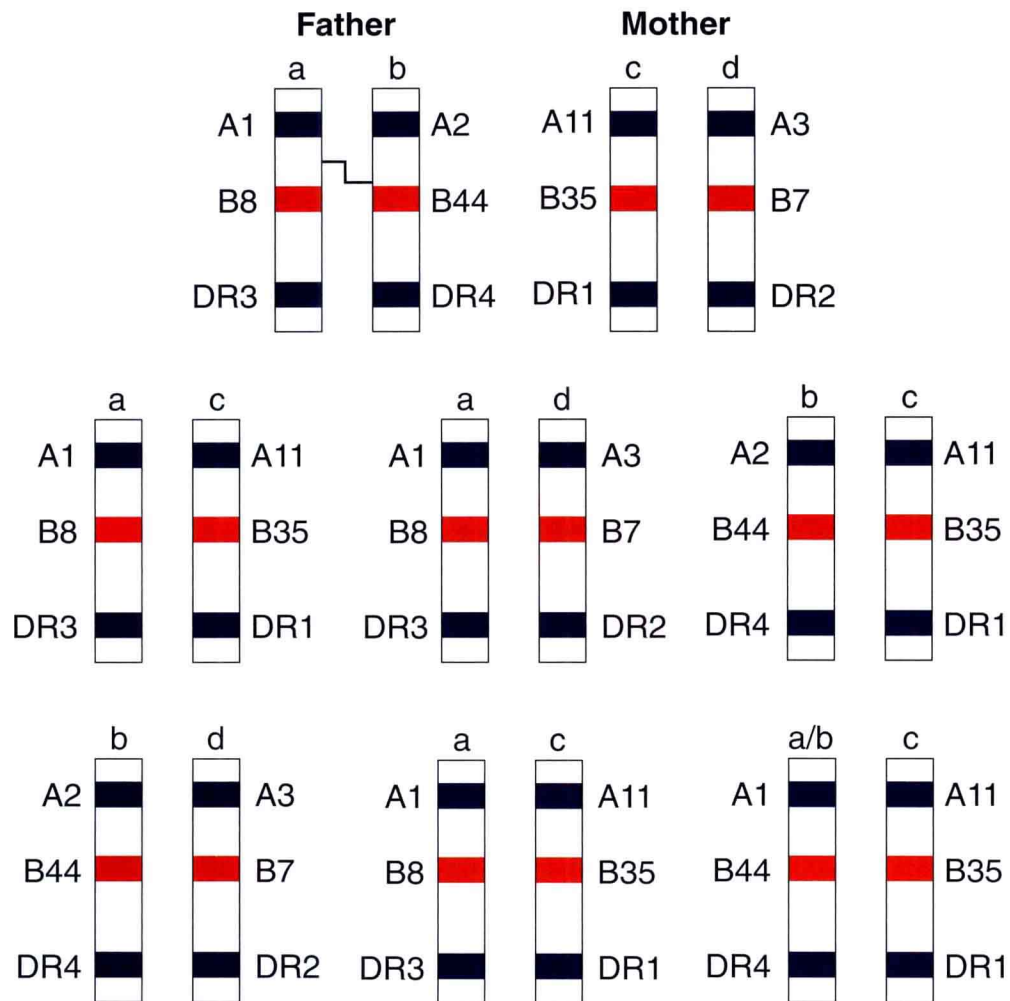
Class II



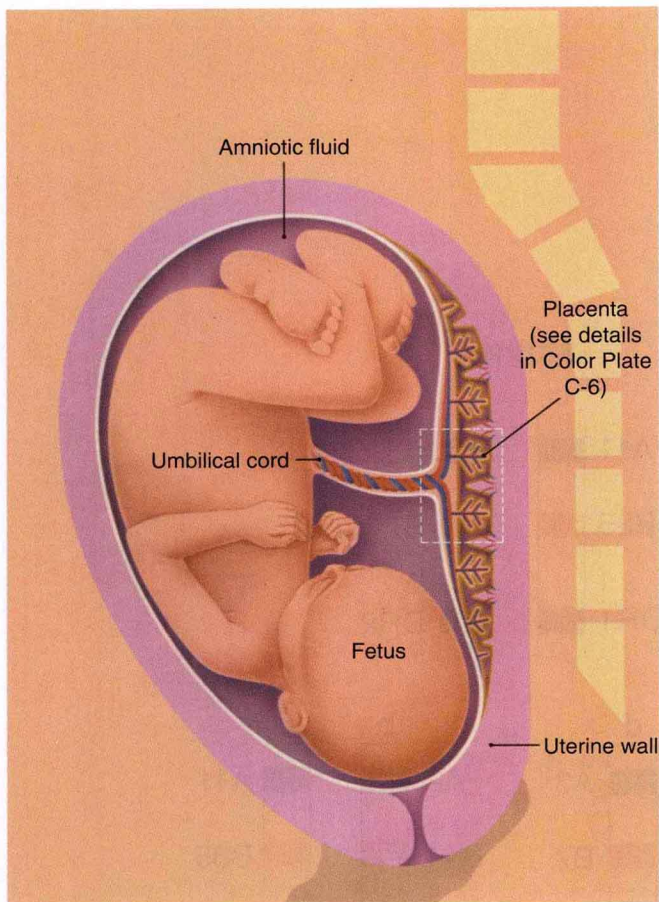
COLOR PLATE C-2 Ribbon structure simulation of the class I and class II HLA molecule and a three-dimensional view of the peptide groove of an HLA class I and class II molecule (Adapted with permission from Macmillan Publishers Ltd. Bjorkman PJ, Saper MA, Samraoui B, et al. The foreign antigen binding site and T cell recognition regions of class I histocompatibility antigens. *Nature.* 1987;329:506).



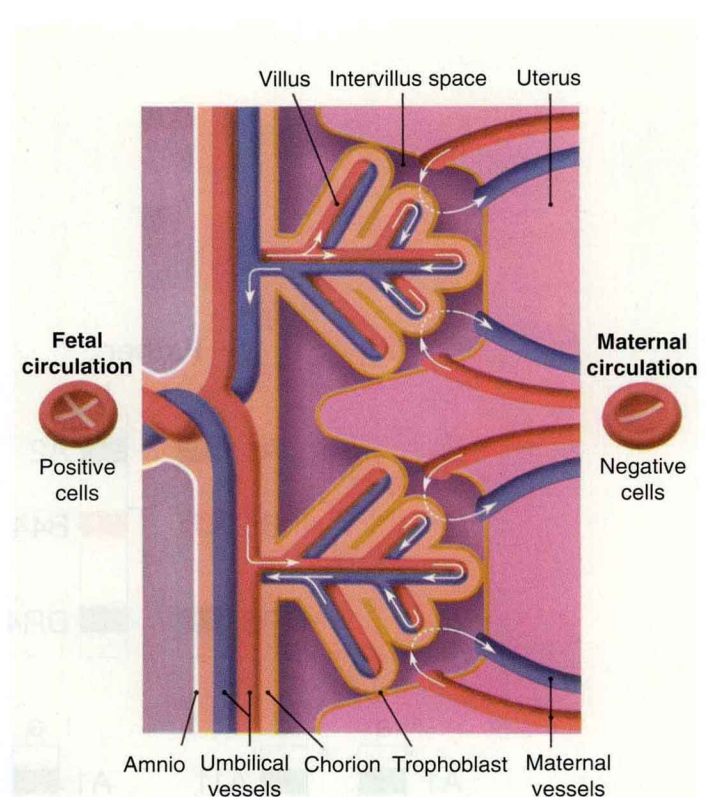
COLOR PLATE C-3 Antigen processing. Panel A shows the principal pathways of generating peptides for loading onto HLA class I molecules. Worn-out or defective proteins in the cytosol are degraded into peptides in proteasomes. Selected peptides are then transported into the endoplasmic reticulum, where they are loaded onto newly synthesized class I molecules. The HLA-peptide complexes are exported by way of the Golgi apparatus to the surface of the cell. In tissues infected with a virus, viral particles are taken up by cells and uncoated. The viral DNA or RNA enters the nucleus and replicates within it. The viral messenger RNA (mRNA) then enters the cytosol and is transcribed into proteins. Some of the proteins are subsequently degraded in proteasomes, and the peptides are delivered into the endoplasmic reticulum, where they are loaded onto class I molecules for export to the surface of the cell. Panel B shows the processing of extracellular proteins. Self or foreign proteins are taken up by endocytosis (or phagocytosis) and sequestered into endosomes. Class II molecules synthesized in the endoplasmic reticulum are delivered by way of the Golgi apparatus into primary lysosomes, which fuse with the early endosomes to form the major histocompatibility complex (MHC) class II compartment. Enzymes brought into this compartment by the lysosomes degrade the engulfed proteins into peptides. HLA-DM molecules synthesized in the endoplasmic reticulum and delivered into the MHC class II compartment by transport vesicles help load the peptides onto the class II molecules. The HLA-peptide complexes are then exported to the surface of the cell. (Reproduced with permission from Klein, J. The HLA system: first of two parts. *N Engl J Med.* 2000;343:705.)



