

# AN ABRIDGED GLOSSARY OF TERMS USED IN INVERTEBRATE PATHOLOGY

*Third Edition, 2006*

**Society for Invertebrate Pathology**  
<http://www.sipweb.org/glossary>

<b>David W. Onstad</b>	Dept. of Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL 61801, USA
<b>James R. Fuxa</b>	Dept. of Entomology, Louisiana State University Ag Center, Baton Rouge, LA 70803, USA
<b>Richard A. Humber</b>	USDA-ARS, US Plant, Soil & Nutrition Laboratory, Ithaca, NY 14853, USA
<b>Jesko Oestergaard</b>	Christian Albrechts Universität Kiel, Institute for Phytopathology, Dept. Biotechnology, 24118 Kiel, Germany
<b>David I. Shapiro-Ilan</b>	USDA-ARS, SE Fruit and Tree Nut Research Unit, Byron, GA 31008, USA
<b>Vladimir V. Gouli</b>	University of Vermont, Entomology Research Laboratory, South Burlington, VT 05405, USA
<b>Robert S. Anderson</b>	University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons, MD 20688, USA
<b>Theodore G. Andreadis</b>	The Connecticut Agricultural Experiment Station, New Haven, CT 06504, USA
<b>Lawrence A. Lacey</b>	USDA-ARS, Yakima Agricultural Research Laboratory, Wapato, WA 98951, USA

*First Edition, 1967*

*Second Edition, 1970*

**Edward A. Steinhaus and Mauro E. Martignoni**

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## **Introduction to the first and second editions**

In invertebrate pathology, as in other branches of science, we are in need of constant attention to and revision of the meaning of the terms used to describe our findings. Contributions toward this end are evident in a number of books and papers. However, these publications do not include lists of many terms which the student, researcher, or author will find pertinent to his work. Therefore, we have prepared a glossary of selected terms commonly appearing in the literature of invertebrate pathology, with the hope that it may be of use to invertebrate pathologists and to readers of invertebrate pathology literature. We also hope that this will stimulate the student to analyze a definition or explanation, and that he will not refrain from challenging the status quo or usage by instructors, textbooks, and other 'authorities.'

Terminology is a convenient tool but needs constant repair and improvement if it is to serve its purpose in a satisfactory manner. Thus, the definitions and explanations presented here will change, new terms will appear, and obsolete terms will be discarded.

The glossary presented here has grown out of a similar list of definitions presented in 1962 when both authors were on the Berkeley campus of the University of California. At that time, it was intended primarily for use by students enrolled in courses in insect pathology at the university. During the intervening years, its usage has extended far beyond that of the classroom. Moreover, as predicted, those inevitable changes have occurred in the use and meaning of words which require an 'up-dating' of the previous glossary. Accordingly, we are presenting a revised list for use by invertebrate pathologists generally, as well as students and authors of papers concerned with the diseases of invertebrate animals.

Most of the glossary to follow consists really not so much of definitions, as of explanations to indicate the general meaning of words and terms as most invertebrate pathologists may properly employ them. Derivations, pronunciations, and variations in meaning may, of course, be found in any reliable dictionary or lexicon. Moreover it should be remembered that the explanations in the present glossary are directed particularly to their use in invertebrate pathology and relate to the situation as found in invertebrates, especially insects. Many additional terms found in standard reference works are, of course, also used in invertebrate pathology. With few exceptions (e.g., polyhedrosis, granulosis), the names of specific diseases have not been included in the list.

## **Introduction to third edition**

We added approximately 400 terms and doubled the size of the glossary. We improved over 40 definitions from the Second Edition and deleted less than 30 terms that are no longer used or are too general for this glossary. Our goal was to emphasize terms that contemporary scientists would need to know to understand not only modern publications but also literature published before 1970. For less than 100 terms, we use verbatim (with permission) definitions from three published sources. One reason to do this is to maintain consistency across disciplines and across sources

within a discipline. Some very important, yet sometimes vague, terms must be consistently used in a discipline. For example, Shapiro-Ilan, D. I., J. R. Fuxa, L. A. Lacey, D. W. Onstad, and H. K. Kaya (2005. *J. Invert. Pathology* 88:1-7) presented the history and logic behind the definitions of virulence and pathogenicity. They addressed one group's attempt to change the traditional definitions used in invertebrate pathology. Steinhaus and Martignoni, in the first two editions, emphasized the variability in the definitions and use of the word 'disease' by presenting the following statements.

