MACMILLAN DICTIONARY OF IMMUNOLOGY

FRED S. ROSEN
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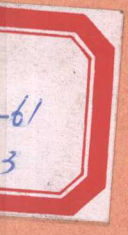

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MACMILLAN
REFERENCE
BOOKS

First published 1989 by
THE MACMILLAN PRESS LTD.
London and Basingstoke

Associated companies in Auckland, Delhi, Dublin, Gaborone, Hamburg, Harare, Hong Kong, Johannesburg, Kuala Lumpur, Lagos, Manzini, Melbourne, Mexico City, Nairobi, New York, Singapore, Tokyo.

British Library Cataloguing in Publication Data

Rosen, F.
Dictionary of immunology.
1. Immunology — Dictionaries
I. Title II. Steiner L. III. Unanue, Emil R.
574.2'9'0321 QR180.4

ISBN 0-333-34742-0
ISBN 0-333-39248-5 Pbk

Printed in Great Britain

We dedicate this dictionary to the memory of our teachers
John H. Humphrey, Irwin H. Lepow and Rodney R. Porter.

Introduction

This book contains definitions of terms that may be encountered in contemporary papers in immunology. It draws from the vocabulary of molecular biology, cell biology and genetics, as well as from immunology itself. For the immunologist or clinician, it may serve as a guide to these other disciplines; for the biologist with little background in immulogy, we hope it will clarify the complex terminology of this field. Many of the definitions are long and contain considerable, if not encyclopedic, detail. Usually, the first paragraph contains the overall meaning and the rest of the text, the fine details.

Whoever is so foolish as to write a dictionary can find wisdom, solace and sympathy in the writings of Samuel Johnson. His remark "the lexicographer can only hope to escape reproach" prompts us to encourage readers to bring errors to our attention so that they may be corrected in a future edition.

We are grateful to Julian B. Fleischman, William P. Girard, Richard A. Harrison, William P. Jencks, John W. Kimball, Roger K. Patient, David H. Raulet and Patricia Woo, who read large groups of definitions and provided helpful criticism.

We also thank colleagues who provided useful information and criticism: Chester A. Alper, David Baltimore, Timothy H. Bestor, Barbara K. Birshtein, Kurt J. Bloch, Bonnie Blomberg, David Botstein, John M. Buchanan, Steven J. Burakoff, Michael C. Carroll, Alvin E. Davis, III, Bernard D. Davis, Herman N. Eisen, George Feher, Sol H. Goodgal, W. Carey Hanley, Stephen C. Harrison, Nancy H. Hopkins, H. Robert Horvitz, Vernon M. Ingram, Fred Karush, Tomas Kirchhausen, Katherine L. Knight, Monty Krieger, Harvey F. Lodish, Rose G. Mage, Henry Metzgar, Barbara Meyer, Marian R. Neutra, Alfred Nisonoff, Mary Lou Pardu, Jane R. Parnes, Andrew G. Plaut, Eileen Remold-O'Donnell, Uttam L. Rajbhandary, Linda S. Reidl, Phillip W. Robbins, Paul R. Schimmel, Milton J. Schlesinger, Sondra Schlesinger, Robert D. Schreiber, Ranjan Sen, Hee-Sup Shin, Steven L. Spitalnik, Ursula Storb, Eng M. Tan, Cox P. Terhorst, Anna Maria Torriani-Gorini, Philip W. Tucker, Jay C. Unkeless, Alexander Varshavsky, Thomas A. Waldmann, Robert A. Weinberg, Alexander S. Whitehead, Don C. Wiley and Diane J. Zezza.

Notes on use

The head words defined in the dictionary are placed in alphabetical order. This applies to the complete term regardless of spaces and hyphens. For example, **second-set rejection** comes after **secondary structure**.

Many, but not all of the head words defined, are shown in small capitals when they occur in another entry. So if a word not appearing in small capitals causes difficulty it might be helpful to try looking it up.

Where a numeral occurs before the first letter of the head word, the entry will still be ordered under the first letter. For example **6-mercaptopurine** occurs before **metaproteranol**. Where the numeral immediately follows the first letter, they count as being first in the alpha ordering. For example **C9 deficiency** occurs immediately before **cachectin**.

