A Dictionary of Immunology

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Compiled by members of staff of the
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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.

W. J. HERBERT
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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.

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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 **allogenic lymphocytes** but only of **allogenic** and of **lymphocyte.** Superscript numerals refer to sections of an entry; see the paragraph above.

Abbreviations etc.

Amer.	American spelling or usage.
cf.	compare.
e.g.	for example.
esp.	especially.
Gell and Coombs	*Clinical Aspects of Immunology* 3rd ed. Ed. P. G. H. Gell, R. R. A. Coombs and P. J. Lachmann. Blackwell Scientific Publications, Oxford, 1975.
H and E stain	haematoxylin and eosin stain.
Hist.	of historical interest only.
i.e.	that is to say.
inter alia	amongst other things.
Mol. wt.	molecular weight.
mm.	millimetre.
nm.	nanometre (millimicron, mμ).
N.B.	Note!
q.v.	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'.
Syn.	synonym.
μm	micrometre (μ or micron).
Vet.	veterinary vaccine or usage.
viz.	namely.

Other abbreviations, e.g. HSA, s_{20}, etc., will be found as entries in the text of the Dictionary.

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

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 **lysin**[1] or **opsonin**[1].

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 **secretors.** 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** 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.

acetylethylenimine. A substance used to inactivate pathogenic viruses for use as **inactivated vaccines.**

acquired immunity. Immunity[1] that develops as a result of exposure to a foreign substance or organism. Cf. **native immunity** and **non-specific immunity.**

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.**

acridine orange. A dye used to identify DNA and RNA. In cells stained with it and viewed under ultraviolet illumination, DNA shows as bright green, and RNA as orange-red. Used to identify **activated macrophages.**

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.

activated macrophage. (1) A **macrophage** that, following differentiation and increased DNA and protein synthesis, has become more efficient at killing bacteria (such as *Listeria monocytogenes*) or other target cells, than the predecessor macrophage from which it was derived. Products released from **T lymphocytes** on contact with antigen may act as macrophage activators. (2) The term is also sometimes used to refer to the enhancement of other macrophage functions. The preferred term for cells showing such enhancement is **stimulated macrophage** q.v.

activated reticular cell. A primitive reticular cell of the **spleen** or **lymph-node** that has a rounded or oval nucleus with prominent pyroninophilic nucleoli (*see* **methyl green pyronin stain**) and cytoplasm flecked with basophilic or pyroninophilic particles.

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** so as 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 and rapidly revived by a **booster dose,** cf. **passive immunization.**

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

acute phase substances. Non-antibody substances appearing in the plasma soon after the onset of infections or tissue damage. Some of these are agents of **non-specific immunity** and may be bactericidal. They include **C reactive protein** and **interferon.** The term may also include substances normally present, but which increase in quantity in similar conditions, e.g. fibrinogen and **complement.**

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 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 **combined immunity deficiency 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. antibody of different immunoglobulin types 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 most usages of the term this is non-specific (*see* **adjuvants**), but the term is used by some workers as an attribute of certain **antigens**[1,2], e.g. ultracentrifuged **BGG** is **non-immunogenic**[1] in mice although uncentrifuged material stimulates a normal immune response; the latter is therefore said to possess 'adjuvanticity'.

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 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.**

AEI. *See* **acetylethylenimine.**

affinity. A thermodynamic expression of the strength of interaction or binding between an antibody combining site and an 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 antibody **combining site.** Antibody is treated with a chemically-reactive, radioactive **hapten,** which binds specifically to the antibody combining site and, more

slowly, bonds covalently to amino acid residues surrounding the antibody combining site. The antibody is then hydrolysed and the peptide fragment that has bound to the hapten is separated and identified. This method has so far yielded an approximate, rather than a precise, location for the combining site.

ag. Abbreviation for **antigen.**

agammaglobulinaemia. *See* **hypogammaglobulinaemia** (*preferred term*).

agar gel diffusion. *See* **gel diffusion.**

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.**

agglutination. Clumping of **particulate antigens,** e.g. red cells, bacteria, etc. by reaction with specific antibody which forms bridges between **antigenic determinants** on contiguous cells. 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. **lectins.**

agglutinogen. 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.