COLOR PLATE C-4 The inheritance of HLA haplotypes. a and b denote paternal haplotypes, and c and d denote maternal haplotypes. a/b denote a paternal recombinant haplotype derived from a recombination event occurring between the HLA-A and HLA-B locus.



COLOR PLATE C-5 Fetus and placenta. (From *Blood Group Antigens and Antibodies as Applied to Hemolytic Disease of the Newborn*. Raritan, NJ: Ortho Diagnostics, Inc.; 1968, with permission.)



COLOR PLATE C-6 Scheme of placental circulation. White arrows depict separate routines of fetal and maternal circulations within the placenta. Dotted lines represent oxygen nutrient and waste exchange through the placental barrier. (From *Blood Group Antigens and Antibodies as Applied to Hemolytic Disease of the Newborn*. Raritan, NJ: Ortho Diagnostics, Inc.; 1968, with permission.)

COLOR PLATE C-7 Separation of placenta following delivery. Diagram portrays the rupture of placental vessels (villi) and connective tissues allowing escape of fetal blood cells. Prior to complete constriction of the open-end maternal vessels, some fetal blood may enter maternal circulation. (From *Blood Group Antigens and Antibodies as Applied to Hemolytic Disease of the Newborn*. Raritan, NJ: Ortho Diagnostics, Inc.; 1968, with permission.)

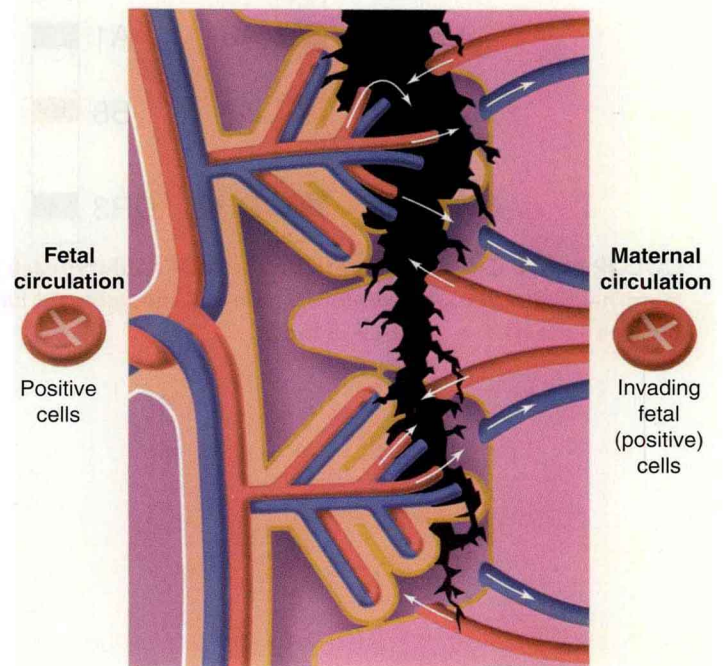


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