Commonly Used Abbreviations

ADA – adenosine deaminase. *See* ADENOSINE DEAMINASES DEFICIENCY.
ADCC – antibody-dependent cell-mediated cytoxicity. *See* NATURAL KILLER CELLS.
AGN – acute glomerulonephritis.
AIDS – acquired immunodeficiency syndrome.
ALS – anti-lymphocyte serum.
ANA – anti-nuclear antibody.
AP – alkaline phosphate.
ApoE – apolipoprotein E.
ARC – AIDS-related complex.
ASA – acetylsalicylic acid. *See* ASPIRIN.
AT – ataxia telangiectasia.
ATLL – adult T cell leukemia-lymphoma.
ATS – anti-thymocyte serum.
AZT – azidothymidine. *See* ZIDOVUDINE.
BCGF I – B cell growth factor I. *See* INTERLEUKIN-4.
BCGF II – B cell growth factor II. *See* INTERLEUKIN-5.
BiP – immunoglobulin heavy chain binding protein.
BSF-1 – B cell stimulating factor-1. *See* INTERLEUKIN-4.
BSF-2 – B cell stimulating factor-2. *See* INTERLEUKIN-6.
C – complement.
C1 INH – C1 inhibitor.
C3NeF – C3 nephritic factor.
C4bp – C4 binding protein.
CALLA – common acute lymphocytic leukemia antigen.
CD – cluster of differentiation.
CDR – complementarity-determining region.
CLL – chronic lymphocytic leukemia.
cM – centiMorgan.
CR1 – complement receptor 1.
CR2 – complement receptor 2.
CR3 – complement receptor 3.
CR4 – complement receptor 4.
CRI – cross-reacting idiotype. *See* PUBLIC IDIOTYPIC DETERMINANT.
CRP – C-reactive protein.
CTL – cytotoxic T lymphocyte.
CTLp – cytotoxic T lymphocyte precursor.
CVF – cobra venom factor.
CVI – common variable immunodeficiency.
DAF – decay antibody-accelerating factor.
DEC – dendritic epidermal cell.
DNP – dinitrophenyl.
DTH – delayed-typed hypersensitivity.
E – erythrocyte.
EAE – experimental allergic encephalomyelitis.
EBV – Epstein–Barr virus.
EC – enzyme classification, International Union of Biochemistry 1978.
E-LAM – endothelial–leukocyte adhesion molecule.
ELISA – enzyme-linked immunosorbent assay.
ER – endoplasmic reticulum.
ETAF – epithelial thymic-activating factor.
FACS – fluorescence-activated cell sorter.
GALT – gut-associated lymphoid tissue.
GVH – graft-*versus*-host disease.
HANE (or HAE) – hereditary angioneurotic edema.
HIV – human immunodeficiency virus.
HMK – high molecular weight kininogen. *See* KININOGEN.
HTLV – human T cell leukemia virus. *See* ADULT T CELL LEUKEMIA-LYMPHOMA and HUMAN IMMUNODEFICIENCY VIRUS.
ICAM-1 – intercellular adhesion molecule-1.
ID – immunodeficiency.
IDDM – insulin-dependent diabetes mellitus.
Idl – private idiotypic determinant.
IdX – public idiotypic determinant.
IEF – isoelectric focusing.
IEP – immunoelectrophoresis.
Ii – invariant chain.
IK – immunoconglutination.
IL-1 – interleukin-1.

IL-2 – interleukin-2.
IL-3 – interleukin-3. *See* COLONY STIMULATING FACTOR.
IL-4 – interleukin-4.
IL-5 – interleukin-5.
IL-6 – interleukin-6.
IL-2R – interleukin-2 receptor.
ISG – immune serum globulin.
ITP – idiopathic thrombocytopenic purpura.
K – killer cells. *See* NATURAL KILLER CELL.
K – conglutinin.
K_A – association constant.
KAF – conglutination activation factor. *See* FACTOR I.
kb – kilobase.
K_D – dissociation constant.
K_O – average association constant.
LAD – leukocyte adhesion deficiency.
LATS – long acting thyroid stimulator. *See* GRAVE'S DISEASE.
LC – Langerhans cell.
LCM – lymphocytic choriomeningitis.
L-CA – leukocyte common antigen.
Leu 1 – *See* CD5.
Leu 2 – *See* CD8.
Leu 3 – *See* CD4.
Leu 4 – *See* CD3.
Leu 5 – *See* CD2.
Leu 6 – *See* CD1.
LFA-1 – lymphocyte function associated antigen-1.
LFA-2 – lymphocyte function associated antigen-2. *See* CD2.
LFA-3 – lymphocyte function associated antigen-3.
LMK – low molecular weight kininogen. *See* KININOGEN.
LPS – lipopolysaccharide.
LT – leukotriene.
LT – lymphotoxin.
MAC – membrane attack complex.
Mac1 – macrophage antigen 1. *See* COMPLEMENT RECEPTOR 3.
MAF – macrophage activating factor.
MDP – muramyl dipeptide.
MHC – major histocompatibility complex.
MIF – migration inhibiting factor.
mIg – membrane immunoglobulin.
MLC – mixed lymphocyte culture.
MLR – mixed lymphocyte reaction.
Mo1 – monocyte antigen 1. *See* COMPLEMENT RECEPTOR 3.
MPGN – membranoproliferative glomerulonephritis.
6-MP – 6-mercaptopurine.
MPO – myeloperoxidase. *See* MYELOPEROXIDASE DEFICIENCY.
NBT – nitroblue tetrazolium dye test.
NK – natural killer cells.
NZB – New Zealand black mouse. *See* NEW ZEALAND MOUSE.
NZW – New Zealand white mouse. *See* NEW ZEALAND MOUSE.
OAF – osteoclast activating factor.
ORF – open reading frame.
OT – old tuberculin.
P – properdin.
PA – pernicious anemia.
PAF – platelet-activating factor.
PCA – passive cutaneous anaphylaxis.
PFGE – pulsed field gradient gel electrophoresis.
PGL – persistent generalized lymphadenopathy. *See* HIV INFECTION.
P–K – Prausnitz-Küstner reaction.
PMA – phorbol myristate acetate. *See* PHORBOL ESTER.
PMN – polymorphonuclear leukocyte.
PNP – purine nucleoside phosphorylase. *See* PURINE NUCLEOSIDE PHOSPHORYLASE DEFICIENCY.
PPD – purified protein derivative.
RA – rheumatoid arthritis.
RAST – radioallergosorbent test.
RES – reticuloendothelial system.
RFLP – restriction fragment length polymorphism.
RI – recombinant inbred strain.
RIA – radioimmunoassay.
RIST – radioimmunosorbent test.
SAA – serum amyloid A component.
SAP – serum amyloid P component.
SCID – severe combined immunodeficiency.
SDS–PAGE – polyacrylamide gel electrophoresis in sodium dodecyl sulfate.
sIg – secreted immunoglobulin.
SLE – systemic lupus erythematosus.
SRS-A – slow reacting substance of anaphylaxis.
T1 – *See* CD5.
T3 – *See* CD3.
T4 – *See* CD4.
T6 – *See* CD1.
T8 – *See* CD8.
T9 – *See* TRANSFERRIN RECEPTOR.
T11 – *See* CD2.
TdT – terminal deoxynucleotidyl transferase. *See* DNA NUCLEOTIDYLEXOTRANSFERASE.

