

Dictionary of **Immunology**

Edited by

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THIRD EDITION

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THIRD EDITION

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We also thank contributors to the previous editions whose names are listed in those editions.

Preface to the Third Edition

The Third Edition contains about 300 new entries, many in the rapidly developing fields of cellular immunology and immunogenetics. About 100 entries have been ~~deleted~~ and many of the existing entries have been revised.

WJH, PCW, DIS

Preface to the Second Edition

This edition contains 230 new entries, and many of the existing entries have been extensively revised and some new tables added. To contain this expansion, over one hundred of the original definitions have been deleted, either because they were obsolete or because the authors felt that they had now entered the corpus of general biological knowledge and were only marginally immunological.

WJH, PCW

Preface

The easiest dictionaries to write are dictionaries of dead languages. Living languages develop and change so that the meaning of words often becomes the subject of furious debate. Since this is undoubtedly true for immunology, it is with considerable trepidation that we offer this Dictionary to the reader. Concepts in immunology have, in recent years, undergone and continue to undergo radical changes, such that the terminology of the science is, and must remain, fluid and adaptable. But this fluidity presents great difficulty, not only to the beginner in the science and to the expert in a related subject, but even to the established immunologist whose experience lies chiefly within a specialized field.

Our aim, therefore, in compiling this Dictionary, has been to include a range of terms wide enough to satisfy the needs of any biologist, clinician or biochemist who requires easy reference to current immunological usage. The idea of the Dictionary originated from the need for a glossary for use in undergraduate teaching. We have, therefore, tried to ensure that the definitions can all be understood by anyone with a minimum background of biological knowledge. Extensive cross-referencing has been employed both to expand individual definitions and to enable a chosen theme to be followed through the book. We should like to emphasize that the definitions given are not intended to reflect our personal views as to how the terms *should* be used but, rather, to tell the reader how they *have been* used in the literature.

We have drawn on the expertise of a number of collaborators from different disciplines for help in compiling the Dictionary. We thank those listed on p.v most profoundly for the definitions that they provided and the revision and checking of entries which they carried out. We are also grateful to many other colleagues in this and other Universities, for their criticisms and suggestions at all stages of the work. However, we as editors, take full responsibility for the final form of each entry.

Finally, we invite readers who spot any mistakes or major omissions to use the tear-out page at the end of the book to let us know about them.

WJH, PCW

Acknowledgements

We are very grateful to the following who filled in the tear-out sheet or sent us letters with corrections, amendments, suggestions or complete definitions.

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Arrangement of entries

Preferred terms

The terms included in this Dictionary have been defined under the heading that appeared most convenient at the time of writing. The Editors wish to make it clear that, unless specially indicated, it is not their intention to show any personal preferences in this way for the use of one term rather than another. However, where *preferred term* or *obsolete term* is mentioned, this indicates the supersession of an older term either by international agreement, or by a consensus of modern usage.

Numbered sections

Some definitions have been divided into sections. When these are numbered this is intended to indicate that the word has several distinct meanings. Where such sections are distinguished by letters, the differences between them are much less important, e.g. as in the entries for vaccines. In the cross references, the section of the definition intended is indicated by a superscript numeral or letter, e.g. **sensitized cells**¹.

Cross references

Words printed in **bold type** within any definition appear elsewhere as dictionary entries in their own right. The grammatical form of each cross reference has, as far as possible, been made to conform with that of the main entry, plurals being ignored. It should be noted that, in a few cases, two words referable to different entries appear in sequence and should be distinguished; thus there is no definition of **allogeneic lymphocytes** but only of **allogeneic** and of **lymphocyte**. Superscript numerals refer to sections of an entry; see the paragraph above.

A note on alphabetical order

In this edition, we have listed the entries in strict alphabetical order as in the example given below. Greek letters appear where

Arrangement of entries

their fully spelt-out romanized version would appear, e.g. β , as beta.

