Contents

Preface	\mathbf{v}	Primary Lymphoid Organs	3.1
User Guide	\mathbf{v}	The Thymus	3.1
Acknowledgements	\mathbf{v}	The Bursa of Fabricius and its Mammalian	
Contributors	xii	Equivalent	3.2
		Secondary Lymphoid Organs and Tissues	3.2
1. INTRODUCTION TO THE IMMUNE SYSTEM		The Systemic Lymphoid Organs	3.3
		Lymph Nodes and the Lymphatic System	3.4
Dr David Male and Professor Ivan Roitt		The Mucosal Lymphoid System	3.9
Adaptive and Innate Immunity	1.1	Lymphocyte Traffic	3.11
Cells of the Immune System	1.1	Lymphocyte manie	9.11
•	1.3		
Phagocytes	1.3	4. ANTIGEN RECEPTOR MOLECULES	
Lymphocytes	1.4	4. AITHGEN MEDEL TON MOLLOCKED	
Cytotoxic Cells	1.4	Dr Malcolm Turner and Dr Michael Owen	
Auxiliary Cells	1.5		4 1
Soluble Mediators of Immunity	1.5	Immunoglobulins	4.1
Complement	1.5	Antibody Function	4.2
Cytokines	1.6	Immunoglobulin Classes and Subclasses	4.2
Antibodies	1.6	General Properties of Immunoglobulins	4.2
Antigens	1.7	Antibody Structure	4.3
Immune Responses	1.8	The Genetic Basis of Antibody	/ _
Clonal Selection	1.8	Heterogeneity	4.7
Immune Effector Mechanisms	1.9	Antibody Effector Functions	4.8
Inflammation	1.10	Immunoglobulin Structure and Function	4.9
Defences against Extracellular and		T-cell Antigen Receptors	4.12
Intracellular Pathogens	1.11	The CD3 Complex	4.12
Vaccination	1.11	Structure of the αβ TCR Heterodimer	4.13
Immunopathology	1.12	Structure of the TCR Complex	4.13
		Structure of the γδ TCR Heterodimer	4.14
		Distribution of $\alpha\beta$ and $\gamma\delta$ forms of TCR	4.14
2. CELLS INVOLVED IN IMMUNE RESPO	NSES	Major Histocompatibility Complex Antigens	4.14
		The Structure of Class I Molecules	4.15
Dr Peter Lydyard and Professor Carlo Grossi		The Structure of Class II Molecules	4.16
Lymphoid Cells	2.2	Genomic Organization of the MHC	4.17
Morphological Heterogeneity of		MHC Polymorphism	4.19
Lymphocytes	2.2		
Markers	2.4		
T Cells	2.5	5. THE GENERATION OF DIVERSITY	
B Cells	2.8		
Natural Killer Cells	2.9	Professor Frank Hay	
Lymphocyte Activation	2.10	Theories of Antibody Formation	5.1
Activation Markers	2.12	Immunoglobulin Variability	5.2
Mononuclear Phagocytes	2.13	Light Chain Gene Recombination	5.3
The Mononuclear Phagocyte System	2.13	Heavy Chain Gene Recombination	5.5
Antigen-presenting Cells	2.15	Random or Programmed V-Region Readout?	5.6
Polymorphonuclear Granulocytes and	2.1)	Recombination Sequences	5.6
Platelets	2.16	Additional Diversity	5.6
Neutrophils	2.17	Variable Recombination	5.6
Eosinophils	2.18	Somatic Mutation	5.7
Basophils and Mast Cells	2.18	Diversity in Sharks, Birds and Rabbits	5.8
Platelets		Pseudogenes in Human Diversification	5.9
Tatelets	2.20	Heavy Chain Constant Region Genes	5.9
		Membrane and Secreted Immunoglobulin	5.11
3. THE LYMPHOID SYSTEM		Production of Immunoglobulin	5.13
3. THE LIMPHOID STSTEM		Genes of the T-cell Antigen Receptor	
Dr. Dotor I reduced and Drofesson Orde Orde			5.13
Dr Peter Lydyard and Professor Carlo Grossi	2.1	Recombination of T-cell Receptor Genes	5.13
Primary and Secondary Lymphoid Tissue	3.1	Magnitude of Diversity	5.14