T_C – cytotoxic T lymphocyte.
TC2 – transcobalamin 2. *See* TRANSCOBALAMIN 2 DEFICIENCY.
TCGF – T cell growth factor. *See* INTERLEUKIN-2, INTERLEUKIN-4.
TcR – T cell receptor.
T_H – helper T lymphocyte.
Ti – *see* T CELL RECEPTOR.
Ti/T3 – T cell idiotype/CD3. *See* CD3, T CELL RECEPTOR.
TNF – tumor necrosis factor.
TPA – tetradecanoylphorbol-13-acetate. *See* PHORBOL ESTER.
TRF – thymus replacing factor. *See* INTERLEUKIN-5.
T_S – suppressor T lymphocyte.
UDF – unidentified reading frame.
WAS – Wiskott–Aldrich syndrome.
XLA – X-linked agammaglobulinemia.

List of CD antigens*

CD1	T6, Leu 6, common thymocyte antigen
CD2	T11, Leu 5 LFA-2, E-rosette receptor
CD3	T3, Leu 4, (part of T cell receptor complex (Ti/CD3))
CD4	T4, Leu 3, ('helper/inducer' T cell subset)
CD5	T1, Leu 1, Ly1
CD6	T12 (M_r 100,000 molecules of all T lymphocytes)
CD7	Leu 9
CD8	T8, Leu 2, ('cytotoxic/ suppressor' T cell subset)
CD9	BA2 (M_r 24,000 molecule of monocytes, pre-B cells, platelets)
CD10	**common acute lymphocytic leukemia antigen** (CALLA)
CD11a	Alpha chain of **lymphocyte function associated antigen-1** (LFA-1)
CD11b	Alpha chain of **complement receptor 3** (CR3), Mac1, Mo1
CD11c	Alpha chain of **p150,95**, LeuM 5
CD13	MY7
CD14	Leu M3, Mo3, My4
CD15	Leu M1, My1
CD16	**Fcγ receptor III**, Leu 11
CD18	Beta chain of LFA-1, CR3, **p150, 95**
CD19	Leu 12, B4 (M_r 95,000 molecule of B lymphocytes)
CD20	Leu 15, B1 (M_r 35,000 molecule of B lymphocytes)
CD21	**complement receptor 2** (CR2), B2
CD22	Leu 14 (M_r 135000 molecule of B lymphocytes)
CD23	**Fcε receptor II**
CD25	Tac, **interleukin-2 receptor**
CD28	Tp44
CD29	4B4 (*see* **inducer T lymphocyte**)
CD32	**Fcγ receptor II**
CD35	**complement receptor** 1 (CR1)
CD38	T10, Leu 17 (M_r 45,000 molecule of precursor and mature T lymphocytes, natural killer cells, monocytes)
CD40	gpIIb/IIIa on platelets
CD41	gpIb on platelets
CD43	**sialophorin**
CD45	**common leukocyte antigen,** T200, Leu 18

* defined words or symbols are in bold type.

A

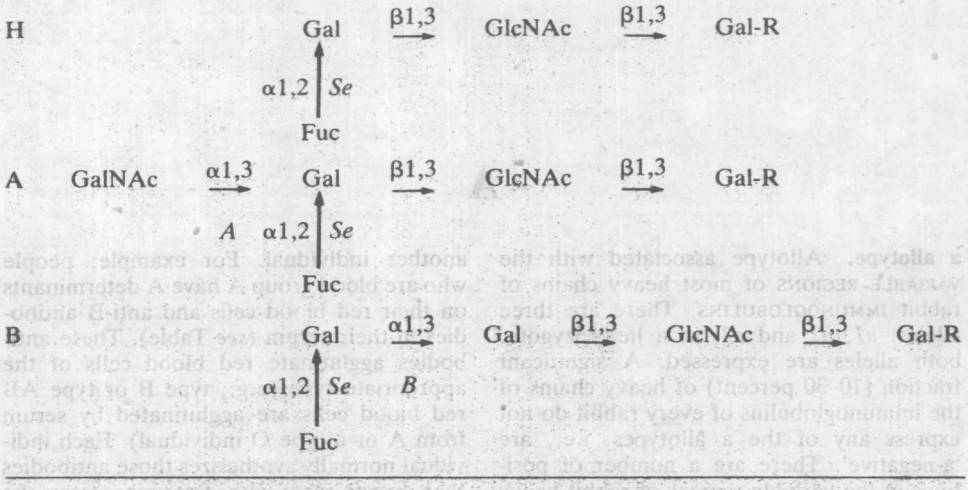
a allotype. Allotype associated with the VARIABLE REGIONS of most heavy chains of rabbit IMMUNOGLOBULINS. There are three alleles: *a1*, *a2* and *a3*; in a heterozygote, both alleles are expressed. A significant fraction (10–30 percent) of heavy chains of the immunoglobulins of every rabbit do not express any of the a allotypes, i.e., are 'a-negative'. There are a number of positions in the variable regions of rabbit heavy chains at which the a allotypes differ; these allotypes, therefore, are examples of COMPLEX ALLOTYPES. The relationship of a allotypes to the genes encoding heavy chain variable regions is not understood at present. *See* b ALLOTYPE.