Subscript letters have been ignored in listing. Numerals are listed before letters, e.g. C2 comes before caecal tonsils, for example

B

bacteriolysis

B blood group

BCG

β (beta) lysin

β_1 A globulin

β_2 A globulin

blast cell

blood group

B lymphocyte

B₁ lymphocyte

Abbreviations

<i>Amer.</i>	American spelling or usage.
<i>cf.</i>	compare.
<i>e.g.</i>	for example.
<i>esp.</i>	especially
Gell and Coombes	<i>Clinical Aspects of Immunology</i> (1963) 1st Edition. Oxford, Blackwell Scientific Publications.
H and E stain	haematoxylin and eosin stain.
<i>Hist.</i>	of historical interest only.
<i>i.e.</i>	that is to say.
<i>inter alia</i>	amongst other things.
Mol. wt.	molecular weight.
mm.	millimetre.
nm.	nanometre (millimicron, mμ).
N.B.	Note!
<i>obs.</i>	obsolete
<i>q.v.</i>	which see (where used, indicates important extension to definition).
®	Word known to be or thought to be a proprietary name. The inclusion of any other proprietary name without such indication is not to be taken as a representation by the editors or publisher that it is not subject to proprietary rights.
superscript numeral	
or letter.	see paragraph above headed 'Numbered sections'.
<i>Syn.</i>	synonym.
μm	micrometre (μ or micron).
<i>Vet.</i>	veterinary vaccine or usage.
<i>viz</i>	namely.

Other abbreviations, e.g. HSA, s₂₀ etc., will be found as entries in the text of the Dictionary.

absorption

ab. Abbreviation for **antibody**.

AB blood group. *See* **ABO blood group system**.

ABC. *See* **antigen binding capacity**.

aberrant clone. *See* **forbidden clone (preferred term)**.

ablastin. An antibody that inhibits the reproduction (by multiple fission) of *Trypanosoma (Herpetosoma) lewisi*, a parasite of the rat. This antibody appears to have no other function, e.g. it does not act as a lysin¹ or opsonin¹.

A blood group. *See* **ABO blood group system**.

ABO blood group substances. Soluble substances bearing **ABO blood group system** specificity. Present in human mucous secretions, e.g. ovarian cyst fluid, gastric juice, saliva, etc. of **secreters**. They are high molecular weight glycopeptides with a high-peptide-content backbone and oligosaccharide side chains bearing **ABO antigenic determinants** identical to those of the erythrocytes of the same individual.

ABO blood group system. One of the human blood group systems. It is the most important in blood transfusion serology because **natural antibodies** against ABO blood group antigens occur in serum. Humans belong to one of four groups: A, B, AB and O; the red cells of each group carry respectively the A antigen, the B antigen, both A and B antigens, or neither antigen. The antibodies in serum are specific for those ABO antigens not present on the red cells of the bearer, e.g. persons of group A have serum antibodies to B antigen, as shown in the table below. *See also* **universal donor**.

Blood group (phenotype)	Antigen on cells	Antibody in serum
A	A	anti-B
B	B	anti-A
AB	A and B	neither
O	neither	anti-A and anti-B

absorption. In immunology the term refers to the use of reagents to remove antigens or antibodies from a mixture. Used to remove unwanted possibly **cross-reacting antibodies** from an **antiserum**

absorption elution test

to make it more specific. Accomplished by adding antigen and then removing the antigen-antibody complex formed. Cf. **adsorption**.

absorption elution test. A test employed to identify the ABO blood group of human blood and seminal stains. The stain is first fixed by dipping into boiling water and is then treated with antiserum to one of the blood groups and excess serum removed by washing. Subsequent heating in saline to 56°C elutes any antibody that has combined with the stain; if red cells of the appropriate group are then added to the eluate, they agglutinate in positive cases.

accessory cell. Non-lymphocytic cell which functions as a modulator of immune responses or of lymphocyte function or development. Usually Ia-positive (see **Ia antigens**). In many cases, essential for **helper T lymphocyte** activity in initiating immune responses, the interaction between accessory cells and helper T lymphocytes showing **MHC restriction**, as the two cell-types require to be **syngeneic** for **Class II antigens**. See also **antigen-presenting cell**. Many accessory cells resemble the **mononuclear phagocytes** in their physiological characteristics but others e.g. **dendritic cells**² and **Langerhans cells** are not phagocytic.

acquired immunity. Immunity¹ that develops as a result of exposure to a foreign substance or organism. Cf. **native immunity** and **non-specific immunity**.