CELL-MEDIATED IMMUNE REACTIONS 6. ANTIGEN RECOGNITION Dr Michael Owen and Professor Michael Steward Dr Graham Rook T-cell-independent Cell-mediated Defence Antigen-Antibody Binding 6.1 Antibody Affinity Mechanisms 8.1 6.3 Affinity and Avidity 6.3 8.1 Phagocytosis Cytokine Release Kinetics of Antibody–Antigen Reactions 6.4 8.2 T-cell-dependent Cell-mediated Responses Antibody Specificity 6.4 8.2 The Regulatory role of TH Cells Designer Antibodies 6.5 8.2 The Role of TH Cells in the Selection Polyfunctional Binding Sites 6.5 of Effector Mechanisms Directed Against The Physiological Significance of High and Low Affinity Antibodies Target Antigens 8.3 6.6 Determination of Affinity and Avidity Cell-mediated Cytotoxicity 6.6 8.4 Antibody-independent Cell-mediated Antibody Affinity Heterogeneity 6.7 The Structure of Antigens 6.8 Cytotoxicity 8.5 Antibody-dependent Cell-mediated Cytotoxicity T-cell-Antigen Recognition 6.8 Antigen Processing and Presentation 6.9 (ADCC) 8.6 The Mechanisms of Cell-mediated Processing of Antigens 6.10 Structure of Class I Antigens 8.7 6.10 Cytotoxicity Lymphokine-mediated Activation of MHC-Peptide Association 6.11 Macrophages Class I-Peptide Association 8.8 6.11 Heterogeneity of Activated Macrophages Processing of Cytoplasmic Antigen 8.9 6.12 The Role of Calcitriol in the Activation Transmembrane Transporters 6.12 Class II-Peptide Association 6.13 of Human Macrophages 8.11 Negative Regulation of Macrophage Role of Accessory Molecules 6.13 **Effector Functions** 8.11 Granuloma Formation 8.11 7. CELL COOPERATION IN THE ANTIBODY Immunopathology 8.12 The Cytokine Network RESPONSE 8.12 The Role of the Cytokine Network 8.15 **Professor Marc Feldmann** Cooperation between Different Cell Types 7.1 REGULATION OF THE IMMUNE RESPONSE Antigen-presenting Cells (APCs) and T cells Types of APC 7.1 Dr Anne Cooke What are the Essential Molecular Interactions Regulation by Antigen of Antigen Presentation to T Cells? 9.1 7.3 Regulation by Antibody 9.1 Antigen Processing 7.3 **Antibody Suppression** Interaction of B Cells and T Cells 9.2 7.3 Regulation by Immune Complexes Cytokine Secretion and Action 9.2 7.4 Regulation by Lymphocytes Consequences of B-T Interaction 9.2 7.5 Idiotypic Modulation of Responses T-dependent and T-independent Antigens 7.5 9.4 Idiotypic Interactions in Immunoregulation 9.5 Secondary Response in Vitro 7.5 Neuroendocrine Modulation of Immune Haptens and Carriers 7.6 9.5 Cell Activation Responses Antigen-specific Triggering of Lymphocytes Genetic Control of the Immune Response 9.6 7.8 MHC-linked Immune Response Genes 9.7 Co-stimulatory Signals 7.8 Positive Selection in the Thymus 9.9 Cytokines 7.8 Negative Selection in the Thymus 9.10Interleukins 7.9 MHC-linked Gene Control of the Cytokine Receptors 7.12 Response to Infection Cytokine Antagonists 9.12 7.13 MHC-linked Gene Effects on Autoimmune Intracellular Pathways of Activation 7.13 Cell Proliferation 9.12 7.14 Disease Non-MHC-linked Immune Response Genes 9.13 Antibody Responses in Vivo 7.14 The Effect of Non-MHC-Linked Genes on Class Switching 7.14 the Response to Infection 9.13 Affinity Maturation 7.15 Immunological Memory Non-MHC-linked Genes Affect the 7.16

9.13

Development of Autoimmune Disease

	10. IMMUNOLOGICAL TOLERANCE		Biological Effects of Complement Complement, Inflammation and	12.13
	Dr Jaques Miller		Anaphylatoxins	12.13
	Historical Background	10.1	Membrane Attack Complex and	12.1.