Abelson murine leukemia virus. Retrovirus that carries the v-*abl* ONCOGENE and causes leukemia, usually of B LYMPHOCYTES in mice. This virus also can transform immature B lymphocytes (from fetal liver or adult bone marrow) in culture, yielding permanent cell lines representing PRE-B CELLS or earlier stages of the B-cell differentiation pathway. Studies of these cell lines have elucidated features of immunoglobulin differentiation, including assembly of heavy and light chain IMMUNOGLOBULIN GENES and immunoglobulin CLASS SWITCHING. Abelson virus is defective and cannot replicate without a co-infecting helper retrovirus.

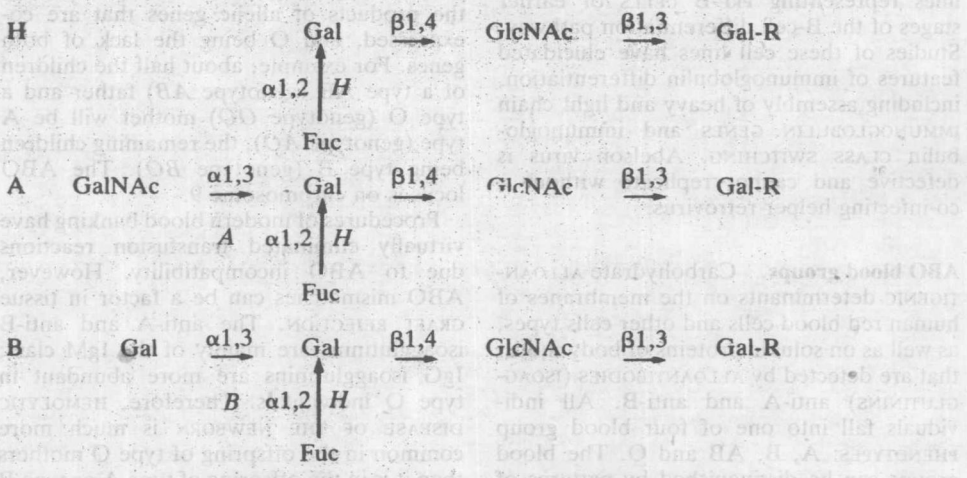
ABO blood groups. Carbohydrate ALLOANTIGENIC determinants on the membranes of human red blood cells and other cells types, as well as on soluble proteins of body fluids, that are detected by ALLOANTIBODIES (ISOAGGLUTININS) anti-A and anti-B. All individuals fall into one of four blood group PHENOTYPES: A, B, AB and O. The blood groups can be distinguished by patterns of agglutination of red blood cells taken from one individual by normal serum taken from another individual. For example, people who are blood group A have A determinants on their red blood cells and anti-B antibodies in their serum (*see* Table). These antibodies agglutinate red blood cells of the appropriate type (e.g., type B or type AB red blood cells are agglutinated by serum from A or a type O individual). Each individual normally synthesizes those antibodies that do not react with determinants on the red blood cells of that individual (e.g., someone of blood type A synthesizes anti-B, but not anti-A). Specific immunization is not required to raise anti-A and anti-B isoagglutinins, the relevant IMMUNOGENIC determinants presumably being encountered on naturally-occurring antigens. It is supposed that individuals who have endogenous A (or B) antigenic determinants cannot make anti-A (or anti-B) antibodies because they are tolerant to these determinants. Family studies have established that the inheritance of the ABO blood groups follows simple Mendelian principles, with A and B being the products of allelic genes that are co-expressed, and O being the lack of both genes. For example, about half the children of a type AB (genotype *AB*) father and a type O (genotype *OO*) mother will be A type (genotype *AO*), the remaining children being type B (genotype *BO*). The ABO locus is on chromosome 9.