There are many definitions of the term disease. A healthy animal is one so well-adjusted in its internal milieu and to its external environment that it is capable of carrying on all the functions ultimately necessary for its maintenance, growth, and multiplication with the least expenditure of energy. The following are examples of the most significant interpretations of the word disease:

According to Birkeland (1942), "Disease, then is a process, not a thing and represents the response of the body to injury or insult. ... When the range of easy tolerance within which an organism can function without too great a strain is passed, the organism may be said to be diseased or in a pathic state." (Birkeland, J. M. 1942. *Microbiology and Man*. F. S. Crofts, New York.

According to Engel (1960), "Health and disease are relative concepts which do not easily lend themselves to simple definition. Disease corresponds to failures or disturbances in the growth, development, functions, and adjustments of the organism as a whole or of any of its systems. ... The broad definition of disease does not confine our attention to any single system or organization of the body. It permits us to conceptualize disturbances or failures at all levels of organization--biochemical, cellular, organ, psychological, interpersonal, or social--and to consider their inter-relationships. Further, it does not restrict us to any single etiologic concept but permits the application of a multi-factor concept." (Engel, G. L. 1960. *A unified concept of health and disease*. *Perspectives Biol. Med.* 3, 459-485.)

White (1926) stated "Disease--any destructive process whatever, no matter how small or of how short duration, comes within the meaning of the term. Not only are pneumonia and typhoid fever diseases in this sense, so is broken leg or a cut or bruised finger." White, W. A. 1926. *The Meaning of Disease*. Williams and Wilkins, Baltimore.

According to Dawkins and Rees (1959), "The chemical reactions of the cell are not a series of isolated reactions, but are all in dynamic equilibrium. Interference with one reaction will therefore affect the whole system to varying degrees. ... Disease can thus be considered as the modifications in cellular metabolism produced by pathogenic agents." (Dawkins, M. J. R., and K. R. Rees. 1959. *A Biochemical Approach to Pathology*. Edward Arnold Ltd., London.)

## **Other Resources**

We realize that this glossary cannot cover all terms that an invertebrate pathologist may encounter in his or her work. For example, invertebrate anatomy and morphology must be understood to study most pathogens. Yet we have chosen not to place these terms in this glossary. We recommend that SIP members consult the following sources for definitions of additional terms:

Nichols, S. W. 1989. *The Torre-Bueno Glossary of Entomology*. The New York Entomological Society. New York.

Gordh, G., and D. Headrick. 2001. *A Dictionary of Entomology*. CABI Publishing. New York.

Kirk, P. M. et al. 2001. *Ainsworth & Bisby's Dictionary of the Fungi. 9th Edition*. CABI

Publishing. Wallingford, UK

Sprague, V. and Becnel, J. J. 1999. Glossary. pp. 531-539. In *The Microsporidia and Microsporidiosis*, M. Wittner and L. M. Weiss, eds., American Society for Microbiology Press, Washington, DC.

Lee, J. J., G. F. Leedale, and P. Bradbury. 2000. *An Illustrated Guide to the Protozoa*, 2<sup>nd</sup> Edition. Vol. II pp. 690-1432. Society of Protozoologists, Lawrence, KS.

The Natural History Museum of Los Angeles County has a good glossary for terms concerning crustacea: <http://crustacea.nhm.org/glossary/index.html>. Two Internet glossaries for mollusks are <http://www.fish.washington.edu/naturemapping/mollusks/glossary.html> produced by R.L. Body at the University of Washington and <http://www.palaeos.com/Invertebrates/Molluscs/Mollusca.Glossary.html> on the Palaeos biodiversity web site.

### **Language**

We chose to produce this edition in English, not out of disregard for other languages, but because of the convenience of keeping the same language used in past editions. Anyone wishing to translate this glossary into another language is welcome to do so. The Society would likely be willing to post the translated version on its Internet web site. Permissions to use copyrighted definitions, however, do not currently pertain to translations.