	Experimental Methods	10.2	Tissue Injury	12.14
	Routes to Tolerance	10.2	Complement and Induction of Immune	12.1
	T-cell Tolerance to Self Antigens		Responses	12.15
		10.3	1	
	Intrathymic Clonal Deletion	10.3	Complement and Defence Against	12.15
	Post-thymic Tolerance	10.5	Complement and Defence Against	12.16
	B-cell Tolerance to Self Antigens	10.5	Infection Complement and the Datherenseis of	12.15
*	Clonal Deletion	10.6	Complement and the Pathogenesis of	12.1/
	Clonal Anergy	10.6	Disease	12.16
	Artificially Induced Tolerance in Vivo	10.7		
	Maintaining Tolerance	10.8	12 CELL MICDATION AND INCLAMMATI	ON
	Artificially Induced Tolerance in Vitro	10.8	13. CELL MIGRATION AND INFLAMMATION	UN
	Potential Therapeutic Applications of	10.10	D. David Mala	
	Tolerance	1 0.10	Dr David Male	12.0
			Cell Migration and Localization	13.2
	44 DEVELOPMENT OF THE INABALINE OV	OTE	Intercellular Adhesion Molecules	13.3
	11. DEVELOPMENT OF THE IMMUNE SY	SIEW	Families of Adhesion Molecules	13.3
			Functions of Adhesion Molecules	13.4
	Dr Peter Lydyard and Professor Carlo Grossi		Inflammation	13.6
	Myeloid Cells	11.2	The Control of Inflammation	13.6
	Granulocyte Development	11.2	Chemotaxis	13.8
	Development of Antigen-presenting Cells	11.3		
	The Complement System	11.4		
	Lymphoid Cells	11.4	14. EVOLUTION OF IMMUNITY	
	T Cells	11.4		
	B Cells	11.9	Dr John Horton and Professor Norman Ratcliff	е
	Diversity of Antibody Specificity	11.12	Vertebrate Blood Cell and Immune System	
	Diversity of Antibody Class	11.13	Evolution	14.1
	Development of Memory B Cells	11.15	Invertebrate Immunity	14.2
			Immunocytes	14.2
			Immune Defences	14.3
	12. COMPLEMENT		Clotting/Coagulation and Wound Healing	14.4
			Phagocytosis and Encapsulation	14.4
	Dr Mark Walport		Humoral Immunity	14.4
	Introduction	12.1	Non-self Recognition and Cell-Cell	
	History	12.1	Cooperation	14.5
	Nomenclature	12.1	Cytokine-like Molecules	14.5
	Activities of Complement Proteins	12.1	Transplantation Immunity	14.6
	Families of Complement Proteins	12.2	MHC and the Immunoglobulin Superfamily	14.7
	Activation of Complement	12.3	Vertebrate Immunity	14.8
	C3 and Thioester-containing Proteins	12.3	T Cells and Evolution of the MHC	14.9
	Classical Pathway	12.5	Genetic Organization of the MHC	14.9
	Regulation of Classical Pathway Activation	12.6	T Cell Function in Primitive Fish	14.9
	Alternative Pathway Activation	12.7	B cells and Immunoglobulin Evolution	14.10
	Amplification Loop	12.7	Non-specific Mediators of Immunity	14.12
	Regulation of Alternative Pathway and		Lymphoid Tissues in Lower Vertebrates	14.13
	Amplification Loop Activation	12.8	Thymus	14.14
	Membrane Attack Complex	12.9	Spleen	14.14
	Regulation of Activation	12.10	Lymphomyeloid Nodes	14.16
	Complement Receptors	12.11	Gut-associated Lymphoid Tissues	14.16