Procedures of modern blood banking have virtually eliminated transfusion reactions due to ABO incompatibility. However, ABO mismatches can be a factor in tissue GRAFT REJECTION. The anti-A and anti-B isoagglutinins are mainly of the IgM class; IgG isoagglutinins are more abundant in type O individuals. Therefore, HEMOLYTIC DISEASE OF THE NEWBORN is much more common in the offspring of type O mothers than it is in the offspring of type A or type B mothers (IgG, but not IgM, crosses the placenta).

type 1 (secretions)



type 2 (red blood cells)



Gal, D-galactose; GalNAc, N-acetyl-D-galactosamine; GlcNAc, *N*-acetyl-D-glucosamine; Fuc, L-fucose

The ABO antigenic determinants reside on the terminal sugars of oligosaccharides that are the end-products of the sequential action of a series of glycosyl transferases. Four independent genes, acting on an oligosaccharide precursor, are involved in the synthesis of these determinants, as well as in the synthesis of the Lewis (Le) antigenic determinants, which may occur on the same oligosaccharide moiety that expresses ABO. The four genes are: (1) *A/B*; (2) *Se*; (3) *H*; and (4) *Le*. The *Se* and *H* genes are tightly linked, and each encodes a distinct galactoside (α1–2) fucosyl transferase. There is no linkage between any other gene pair. The final ABO product can exist in a lipid-associated form (in cell membranes) or in water-soluble form (attached to a protein backbone in secretions). There are two types of precursors, designated type 1 and type 2.

type 1: Gal(β1–3)GlcNAc(β1–3)Gal–R
type 2: Gal(β1–4)GlcNAc(β1–3)Gal–R

The only difference between the two types is that the terminal galactose in linked to the penultimate *N*-acetylglucosamine in β1–3 linkage in type 1 chains and in β1–4 linkage in type 2 chains. Red blood cells possess mainly type 2 chains. Fucose is added in α1–2 linkage to the terminal galactose, a step that is catalysed by the transferase encoded by the *Se* or *H* genes. The *Se* gene is expressed in epithelial tissues and the corresponding enzyme acts preferentially on type 1 chains. The *H* gene is expressed in tissues of mesodermal origin; this enzyme acts preferentially on type 2 chains and is also found in serum. After the addition of fucose, the oligosaccharide is known as 'H substance'. Next, two different glycosyl transferases, encoded by the *A* or *B* genes, add N-acetylgalactosamine or galactose, respectively, to the terminal galactose of H substance, thereby forming the A or B blood group substances. The A or B determinant seems to consist of the terminal group of three or four sugars, not only the monosaccharide added by the *A* or *B* gene product.

Rare individauls lack gene *H* (are genotype *hh*); the corresponding fucosyl transferase cannot be detected in serum and fucose is not added to type 2 chains, so that H substance is not formed and the enzymes specified by the *A* and *B* genes do not have the appropriate substrate. Accordingly, the red blood cells of such individuals cannot express the A or B antigenic determinants. This condition is known as the Bombay phenotype. If the *Se* gene is present, A or B substances can be formed on type 1 chains and the corresponding determinant detected in secretions (the 'para-Bombay' phenotype).

The *Le* gene encodes a transferase that adds a fucose residue in α1–4 linkage to the penultimate *N*-acetylglucosamine of type 1 chains. (This enzyme cannot act on type 2 chains because the 4-position of the *N*-acetylglucosamine is preempted by the β1–4 linkage to the galactose.) In the absence of *Se* activity (i.e., no fucose on the terminal galactose), the resulting antigenic determinant is known as Le^a. If the *Le* and *Se* genes act in concert, fucose is added to both the penultimate *N*-acetylglucosamine and to the terminal galactose, producing the Le^b antigenic determinant. Non-secretors (who lack the *Se* gene) cannot express the Le^b determinant, but may be Le^a. Since the enzyme encoded by the *Le* gene does not act on type 2 chains, the Lewis antigenic determinants are not endogenous to red blood cells. However, they may be detected on such cells due to passive ADSORPTION of glycolipid antigen from serum.

aboriginal mouse. Mouse that has never lived in close association with humans.

absorption. Removal of antibodies from an antiserum by addition of antigen or removal of antigens from a mixture by addition of antibodies. For example, this procedure can be used to render an antiserum specific for a

Blood group	*Genotype*	*Antibodies in serum*	*Frequency (%)*		
			Caucasian	*Blacks*	*Orientals*
A	AA or AO	anti-B	41	25	38
B	BB or BO	anti-A	11	17	22
O	OO	anti-A and -B	45	51	30
AB	AB	none	3	4	10

Modified from Stites, D. P., Stobo, J. D., Fudenberg, H. H., and Wells, J. V. Basic and Clinical Immunology, 5th edition, Lange Med. Pub., Los Altos, Ca (1984).

single antigen (or ANTIGENIC DETERMINANT) by removing antibodies to contaminants or to related antigens. Absorption refers to reactions between soluble antigens and antibodies. *See* ADSORPTION.

accessory cell. Non-lymphocytic cell (DENDRITIC CELL, LANGERHANS CELL, MONONUCLEAR PHAGOCYTE) that helps in the induction of IMMUNE RESPONSES by presenting antigen to HELPER T LYMPHOCYTES. B LYMPHOCYTES can assume the function of accessory cells in ANTIGEN PRESENTATION.

acquired agammaglobulinemia. See COMMON VARIABLE IMMUNODEFICIENCY.