AHG. Anti-human globulin. (N.B. in blood coagulation studies may also mean anti-haemophilic globulin.)

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. Method for separating cells of different types by centrifugation through a density gradient of albumin (e.g. **serum albumin**). Velocity sedimentation allows separation of cells according to size. A more sophisticated method is to use equilibrium sedimentation in which cells are separated according to their own density. As they descend through the gradient, each cell type reaches a point equal to its own specific gravity where it remains. Widely used for separating **lymphocytes** and bone marrow, **stem cells.**

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 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 **antigen–antibody 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.**

allergen. (1) Antigenic substance capable of provoking an **allergic response**[1]. 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.
(2) In Gell and Coombs' terminology, refers to any substance capable of provoking the **allergic state**[1] q.v.

allergic alveolitis. *See* **farmer's lung.**

allergic encephalomyelitis. *See* **experimental allergic encephalomyelitis.**

allergic reactions. *See* **type I, type II, type III** and **type IV reactions.**

allergic response. (1) Obsolete term for a **specific immune** response to antigen resulting in **allergy.**
(2) In Gells and Coombs' terminology; the response of the body leading to the development of the **allergic state**[1] q.v.

allergic rhinitis. Exudative inflammation of the nasal passage occurring in **atopic** persons in contact with airborne **allergen**[1] 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. (1) Defined by Gell and Coombs as: 'state of specifically altered potential reactivity to a particular chemically definable substance'. *See also* **allergy**[2].
(2) Clinical term for diseases in which **hypersensitivity** plays a part, especially **atopic** diseases such as **hay fever.**

allergized cell. Term used by Gell and Coombs to refer to any cell that has undergone a change in its responsiveness to antigen. Thus includes such terms as **committed cell**[2] and **sensitized cell**[1].

allergy. Term introduced by von Pirquet in 1906 to mean altered host reactivity to an antigen. No longer holds this meaning. Current use: (1) a synonym for **hypersensitivity** especially of **immediate hypersensitivity** type, thus with implication of immunologically induced tissue damage;
(2) by Gell and Coombs to mean heightened reactivity to antigen, i.e. any response of a **primed** animal other than **immunological tolerance;** thus synonymous with **immunity**[2] as used by most other immunologists.

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.

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

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

allogenic effect (*syn.* abnormal induction). The stimulation of antibody production to a **thymus dependent antigen** by using **allogenic** lymphocytes rather than antigen-specific **T lymphocytes.**

allogenic inhibition. Term descriptive of *in vitro* damage said to be caused to cells by contact with genetically dissimilar **lymphocytes.** The lymphocytes do not apparently need to be **primed.**

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. **syngenic** graft.

allotype. Genetically determined **antigenic determinants** varying in different members of the same species, i.e. serum protein **isoantigens.** On human **immunoglobulin** molecules are found the **Gm, Inv** and **Oz** allotypes.

α (alpha) chain. The **heavy chain** of **IgA.**

α chain disease. Rare **paraproteinaemia** described in subjects of eastern Mediterranean origin in which there is an infiltrative lymphoma especially of the intestine, associated with malabsorption. Abnormal **plasma cells** are present which manufacture only **α chains** but no **light chains.**

ALS. *See* **anti-lymphocyte serum.**

alternative pathway (alternate pathway). A pathway by which **complement** components C3–C9 are activated without a requirement for C1, C2 or C4. Can be activated by human **IgA** and by guinea-pig γ_1 globulin (i.e. **immunoglobulins** which do not activate the classical complement pathway), by endotoxin without antibody, and by polysaccharides from various fungal or bacterial sources. Sometimes called the properdin pathway since **properdin** is an essential part of it. *See also* **factor B** and **factor D.**