	C3 Receptors	12.11	Kidney and Liver	14.16
	Anaphylatoxin Receptors	12.12	Bone Marrow	14.17
	Other Receptors	12.12	Aspects of Amphibian Immunology	14.17
	Activation of Complement Receptors	12.13	I	/
	The state of the s	12.10		

Thymus Development and Thymectomy	1/10	16. IMMUNITY TO PROTOZOA AND WOR	MS
Experiments	14.18	D. I	
Thymic Education	14.20	Dr Janice Taverne	1/1
Ontogeny of Alloimmunity and	1 / 01	General Features of Parasitic Infections	16.1
Allotolerance	14.21	Effector Mechanisms	16.3
Immunology of Metamorphosis	14.21	T Cells	16.3
Models for the Study of Lymphoid Cell		Cytokine Secretion by T Cells	16.3
Origins	14.21	Macrophages	16.5
Summary of Immunoevolution	14.22	Granulocytes	16.8
		Mast Cells	16.11
		Platelets	16.11
15. IMMUNITY TO VIRUSES, BACTERIA		Antibody	16.11
AND FUNGI		Non-specific Effector Mechanisms	16.14
		Escape Mechanisms	16.14
Dr Graham Rook		Anatomical Sequestration	16.14
Immunity to Viruses	15.1	Avoidance of Recognition	16.17
Viral Infection	15.2	Suppression of the Host's Immune	
T Cell Recognition of Viral Antigens	15.3	Responses	16.17
Effects of Antibody	15.4	Immunopathological Consequences	
Antibody-dependent Cell-mediated		of Parasite Infections	16.20
Cytotoxicity	15.4	Vaccines	16.21
Natural Killer (NK) Cells in Viral Immunity	15.5	Strategies in Vaccine Design	16.22
Tc Cells and MHC Restriction	15.5		
Delayed Viral Hypersensitivity to	-11		
Viral Antigens	15.6	17. TUMOUR IMMUNOLOGY	
Interferon	15.6		
Antiviral Effects of Tumour Necrosis Factor	17.0	Professor Peter Beverley	
(TNF)	15.7	Immune Surveillance	17.1
Human Immunodeficiency Virus (HIV)	15.7	Tumour Antigens	17.2
Immunopathology	15.7	Tumour Associated Transplantation Antigens	1/.2
Viruses and Autoimmunity	15.8	(TATAs)	17.2
Immunity to Bacteria	15.8	Shared Tumour Antigens	17.2
The Structure of Bacteria	15.8		1/.4
	1).0	Tumour Specific Transplantation Antigens	17 2
The Mechanisms of Pathogenicity	15 0	(TSTAs)	17.3
of Bacteria	15.8	Tumour Associated Antigens	17.4
Antibacterial Mechanisms Which Do		Widely Differentiated Antigens	17.4
Not Depend on Antigen Recognition	15 10	Normal Differentiation Antigens	17 6
by T Cells or Antibody	15.10	with Restricted Distribution	17.4
Recognition of Common Bacterial	15 10	Oncofetal Antigens	17.4
Components	15.10	Altered Antigens	17.5
The Role of Antibody and Complement	15.11	Immune Responses to Human Tumours	17.5
Interaction with Phagocytes	15.13	The Immune Response to Tumours in Situ	17.5
The Killing Mechanisms of Phagocytic		Detection of Immune Responses in Vitro	17.6
Cells	15.14	Mixed Lymphocyte–Tumour Interactions	17.6
Activation of Macrophages	15.16	Specificity of Human Anti-tumour	
Antibacterial Activity of Non-Phagocytic Cells	15.16	Lymphocytes	17.7
Mechanisms of Bacterial		Immune Escape Mechanisms	17.7
Immunopathology	15.17	Immunodiagnosis	17.8