acquired C1 inhibitor deficiency. Syndrome characterized by recurrent episodes of swelling of subcutaneous tissues, intestine and larynx. The symptoms are due to increased destruction of C1 INHIBITOR so that increased cleavage of C4 and C2 occurs when C1 is activated. A KININ-like peptide generated from C2b, which enhances vascular permeability, appears to cause the symptoms. Acquired C1 inhibitor deficiency occurs in patients with monoclonal proliferation of B LYMPHOCYTES or PLASMA CELLS (e.g., MULTIPLE MYELOMA, B cell LYMPHOMA, MACROGLOBULINEMIA OF WALDENSTRÖM) who also have ANTI-IDIOTYPIC ANTIBODIES to MEMBRANE IMMUNOGLOBULINS or to MYELOMA PROTEINS. The reaction of anti-idiotypic antibodies with the IDIOTYPE of the membrane immunoglobulin or myeloma protein leads to fixation of C1 and increased consumption of C4 and C2 and, for unknown reasons, the CLASSICAL PATHWAY convertase (C4b2a) is not formed in sufficient amount; therefore C3 and the later acting complement components are not consumed. Acquired C1 inhibitor deficiency may also result from the reaction of C1 inhibitor with AUTOANTIBODIES. *See* HEREDITARY ANGIONEUROTIC EDEMA.

acquired immunodeficiency syndrome (AIDS). Form of IMMUNODEFICIENCY that results from infection with a LYMPHOCYTOTROPIC virus, called HUMAN IMMUNODEFICIENCY VIRUS (HIV). HIV INFECTION can cause profound LYMPHOPENIA, primarily of the CD4 subset of T LYMPHOCYTES. Affected individuals have decreased or absent DELAYED-TYPE HYPERSENSITIVITY, extreme susceptibility to OPPORTUNISTIC INFECTIONS and may acquire certain unusual malignancies, such as KAPOSI'S SARCOMA or BURKITT'S LYMPHOMA. HIV also causes polyclonal expansion of B LYMPHOCYTES, leading to HYPERGAMMAGLOBULINEMIA. Despite the marked increase in amounts of IMMUNOGLOBULINS in serum, affected individuals are incapable of mounting a PRIMARY IMMUNE RESPONSE to newly encountered antigens. The syndrome has been recognized almost exclusively in 'at risk' groups, including homosexually active males, intravenous drug abusers, recipients of blood or blood products, and certain populations from Central Africa and the Caribbean. The syndrome has also been recognized in heterosexual partners of individuals in all 'at risk' groups and in infants of affected mothers. AIDS is almost invariably fatal. *See* AIDS-RELATED COMPLEX, HIV INFECTION, PEDIATRIC AIDS.

activated macrophage. Macrophage (MONONUCLEAR PHAGOCYTE) that has increased microbicidal and tumoricidal activity compared to resting macrophages. Activated macrophages are approximately twice the size of resting macrophages, have an increased content of cytoplasmic organelles, especially lysosomes, tend to spread on wettable surfaces (e.g., glass) and develop ruffled borders. Macrophages are activated by lymphokines, especially by INTEFERON-GAMMA, which induces increased expression of CLASS II HISTOCOMPATIBILITY MOLECULES. Activated macrophages are essential in resistance to intracellular pathogenic microorganisms (e.g., Mycobacteria, Toxoplasma).

activity immunity. Immunity acquired as a result of stimulation with antigen after a natural infection or any other exposure to antigen. *See* PASSIVE IMMUNITY.

acute disseminated encephalomyelitis. INFLAMMATION of the brain following an acute viral infection usually of childhood (e.g., measles). It also may occur after smallpox vaccination or in recipients of rabies vaccine prepared in neural tissue. Patients develop headache, stiff neck, confusion and coma. The cerebrospinal fluid contains increased amounts of protein and mononuclear cells. There are perivascular infiltrates of NEUTROPHILS, LYMPHOCYTES and PLASMA CELLS. EXPERIMENTAL ALLERGIC

ENCEPHALOMYELITIS is a laboratory model for this disease.

acute phase reaction. Changes in the rates of synthesis of certain serum proteins during inflammation. There is increased synthesis of C-REACTIVE PROTEIN, SERUM AMYLOID A COMPONENT, haptoglobin, ceruloplasmin, alpha-1 antitrypsin and most of the COMPLEMENT components and a decrease in synthesis of SERUM ALBUMIN and transferrin. The acute phase reaction is induced by INTERLEUKIN-1, interleukin-6 and TUMOR NECROSIS FACTOR. The acute phase reaction rapidly protects the host against microorganisms by bringing about an increase in proteins that are important in non-specific defense mechanisms (e.g., OPSONIZATION by complement components).

acute post-streptococcal glomerulonephritis (AGN). Benign form of IMMUNE COMPLEX DISEASE of the renal glomeruli, which occurs mainly in children 10–21 days following a streptococcal infection of the skin or pharynx. AGN is characterized by the sudden onset of hematuria (blood in the urine). Only infections with types 1, 4, 12 and 49 group A streptococci precede the nephritis, and hence these strains are called nephritogenic. Serum levels of C3 are decreased. IgG and C3, presumably complexed to streptococcal antigens, are deposited in the renal glomeruli, as demonstrated by IMMUNOFLUORESCENCE. *See* GLOMERULONEPHRITIS.

acute rheumatic fever. Febrile illness characterized by inflammation of connective tissue, the heart (carditis) and joints (arthritis), which usually follows a throat infection by group A streptococci. The arthritis is typically migratory, involving several joints in succession. The carditis can lead to scarring of the heart valves. Very high titers of antibodies to streptococcal antigens are found in the serum. Some of the antibodies (e.g., to the M protein of the streptococcal cell wall) cross-react with ANTIGENIC DETERMINANTS of human myocardium. In the heart tissues, massive deposition of IgG and COMPLEMENT has been found by IMMUNOFLUORESCENCE. Acute rheumatic fever is thought to be an AUTOIMMUNE DISEASE.

