THE EXPERIMENTAL FOUNDATIONS OF MODERN IMMUNOLOGY

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Fourth Edition

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Edward Jenner (1749–1823) discovered that immunization with the relatively innocuous cowpox conferred protection against the more deadly smallpox. This discovery led to the widespread adoption of vaccination and was a major stimulus for the study of the phenomenon of immunity.

Early nineteenth-century line engraving by Antoine Maxime Monsaldi. The original engraving is in the collection of, and is reproduced here with the kind permission of, Dr. Derrick Baxby, Department of Medical Microbiology, Liverpool University. The history of this engraving is discussed in Med. History 22, *335 (1978).*

Preface

The underlying philosophy of the fourth edition of *The Experimental Foundations of Modern Immunology* remains the same as for the first edition: The best way to learn immunology is to study those landmark experiments that have brought us to our present understanding of how the immune system functions. This is true whether the student is preparing for a career in basic research or in medicine. In either profession, one must always ask not simply *whether* something is so, but *why* it is so; how we *know* it is so.

No textbook for an advanced scientific course can ever be a substitute for reading the primary scientific literature. This text is designed to teach the language of immunology and to describe the most important experiments during the early development of the field. But this should only be seen as preparation for the student to begin reading the current primary immunology literature on his or her own as soon as possible.

More recent developments in immunology are also described from an experimental point of view. Some of these were "hot new topics" from earlier editions of this text; those that survive in this edition are beginning to take their place as classic and definitive experiments. Some of the most intriguing new developments described in the present edition will make it to future editions; others won't. That's part of the excitement of being at the leading edge of any field. Many of the most compelling new developments in these chapters are still incomplete, left hanging, as it were, almost in midsentence. If you are curious about the outcome, look up the experimenters or the topic in the most current volumes of *Biological Abstracts* or *Chemical Abstracts*, or thumb through recent issues of the *Journal of Immunology*, *Nature*, *Cell*, or *PNAS*.

As with previous editions, about one-fourth of the material in this edition is new. Much more information about the T cell receptor is now available, including the γ/δ receptor. The relationship between MHC and antigen processing is discussed in a greatly expanded section. The information on T cell receptors, particularly their ontogeny, together with the new antigen processing and MHC data, has led to important new insights into tolerance to self and to other antigens. The value of transgenic mice in studying these and many other problems in immunology will be apparent from the wide range of new experiments described throughout the text utilizing this valuable tool. An expanded discussion of inflammation has been added, based on our increased understanding of cytokine biology and chemistry. The chapter on autoimmunity has been reorganized, and includes the intriguing new insights into the role of MHC in this phenomenon provided by the studies on diabetes in humans and rodents.

Very few fields in the biological sciences generate new information at the startling pace evident in immunology. That's what makes it exciting. Immunology is not for the

faint of heart; but the effort required to get a good running start, which is what this text provides, will be amply rewarded. One of my greatest personal satisfactions in teaching immunology has been to watch young people catch fire and charge forward into the immunological future, creating even more complex experiments for me to dissect and present to subsequent generations. I hope that some of you who read this text will be in that select group.

WILLIAM R. CLARK

LOS ANGELES, 1990

Abbreviations Commonly Used in Immunology

Ab	Antibody
AChR	Acetylcholine receptor (immune target in myasthenia gravis)
ADCC	Antibody-dependent, cell-mediated cytotoxicity
AEF	Allogeneic effect factor
AFP	Alpha-fetoprotein
Ag	Antigen
AIDS	Acquired immune deficiency syndrome
AMuLV	Abelson murine leukemia virus
APC	Antigen-presenting cell (In the older literature, sometimes used for "antibody producing cell")
BCG	Bacillus Calmette-Guerin
BCGF	B-cell growth factor (term replaced by IL-4, IL-5, etc.)
BRM	Biological response modifier
C′	Activated complement
CD	Cluster of differentiation (refers to antigens on lymphocyte surfaces)
CDR	Complementarity-determining region (Part of Ab V region)
CEA	Carcinoembryonic antigen (A tumor antigen)
CFA	Complete Freund's adjuvant
CMC	Cell-mediated cytotoxicity
CMV	Cytomegalovirus
Con A	Concanavalin A (A plant lectin)
CsA	Cyclosporin A
CTL	Cytotoxic T lymphocyte
DAG	Diacylglycerol
DTH	Delayed-type hypersensitivity
EAE	Experimental allergic encephalomyelitis
EBV	Epstein-Barr virus
ELISA	Enzyme-linked, immunoabsorbant assay
ER	Endoplasmic reticulum
FcR	Fc receptor
GALT	Gut-associated lymphoid tissue

GVH	Graft-vs.-host. GVHD: GVH disease; GVHR: GVH reaction
HCG	Human chorionic gonadotrophin (as a tumor antigen)
HEV	High endothelial vessel
HIV	Human immune-deficiency virus
HLA	Human lymphocyte antigen
HRF	Homologous restriction factor
HVG	Host-vs.-graft
Ia	I-region associated (old name for class II molecules)
IDDM	Insulin-dependent diabetes mellitus (an autoimmune disease)
IFN	Interferon
Ig	Immunoglobulin
Ir	Immune response (former designation for class II genes)
ITP	Inositol triphosphate
LAK	Lymphokine-activated killer cell
LFA	Lymphocyte function-associated
LGL	Large granular lymphocyte
LPS	Lipopolysaccharide
MAb	Monoclonal antibody (sometimes MoAb)
MAC	Membrane attack complex (complement)
MBP	Myelin basic protein
MHC	Major histocompatibility complex
MLC	Mixed leukocyte culture
MLR	Mixed lymphocyte reaction
MTOC	Microtubule organizing center
NK	Natural killer (cell)
NKCF	Natural killer (cell) cytotoxic factor
PFC	Plaque-forming cell
PHA	Phytohemaglutinin (plant lectin)
PI	Phosphatidylinositol
PKC	Protein kinase C
PLC	Phospholipase C
PMN	Polymorphonuclear leukocyte
PPD	Purified protein derivative
RES	Reticuloendothelial system
RIA	Radioimmunoassay
SCID	Severe combined immune deficiency
SLE	Systemic lupus erythematosis
SRSA	Slow reacting substance of anaphylaxis (leukotriene)
TCGF	T-cell growth factor (term replaced by IL-2, IL-4, etc.)
TCR	T-cell receptor (for antigen)
Th	T-helper cell
Ti	T-cell idiotype (refers to T-cell receptor)

TI	Thymus-independent (antigen)
TNF	Tumor necrosis factor
TRF	T-cell replacing factor (term replaced by IL-4, IL-5, etc.)
TSA	Tumor-specific antigen
Ts	T suppressor cell
TsF	T-suppressor cell factor
TSTA	Tumor-specific transplantation antigen

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