M. E. Martignoni et al. 1984. *Terms used in invertebrate pathology in five languages: English, French, German, Italian, and Spanish*. USDA Forest Service Pacific Northwest Forest and Range Experiment Station. Gen. Tech. Rep. PNW 169.

### **Future Revisions**

Steinhaus and Martignoni stated “this glossary, to remain useful, must be revised at regular intervals. Users are urged to address their criticism and suggestions to the compilers and to propose additional entries to be included in future editions.” Therefore, users are encouraged to send their new definitions or suggestions for changes to the SIP Publications Committee for review. Minor changes to the document on the SIP web site will likely occur on an annual basis without the need for declaring new editions.

### **Acknowledgements**

The producers of this third edition thank several SIP members for their assistance. J. Harper provided the electronic, digital files of the first two editions of the glossary with a note about the wishes of Dr. Martignoni. L. Solter helped with interactions with the US Forest Service. G. Blissard provided two important definitions. M. Rotstein added the glossary to the SIP web site. The Publications Committee granted approval for our work and the publication of the document on the SIP web site.

## An Abridged Glossary of Terms Used in Invertebrate Pathology

### Third Edition

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Definitions cited with permission from another glossary or dictionary are indicated with a number referring to the source at the end of the definition. The sources are listed at end of glossary.

#### A

**Abnormality** The quality or state of being abnormal. A deviation from the normal. A structure, function or condition different from the usual. A malformation or teratology. A state of disease.

**Abundance** The incidence or density of organisms in relation to the area.

**Acarine disease** Parasitism of adult honey bees by Acarapis woodi (Rennie). The mite infests the tracheae, mainly those leading from the first pair of thoracic spiracles, and caused them to blacken. It causes no outward symptoms but shortens the lives of bees slightly. Infested colonies can survive indefinitely but sometimes, when most of their individuals become infested, they die in late winter. See also Isle of Wight disease.

**Accidental host** A host in which the pathogenic microorganism (or parasite) is not commonly found, nevertheless one suitable for the pathogen's development.

**Accumulation** (Cumulation) Enrichment of substances, toxins or organisms.

**Activity standardization** A process by which the activity of a microbial preparation is measured in standard activity units, i.e., units accepted by consent as a basis for comparison. Standardization can be of limited import, e.g., within one laboratory or among few laboratories, or it can extend nationally and internationally as it does for Bacillus thuringiensis preparations. See activity unit.

**Activity titer** (Potency) The amount of activity (e.g., insecticidal activity) per unit weight or volume of a product (such as a virus preparation). The activity titer is measured by determining the amount of product needed to obtain a specific response in a host. See bioassay, activity unit.

**Activity unit** A precisely defined standard of measure of the activity of a substance or product (such as a toxin or a virus preparation). Multiples of this standard unit are used for measuring the activity titer (potency) of that substance or product. Activity units are usually defined by national or international cooperation and accepted by consent as a basis for comparison. See activity standardization.

**Acute paralysis** A fatal disease of adult honey bees and of certain bumblebees, caused by a virus. Affected bees can neither feed nor fly, and they walk around with trembling legs and wings. At 30 degrees C. death occurs within 1 or at most 2 days following appearance of the symptoms. The virus particles are isometric and measure about 28 millimicrons in diameter.

**Acute** Of short duration. Characterized by sharpness or severity. As "acute disease."

**Adaptation** Changing of the physiology or morphology of species over many generations by the process of natural selection

**Additive effect** or **additivity** Cooperative action between two pathogens or agents, such that the total effect is equal to the sum of the effects of the agents taken independently; the agents may be substituted for each other in amounts inversely proportional to their activity.

**Additive** See Adjuvant

**Addled** (or abortive eggs, brood). This term is used by apiculturists to describe eggs that fail to hatch, larvae that fail to pupate, and pupae of honey bees that die without any apparent infection. Addled eggs and addled brood are the results of genetic anomalies. Highly inbred queens have been shown to produce addled progeny.

**Adjuvant** Aiding substance to increase the efficacy of a pesticide by the enhancement of properties like retention and penetration.