Addison's disease. Adrenal failure resulting from destruction of the adrenal cortex by infection (e.g., tuberculosis) or by AUTOIMMUNE DISEASE. The adrenal architecture is usually disrupted by a heavy infiltration of LYMPHOCYTES. The serum frequently contains AUTOANTIBODIES to adrenal cortical cells. Addison's disease is often associated with autoimmune disease of the thyroid, PERNICIOUS ANEMIA, INSULIN-DEPENDENT DIABETES MELLITUS and hypoparathyroidism.

adenosine deaminase deficiency. Form of SEVERE COMBINED IMMUNODEFICIENCY that results from the inheritance of mutant forms of adenosine deaminase (EC 3.5.4.4) (ADA). The immunodeficiency is caused by accumulation of metabolites that are toxic for T and B LYMPHOCYTES. ADA, which is present in all mammalian cells, catalyses deamination of adenosine and deoxyadenosine. ADA deficiency results in increased intracellular concentrations of adenosine, deoxyadenosine, adenosine triphosphate (ATP), deoxyadenosine triphosphate (dATP) and *S*-adenosyl homocysteine. dATP inhibits ribonucleoside-diphosphate reductase, an enzyme involved in DNA synthesis. Adenosine inhibits *S*-adenosyl homocysteine hydrolase, an enzyme involved in the *S*-adenosyl methionine-dependent pathway of DNA methylation. Precursors of B and T lymphocytes are more vulnerable to destruction by the accumulation of these metabolites than are other cells. ADA is relatively abundant in lymphoid tissue and is present in greatest concentration in THYMUS.

The gene encoding ADA has been mapped to chromosome 20q13-ter and encodes a single polypeptide chain (M_r 38,000) of 363 amino acid residues. In almost all cases of ADA deficiency, mRNA of normal size is present in normal or increased amounts. ADA deficiency is inherited as an autosomal recessive. Levels of ADA (usually measured in red blood cells) are half-normal in heterozygotes. ADA is absent from red blood cells of a few individuals who are not immunodeficient. In such cases, T lymphocytes contain mutant ADA with <10 percent of normal function but sufficient to prevent accumulation of toxic amounts of dATP.

ADA deficiency has been treated successfully with transplants of bone marrow cells or by intravenous infusion of ADA conjugated to polyethylene glycol. Recently, retrovirus VECTORS containing cDNA for

ADA have been transfected into bone marrow cells, with the aim of correcting ADA deficiency.

adherent cell. Cell that adheres to surfaces *in vitro*. The term is usually used to refer to MONONUCLEAR PHAGOCYTES. Since B and T LYMPHOCYTES are non-adherent, lymphocytes and macrophages can be separated on the basis of this property.

adjuvant. Substance that enhances, nonspecifically, the IMMUNE RESPONSE to an antigen. An adjuvant is usually administered with antigen, but may also be given before or after antigen. *See* FREUND'S ADJUVANT.

adjuvant disease. Form of arthritis induced in rats by injection of COMPLETE FREUND'S ADJUVANT. The disease is characterized by an acute sterile inflammation of several joints. Adjuvant disease is thought to be a laboratory model for RHEUMATOID ARTHRITIS.

adoptive transfer. Transfer of immunological reactivity by lymphocytes from a primed donor to an unprimed recipient. *See* ACTIVE IMMUNITY, PASSIVE IMMUNITY.

adsorption. Noncovalent binding of a molecule to a cell or particle: for example, antibodies are adsorbed to antigens on a surface. *See* ABSORPTION.

adult T-cell leukemia-lymphoma (ATLL). Rapidly progressive malignancy of mature T LYMPHOCYTES. The original cases were observed in southeastern Japan, but the disease has since been found in patients from the Caribbean Islands, parts of Africa and the southeastern United States. Lymphoma nodules are frequently present in the skin and LYMPH NODES and also in the SPLEEN and liver. Hypercalcemia is often present whether or not there are bone lesions. The causative agent of ATLL is usually the retrovirus HTLV-I (*see* HUMAN IMMUNODEFICIENCY VIRUS), although another retrovirus HTLV–II has been cultured from a few cases. The first isolate of HTLV–II was from a patient with hairy cell leukemia. The membrane phenotype of ATLL cells corresponds to that of a mature T lymphocyte bearing CD4 molecules. In addition, these cells bear receptors for INTERLEUKIN-2. There appears to be a longitudinal transmission of HTLV-I from mother to fetus. HTLV-I was the first retrovirus associated with cancer in humans. Its pathogenic effect *in vitro* is an uncontrolled proliferation of CD4+ T lymphocytes.

affinity. Measure of the reversible interaction between two molecules (e.g., an antibody and a LIGAND). In immunology, the term affinity is frequently used as a synonym for ASSOCIATION CONSTANT, although it is also used in a more qualitative sense. *See* AVIDITY, FUNCTIONAL AFFINITY, INTRINSIC ASSOCIATION CONSTANT.