acquired immunodeficiency syndrome (AIDS). Severe immunodeficiency appearing in adults, and characterized by repeated bizarre and severe infections and an otherwise rare skin tumour, Kaposi's sarcoma. Common in homosexuals and heroin addicts esp. in USA. Patients appear to have a deficiency of **helper T lymphocytes**. Probably caused by a T cell leukaemia virus (HTLV-3).

acquired tolerance. Immunological tolerance induced by injecting very small or very large doses of antigen, and persisting only so long as that antigen remains in the body; in contrast to immunological tolerance arising naturally. See also **adoptive tolerance**.

activated lymphocyte. Any lymphocyte in an active state of differentiation. The term may therefore refer either to a lymphocyte that is proliferating on meeting antigen for the first time, or to a **committed lymphocyte** that is taking part in a cell-mediated immune reaction, reacting to a **mitogen**, or developing to produce antibody.

Addison's disease

activated macrophage. Macrophage with increased functional activity induced by a stimulating agent. The term was first used of macrophages that, following differentiation and increased DNA and protein synthesis, had become more efficient killers of bacteria (such as *Listeria monocytogenes*) than their predecessors. Activation in this system was usually T lymphocyte-dependent. The term activation is often also used to refer to the enhancement of other macrophage functions. It should probably only be used with a qualification defining the experimental system under study.

active immunity. Protection due to development of an immune response in an individual following stimulation with antigen, e.g. in a vaccine or during infection. Cf. **passive immunity**.

active immunization. Stimulation of an individual's immune responses in order to confer protection against disease. Effected by exposure to **protective antigens** either during the course of infection (which may be subclinical) or by **vaccination**. The protection effected takes a week or more to develop, but is then long lasting (see **immunological memory**) and rapidly revived by a **booster dose**, cf. **passive immunization**.

acute lymphoblastic leukaemia. Leukaemia in which the predominant cell-type is lymphoblast-like, and usually lacking T or B lymphocyte markers. Possibly a neoplasm of committed **stem cells**. In a minority of cases, the cells are identifiable as immature B or T lymphocytes.

acute myeloblastic leukaemia. Leukaemia in which the predominant cell-type is myeloblast-like (see **myeloid cell series**).

acute phase serum. Serum collected in the acute phase of an infectious disease. Cf. **convalescent serum**.

acute phase substances. Non-antibody substances appearing in increased quantities in plasma soon after the onset of infections or tissue damage. Many are proteins synthesized in the liver. They include **C reactive protein**, fibrinogen, certain **complement** components, α_1 -antitrypsin and α_1 -acid glycoprotein (orosomucoid). Functions still debatable.

ADCC. See **antibody-dependent cell-mediated cytotoxicity**.

Addison's disease. Adrenal cortical atrophy with hypofunction. In the so-called idiopathic form, lymphocytic infiltration of the atrophic cortex is seen, and **autoantibodies** to adrenal cortical tissue

adenosine deaminase deficiency

specific antigens (steroid hormone producing cells) are present in the serum in a high proportion of cases. Experimental allergic adrenalitis has been produced by injecting adrenal tissue into experimental animals.

adenosine deaminase deficiency. Enzyme deficiency found in children in close association with **severe combined immunodeficiency syndrome**. Inherited as autosomal recessive trait.

adjuvant. Substance injected with **antigens** (usually mixed with them but sometimes given prior to or following the antigen) which non-specifically enhances or modifies the **immune response** to that antigen. Thus **antibody** production or the reactions of **cell-mediated immunity** are more vigorous than would be the case were the antigen injected without adjuvant. In addition, the response may be modified qualitatively, e.g. antibodies of different immunoglobulin classes may be stimulated. *See* **aluminium adjuvants**, **complete Freund's adjuvant** and **pertussis adjuvant**.

Adjuvant 65®. A water-in-oil emulsion of antigen in arachis (peanut) oil stabilized by the addition of **Arlacel A®** and aluminium monostearate. This is accepted as a safe **water-in-oil emulsion adjuvant** for use in man as, being made from a vegetable oil, it is biologically degradable.

adjuvant disease. Clinical abnormality following injection of **complete Freund's adjuvant**, without an added antigen, into experimental animals especially rats. Characterized by inflammatory lesions in joints and periarticular tissues particularly those of the extremities and tail; hence *syn.* 'adjuvant arthritis'.

adjuvant granuloma. **Granuloma**^{2,3} that forms at the site of injection of **adjuvants**, e.g. **complete Freund's adjuvant granuloma** and **alum granuloma**.