New Topics in Bacterial Immunology	15.18	In Vivo	17.8
Immunity to Fungi	15.19	In Vitro	17.8
Vaccine Design	15.20	Immunotherapy	17.8
Microbial Antigens	15.20	Active Immunization	17.9
Localization of Effect	15.20	Passive Immunotherapy	17.10
Immunological Mechanisms	15.21	Therapy with Antibodies	17.10
Adjuvants	15.22	Lymphokine Activated Killer (LAK) Cells	17.11
Trajavanto		Tumour Infiltrating Lymphocytes (TILs)	17.11
		Cytokines	17.12

18. IMMUNODEFICIENCY		Factors Involved in the Development	
		of Allergy	19.18
Professor Fred Rosen		T-cell Deficiency	19.18
B-cell Deficiencies	18.1	Mediator Feedback	19.18
X-linked Agammaglobulinemia (X-LA)	18.1	Environmental Factors	19.19
IgA Deficiency and IgB Subclass		The Concept of Allergic Breakthrough	19.20
Deficiency	18.2	Hyposensitization	19.20
Immunodeficiency with Increased IgM	18.2	The Beneficial Role of IgE	19.22
Common Variable Immunodeficiency			
(CVID)	18.3		
Transient Hypogammaglobulinaemia		20. HYPERSENSITIVITY – TYPE II	
of Infancy	18.3	Dr David Male	
T-cell Deficiencies	18.3	Mechanisms of Damage	20.1
Severe Combined Immunodeficiency		Reactions Against Blood Cells and Platelets	20.4
(SCID)	18.3	Transfusion Reactions	20.4
MHC Class II Deficiency	18.5	Haemolytic Disease of the Newborn	20.6
The DiGeorge Anomaly	18.5	Autoimmune Haemolytic Anaemias	20.7
Hereditary Ataxia-Telangiectasia (AT)	18.5	Drug-induced Reactions to Blood	
Wiskott-Aldrich Syndrome (WAS)	18.5	Components	20.8
Secondary Immunodeficiency Diseases	18.7	Reactions to Leucocytes and Platelets	20.9
Acquired Immunodeficiency Syndrome		Hyperacute Graft Rejection	20.9
(AIDS)	18.7	Reactions to Tissue Antigens	20.10
Defects in the Complement Proteins	18.8	Reactions to Basement Membranes	20.10
Defects in Phagocytosis	18.9	Myasthenia Gravis and Lambert-Eaton	
Chronic Granulomatous Disease (CGD)	18.9	Syndrome	20.11
Leucoyte Adhesion Deficiency (LAD)	18.10	Reactions to Cellular Antigens	20.12
and the second s			
	- A. J. 100 No. 10		
19. HYPERSENSITIVITY - TYPE I		21. HYPERSENSITIVITY - TYPE III	
Dr Jonathan Brostoff and Dr Tony Hall		Professor Frank Hay	
	10.1	Types of Immune Complex Disease	21.1
Types of Hypersensitivity	19.1	Inflammatory Mechanisms in Type III	41.1
Type I – Immediate Hypersensitivity Definition	19.2	Hypersensitivity	21.2
	19.2 19.3	Experimental Models of Immune-complex	21.2
Atopy Immunoglobulin E	19.3	D'	21.3
IgE Levels in Disease	19.5	Induced Serum Sickness	21.3
Control of IgE Production	19.4	Autoimmune Immune-complex Disease	21.4
	19.4	The Arthus Reaction	21.4
Genetics of the Allergic Response in Man Total IgE Levels	19.7	Persistence of Complexes	21.4
	19.7	Deposition of Complexes in Tissues	21.9
HLA-linked Allergen-specific Response		Increase in Vascular Permeability	21.8
General Hyperresponsiveness	19.7	Haemodynamic Processes	