affinity chromatography. Chromatographic procedure in which a mixture of substances is resolved by differential ADSORPTION to a matrix containing a determinant that reacts preferentially with one or more of these substances.

affinity labeling. Technique for specific covalent attachment of a LIGAND (HAPTEN or substrate) to the active site of an ANTIBODY or enzyme, respectively. The ligand contains a chemically reactive substituent (e.g., a diazonium group) capable of forming a covalent bond with an amino acid side chain. The ligand is specifically bound to the active site and forms a covalent bond with an amino acid residue in or near the site. To facilitate localization of the affinity-labelled residue, the ligand my be tagged, e.g., with a radioisotope.

agammaglobulinemia. Decreased amount of serum IMMUNOGLOBULIN. Immunoglobulins are not absent so the term hypogammaglobulinemia would be more accurate. Agammaglobulinemia may be primary (*see* ANTIBODY DEFICIENCY SYNDROMES) due to decreased immunoglobulin synthesis, or secondary due to loss of immunoglobulin into the gut or through the skin as may occur in INFLAMMATORY BOWEL DISEASE or burns, respectively.

agar Complex acidic mucilaginous polysaccharide extracted from algae having the property of melting at 100°C and solidifying into a gel when cooled to approximately 45° C. The major components of agar are agaropectin (a sulfated polymer of D-galactose) and AGAROSE. Agar gels are used

for growing bacteria and for IMMUNODIFFUSION.

agarose. Linear polymer of alternating D-galactose and 3,6-ANHYDROGALACTOSE, WHICH IS THE MAJOR COMPONENT OF AGAR. Agarose gels are used in IMMUNODIFFUSION and for ELECTROPHORESIS of nucleic acids and proteins.

agglutination. Clumping of particulate antigens (e.g., red blood cells, bacteria) as by antibodies. Agglutination may be observed grossly or microscopically, and may be used as a test to measure antigen or antibody.

agglutinin. ANTIBODY that agglutinates cells or particles. At one time, it was thought that the ability to bring about AGGLUTINATION was the property of a particular antibody. It is now known that most antibodies can cause agglutination provided they are directed to ANTIGENIC DETERMINANTS on the surface of the cell or particle.

agglutinogen. Particulate antigen that is agglutinated by antibodies (e.g., type A red blood cell).

agranulocytosis. Marked decrease of granulocytes, i.e., NEUTROPHILS, BASOPHILS and EOSINOPHILS in the blood. *Synonym for* granulocytopenia.

agretope. In ANTIGEN PRESENTATION, the area of a protein antigen that interacts with CLASS II HISTOCOMPATIBILITY MOLECULES. It is believed that different amino acid sequences in a protein vary in their interaction with the alleles of the class II histocompatibility molecules. Agretope is derived from *a*ntigen *r*estriction *e*lement. *See* DESETOPE, HISTOTOPE, RESTITOPE.

AIDS. *See* ACQUIRED IMMUNODEFICIENCY SYNDROME.

AIDS-related complex (ARC). Constelation of symptoms, including fever, night sweats, swollen lymph nodes and weight loss that occurs in some individuals following infection with HUMAN IMMUNODEFICIENCY VIRUS (HIV). ARC differs from full-blown ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS) in that patients with ARC do not have OPPORTUNISTIC INFECTIONS or malignancies. In approximately 10 percent of cases, ARC progresses rapidly (within 12 months) to AIDS. *See* HIV INFECTION.

albumin. Protein that is characterized by its solubility in water, as distinct from GLOBULIN, which is insoluble or only sparingly soluble in water. Albumins are also soluble in solutions of half-saturated ammonium sulfate. Examples of albumins are SERUM ALBUMIN, the major protein component of SERUM, and ovalbumin, the major protein in egg white.

Aleutian mink disease. Chronic fatal infection of mink and ferrets caused by a parvovirus. The infection results in a polyclonal expansion of B LYMPHOCYTES and remarkable HYPERGAMMAGLOBULINEMIA (~100 mg IgG/ml). PLASMA CELLS and LYMPHOCYTES infiltrate the viscera, and immune complexes (*see* ANTIGEN–ANTIBODY COMPLEX) are deposited in the renal glomeruli. In severe forms of the disease, the small and medium-sized arteries of the heart, brain and kidney are inflamed as a result of immune complex deposition.

alexin. *Synonym for* COMPLEMENT.

alkaline phosphatase (AP). (EC 3.1.3.1). Phosphomonoesterase that is active at alkaline pH. AP is a Zn^{2+} metalloenzyme present in nearly all organisms, except some plants. Human AP consists of three tissue-specific forms (isozymes) encoded by at least three genes. The different forms of AP are found in placenta, intestine and liver/bone/kidney. These APs are membrane-bound glycoproteins consisting of a single polypeptide chain of approximately 500 amino acid residues. The physiological role of AP is not known, although it is thought to play a role in bone mineralization.

Alkaline phosphatase, usually from calf intestine, is used for a variety of purposes in immunological procedures and in molecular cloning. It is widely used in enzyme-linked immunoassays (*see* ELISA) and in IMMUNOBLOTTING. AP removes 5′-phosphate groups from the ends of linear DNA. In the preparation of DNA recombinants the VECTOR, after cleavage with a RESTRICTION ENDONUCLEASE, is usually treated with AP to prevent recircularization, thereby reducing the background of vector DNA. Genomic