adjuvanticity. The ability of a substance to enhance or modify an **immune response** in a non-specific manner (*see* **adjuvant**).

adoptive immunity. **Passive immunity** transmitted, not by antibody in serum but by **lymphocytes**. *See* **cell-mediated immunity**.

adoptive tolerance. A state of **immunological tolerance** in an irradiated recipient animal to which have been transferred **lymphoid cells** obtained from a donor made tolerant to an antigen.

adoptive transfer. **Passive transfer** of immunity by transferring lymphocytes from a **primed** donor to a non-immune recipient.

adsorption. Non-specific attachment of soluble substances, proteins, etc. to the surfaces of cells or inert particles. Useful in **serology**, e.g. an antigen may be adsorbed on to red cells and the antibody to it can then be detected by **agglutination** of the cells. Cf. **absorption**.

AET rosette test. A test for human T lymphocytes using aminoethylthiouridium bromide-treated sheep erythrocytes. These rosettes are more stable than E rosettes formed using untreated sheep erythrocytes (*see E-rosette forming cell*).

affinity. A thermodynamic expression of the strength of interaction or binding between two entities, e.g. between an antigen-binding site and antigenic determinant, and thus, of the stereochemical compatibility between them. As such it is expressed as the equilibrium or **association constant** (K litres mole⁻¹) for the antigen-antibody interaction but, since there is usually a heterogeneity of affinities within a population of antibody molecules of defined specificity it is, at the best, an average value referred to as the 'mean intrinsic association constant'.

The term affinity is most accurately applied to interactions involving simple, uniform determinants, e.g. haptens, thus obviating the difficulty of considering heterogeneous determinants on the same molecule.

Techniques for measuring affinity include **equilibrium dialysis**, **fluorescence quenching** and **ammonium sulphate precipitation** of antibody-hapten complexes.

affinity labelling. Immunochemical method of locating the **antigen binding site**. Antibody is treated with a chemically-reactive, radioactive **hapten**, which binds specifically to the antigen binding site and, more slowly, bonds covalently to amino acid residues surrounding the antigen-binding site. The antibody is then hydrolysed and the peptide fragment that has bound to the hapten is separated and identified.

ag. Abbreviation for **antigen**.

agammaglobulinaemia. *See hypogammaglobulinaemia (preferred term).*

Agarose®. Neutral polygalactoside purified from agar. Agarose gels differ from agar gels in that they show less adsorption of basic substances and less electro-osmosis. Used as a medium for **haemolytic plaque tests** and **leucocyte chemotaxis** assays.

agglutination

agglutination. Clumping of **particulate antigens**, e.g. red cells, bacteria, etc. by reaction with specific antibody which forms bridges between **antigenic determinants** on contiguous particles. As agglutination is easily visible, it forms the basis of many serological tests.

agglutinin. (1) An antibody that reacts with surface antigens of particles, e.g. red cells and bacteria, to agglutinate them. *See agglutination.* (2) Any substance, not necessarily antibody, capable of agglutinating particles, e.g. **lectin**.

agglutininogen. Term used in blood group serology to refer to a **particulate antigen** that reacts with an **agglutinin**¹.

aggressins. Diffusible substances produced by pathogenic bacteria. These substances though not necessarily toxic themselves, interfere with normal defence mechanisms and enhance the ability of the organism to establish itself in the host's tissues.

agranulocytosis. Pathological fall in the level of circulating **neutrophil leucocytes** resulting from depression of myelopoiesis. It results in a lowered resistance to bacterial infection, and often presents as a severe pharyngitis (agranulocytic angina). Death may follow from septicaemia, meningitis, etc. or myelopoiesis may be resumed and recovery follow. Can develop without known cause or following administration of certain cytotoxic drugs, e.g. nitrogen mustards, and also as an idiosyncratic response to normally harmless doses of various chemicals or drugs, e.g. chloramphenicol.

AIDS. *See* **acquired immunodeficiency syndrome**.

albumin. *See* **serum albumin**.

albumin agglutinating antibody. Antibody capable of causing **agglutination** of red cells in presence of high concentrations of serum albumin, e.g. 30 per cent **BSA**, but not in saline alone. Many **incomplete antibodies**¹ can be detected in this way, and the method has been extensively used for their detection in blood group serology.

albumin gradient centrifugation. *See* **density gradient centrifugation**.

