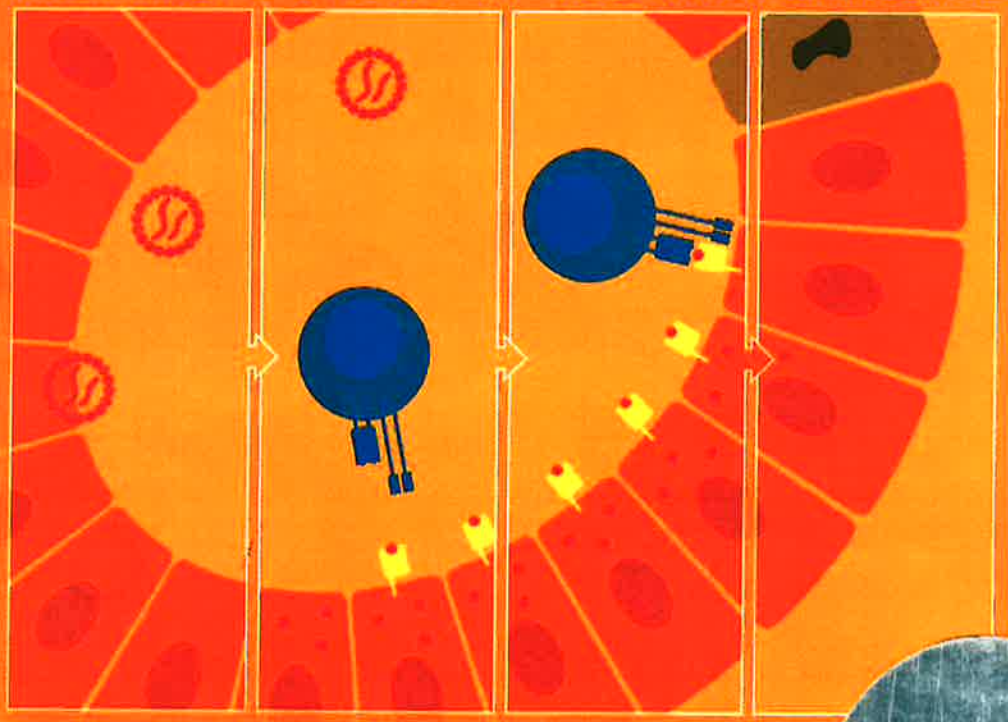
immuno biology 5

THE IMMUNE SYSTEM IN HEALTH AND DISEASE



FIFTH EDITION

animated CD-ROM inside

CHARLES A JANEWAY • PAUL TRAVERS
MARK WALPORT • MARK SHLOMCHIK

immunobiology 5

THE IMMUNE SYSTEM IN HEALTH AND DISEASE

Charles A. Janeway, Jr.
Yale University School of Medicine

Paul Travers
Anthony Nolan Research Institute, London

Mark Walport
Imperial College School of Medicine, London

Mark J. Shlomchik
Yale University School of Medicine

Vice President:	Denise Schanck
Text Editors:	Penelope Austin, Eleanor Lawrence
Managing Editor:	Sarah Gibbs
Editorial Assistant:	Mark Ditzel
Managing Production Editor:	Emma Hunt
Production Assistant:	Angela Bennett
New Media Editor:	Michael Morales
Copyeditor:	Len Ceglelka
Indexer:	Liza Furnival
Illustration and Layout:	Blink Studio, London
Manufacturing:	Marlon Morrow, Rory MacDonald

Distributors:
Inside North America: Garland Publishing, 29 West 35th Street, New York, NY 10001-2299.
Inside Japan: Nankodo Co. Ltd., 42-6, Hongo 3-Chrome, Bunkyo-ku, Tokyo, 113-8410, Japan.
Outside North America and Japan: Churchill Livingstone, Robert Stevenson House, 1–3 Baxter's Place, Leith Walk, Edinburgh, EH1 3AF.

ISBN 0 8153 3642 X (paperback) Garland
ISBN 0 4430 7098 9 (paperback) Churchill Livingstone
ISBN 0 4430 7099 7 (paperback) International Student Edition

Library of Congress Cataloging-in-Publication Data
Immunobiology : the immune system in health and disease / Charles A. Janeway, Jr. ... [et al.].-- 5th ed.
p. cm.
Includes bibliographical references and index.
ISBN 0-8153-3642-X (pbk.)
1. Immunology. 2. Immunity. I. Janeway, Charles. II. Title.

QR181 .I454 2001
616.07'9--dc21

2001016039

This book was produced using QuarkXpress 4.11 and Adobe Illustrator 9.0

Published by Garland Publishing, a member of the Taylor & Francis Group, 29 West 35th Street, New York, NY 10001-2299.

Printed in the United States of America.
15 14 13 12 11 10 9 8 7 6 5 4 3 2

CONTENTS

9 The Humoral Immune Response

Many of the bacteria that cause infectious disease in humans multiply in the extracellular spaces of the body, and most intracellular pathogens spread by moving from cell to cell through the extracellular fluids. The extracellular spaces are protected by the **humoral immune response**, in which antibodies produced by B cells cause the destruction of extracellular microorganisms and prevent the spread of intracellular infections. The activation of B cells and their differentiation into antibody-secreting plasma cells (Fig. 9.1) is triggered by antigen and usually requires helper T cells. The term 'helper T cell' is often used to mean a cell from the T_H2 class of CD4 T cells (see Chapter 8), but a subset of T_H1 cells can also help in B-cell activation. In this chapter we will therefore use the term **helper T cell** to mean any armed effector CD4 T cell that can activate a B cell. Helper T cells also control isotype switching and have a role in initiating somatic hypermutation of antibody variable V-region genes, molecular processes that were described in Chapter 4.

Antibodies contribute to immunity in three main ways (see Fig. 9.1). To enter cells, viruses and intracellular bacteria bind to specific molecules on the target cell surface. Antibodies that bind to the pathogen can prevent this and are said to **neutralize** the pathogen. Neutralization by antibodies is also important in preventing bacterial toxins from entering cells. Antibodies protect against bacteria that multiply outside cells mainly by facilitating uptake of the pathogen by phagocytic cells that are specialized to destroy ingested bacteria. Antibodies do this in either of two ways. In the first, bound antibodies coating the pathogen are recognized by Fc receptors on phagocytic cells that bind to

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.