Mast Cells Distribution of Most Cells	19.9		21.8
Distribution of Mast Cells Most Cell Neutral Protococc	19.10	Tissue Binding of Antigen	21.9
Mast Cell Neutral Proteases	19.10	Size of Immune Complexes	21.10
Clinical Studies	19.11	Immunoglobulin Class	21.10
Effect of Drugs	19.11	Complement Solubilization of Immune	21.10
The Structure and Function of Fc Receptors	19.11	Complexes Detection of Immune Complexes	21.10
The High Affinity Receptor – Fc _€ RI	19.11	Detection of Immune Complexes	21.11
The Low Affinity Receptor – Fc _€ RII	19.12		
Other Cells that can Bind IgE	19.13	22 HYDEDCENCITIVITY TYPE IV	
Mast-cell Triggering	19.13	22. HYPERSENSITIVITY - TYPE IV	
T Cells and Mast-cell Triggering	19.14	Dunfaces Dans Dans dans and	
Mediator Release	19.14	Professor Ross Barnetson and	
Basis of Immunopathology of Allergic		Dr David Gawkrodger	
Disorders	19.15	Contact Hypersensitivity	22.1
Cutaneous Reactions	19.15	The Langerhans' Cell	22.1
Bronchial Reactions	19.16	Sensitization	22.2
Bronchoalveolar Lavage	19.17	Elicitation	22.2
		Mechanism	22.3

Tuberculin-type Hypersensitivity	22.4	24. AUTOIMMUNITY AND AUTOIMMUNE	
Tuberculin Skin Test	22.5	DISEASE	
Granulomatous Hypersensitivity	22.5		
Epithelioid Cells	22.6	Professor Ivan Roitt	
Giant Cells	22.6	The Spectrum of Autoimmune Diseases	24.2
Granuloma	22.6	Genetics	24.3
Cellular Reactions in Delayed		Pathogenesis	24.4
Hypersensitivity	22.7	Aetiology	24.7
Diseases Manifesting Delayed Hypersensitivity	22.8	Control Mechanisms	24.8
Leprosy	22.9	Diagnostic and Prognostic Aspects	24.11
Tuberculosis	22.10	Treatment	24.11
Sarcoidosis	22.11		*
Schistosomiasis	22.12		
		25. IMMUNOLOGICAL TECHNIQUES	
23. TRANSPLANTATION AND REJECTION		Professor Michael Steward and Dr David Male	
		Antigen-Antibody Interactions	25.1
Professor Ian Hutchinson		Precipitation Reaction in Gels	25.1
Barriers to Transplantation	23.1	Haemagglutination and Complement	
Genetics of Transplantation	23.2	Fixation	25.2
Haplotype Inheritance of MHC Antigens	23.2	Direct and Indirect Immunofluorescence	25.4
Tissue Expression of MHC Antigens	23.3	Radioimmunoassay and Enzyme-linked	
The Laws of Transplantation	23.3	Immunosorbent Assay	25.7
The Role of T Lymphocytes in Rejection	23.4	Immunoblotting and Immunoprecipitation	25.7
The Molecular Basis of Allorecognition	23.5	Isolation of Pure Antibodies	25.9
The Role of T Helper (TH) Cells in		Assays for Complement	25.10
Rejection	23.6	Isolation of Lymphocyte Populations	25.10
The Role of Lymphokines in Rejection	23.6	Effector Cell Assays	25.13
The Tempo of Rejection	23.7		
Prevention of Rejection by Tissue		Appendices	
Matching	23.9	I HLA specificities	
Treatment of Rejection by Non-specific		II CD markers	
Immunosuppression	23.11	III Cytokines	
Specific Immunosuppression	23.12		
		Glossary	4 - 4
		Index	