Aleutian mink disease. A 'slow' viral disease of mink, particularly those homozygous for the Aleutian gene giving light coloured fur. The disease is transmissible, suggesting that it is due to an

allergic rhinitis

infectious agent. There are clinical and pathological similarities to **systematic lupus erythematosus** and **polyarteritis nodosa** in man. Characterized by hepatitis, vasculitis, nephritis, hypergammaglobulinaemia and the presence of anti-nuclear antibodies (*see anti-nuclear factor*). It is postulated that the chief pathogenic agents are the **immune complexes** formed in the disease.

alexin. Obsolete synonym for **complement**. The term used by Bordet to describe a thermolabile material present in serum that caused the lysis of cells that had previously been sensitized by an immune serum (*see sensitized cells*²).

ALG. *See anti-lymphocyte globulin.*

ALL antigen. (Acute lymphoblastic leukaemia antigen). Surface glycoprotein present on human **pre-B** and **pre-T lymphocytes**, but not expressed on more mature forms (**thymocytes**, **T lymphocytes**, **B lymphocytes**). Present on cells of the common form of acute lymphoblastic leukaemia, hence name.

allelic exclusion. A somatic phenomenon found in animals heterozygous for (an) antibody **allotype(s)**. Although the animal's serum contains both allotypic forms of **antibody**, individual **B-lymphocytes** express only one allotype, not both. Different **lymphocytes** therefore express the different allotypic forms of antibody. This unusual genetic phenomenon relates to the way that antibody genes are assembled in B lymphocytes.

allergen. Antigenic substance capable of provoking an **allergic response**. In common usage the term is restricted to substances, e.g. pollens and dander, that combine with reaginic antibody (**reagin**¹) to provoke allergic reactions in **atopic** subjects.

allergic alveolitis. *See farmer's lung.*

allergic encephalomyelitis. *See experimental allergic encephalomyelitis.*

allergic response. A specific immune response to antigen resulting in allergy.

allergic rhinitis. Exudative inflammation of the nasal passage occurring in **atopic** persons in contact with airborne **allergen** to which they are sensitive. Caused by local release of vasoactive substances in an **immediate hypersensitivity** reaction. Allergic rhinitis is a constant feature of hay fever.

allergic state

allergic state. Clinical term for diseases in which **hypersensitivity** plays a part, especially **atopic** diseases such as **hay fever**.

allergy. Term introduced by von Pirquet in 1906 to mean altered host reactivity to an antigen. No longer holds this meaning. Current use; a synonym for **hypersensitivity** especially of **immediate hypersensitivity** type, thus with implication of immunologically induced tissue damage.

alloantigens. Different (allelic) forms of an antigen coded for at the same gene locus in all individuals of a species. E.g. **histocompatibility antigens** are coded for at the same locus but vary between individuals.

alloantiserum. An antiserum directed against antigens of another animal of the same species and raised in that species. E.g. a serum made in one **inbred strain** of a species against another inbred strain of the same species.

allogeneic (allogenic). Genetically dissimilar within the same species. *See also* **transplantation terminology**.

allogeneic disease. **Graft-versus-host reaction** in animals under immunosuppressive therapy that have been given **allogeneic** lymphocytes. *See also* **secondary disease**.

allogeneic effect. (*syn.* abnormal induction). The stimulation of antibody production to a **thymus dependent antigen** resulting from allogeneic activation of **T lymphocytes**, as in a **graft-versus-host reaction**. Probably mediated by 'non-specific' factors released from activated T lymphocytes, obviating the requirement for **helper T lymphocytes**.

allogeneic inhibition. Term descriptive of cell or tissue damage caused by contact with **lymphocytes** differing at the **major histocompatibility complex**, e.g. inhibition of growth of a parental tumour (*in vivo*) or cell line (*in vitro*) by F_1 lymphocytes. The lymphocytes do not apparently need to be **primed**.

allogeneic restriction. *See* **MHC restriction**.

allograft. Graft exchanged between two genetically dissimilar individuals of the same species, i.e. members of an outbred population, or of two different **inbred strains**. Cf **syngeneic graft**.

allotope. *See* **allotypic determinant**.