**Affinity** Attraction between organisms or substances.

**Aflatoxins** group of secondary fungal metabolites (mycotoxins) mostly produced by *Aspergillus flavus*, *A. niger*, and *A. parasiticus*; toxic and carcinogenic for animals and humans.

**Age-specific mortality rate** A mortality rate for a specified age group, in which the numerator (number dead) and denominator (number at risk) refer to the same age group. 3

**Agglutinin** A molecule capable of agglutinating particles, probably as a result of its possession of two or more binding sites specific for determinants on the particle e.g. some lectins.

**Aggregation** Clotting, agglomeration, agglutination, clotting or clumping of single parts, cells or individuals.

**Agonist** Chemical substance, which imitates the effect of signalling molecules, e.g. neurotransmitter or hormones.

**Allele** DNA code which is located at the same gene locus on homologous chromosomes responsible for a certain character. Mutation can move the allelic genes to other loci.

**Allograft** A tissue graft between two genetically different individuals of the same species.

**Alternate host** See intermediate host.

**Alternation of generations** The alternation in the life cycle of an organism of forms produced in a different manner, esp. the alternation of sexual with asexual generations.1

**Amebocyte** See Coelomocyte and Hemocyte.

**Amensalism** A type of symbiotic relationship in which one of the partners is inhibited and the other is not affected.

**American foulbrood** A disease of larval honey bees caused by Bacillus larvae White. Infection occurs in the youngest larvae and death is most frequent when the insects are in the prepupal or pupal stage, after the cells have been capped. American foulbrood is found at any time of the year when brood is present, in the temperate and subtropical regions throughout the world. No large beekeeping area is entirely free of the disease. Synonymous with Black brood, Ropy brood.

**Amoeba disease** Infection of adult bees by Malpighamoeba mellificae Prell. The amoeba multiplies and encysts in the lumen of the malpighian tubules. The infection has not yet been shown to cause any symptoms. A disease of grasshoppers in which an amoeba Malameba locustae (King and Taylor), infects primarily the malpighian tubes has also been called amoeba disease (or amoebic disease).

**Amoebic disease** See Amoeba disease.

**Amoebiosis** Infection caused by an amoeba.

**Amplification** Raising the number of copies of a gene or plasmid in a cell.

**Amyloidosis** Amyloid degeneration. A pathologic condition linked with the formation

of deposits of amyloid, a type of protein, in various organs or tissues. Amyloidosis occurs in mated queen honey bees, and it seems to cause premature drone laying. The amyloid is deposited in the cytoplasm of the spermathecal epithelium of the affected queens.

**Anamorph** (adjective: anamorphic) The asexual (conidial or imperfect) stage in the life history of an ascomycete (or, rarely, basidiomycete) fungus; the anamorph may have a nomenclaturally valid name different from its teleomorph (sexual state).

**Anchoring disk** A complex membrane, demonstrated by electron microscopy, appearing as a vertical section of an umbrella, continuous with the outer covering of the polar filament and presumed to anchor the everted filament to the microsporidian spore during discharge of the sporoplasm.<sup>1</sup>

**Anisogamous gametes** Gametes or gametic cells that consistently differ in size, the larger designated “female”, the smaller “male”.<sup>2</sup>

**Antagonism** or **antagonistic effect** (1) The total effect of two pathogens or agents on a host is smaller than the effect of the most active agent alone. (2) Direct impairment of an organism by another using means of e.g. competition, parasitism, predatory behaviour.

**Antagonist** Organism which counteracts the development of another organism.

**Antibacterial peptides** Very compact, low molecular weight, often inducible peptides that have antibacterial activity.

**Antibiotica** Substances, produced by micro-organisms, which inhibit selectively the growth of other micro-organisms or kill them.

**Antibodies** Substances (modified blood globulins in vertebrates) that are produced in the body of the animal in response to entering or introduced antigens.

**Antigen, Nonvirion** See Nonvirion antigen.

**Antigens** Substances (especially proteins) that are introduced or gain entrance into the blood and that stimulate the production of antibodies or, as far as insects are concerned, other protective, lytic, or cidal substances. See also Immunogen.

**Aphagia** Inability to ingest.

**Apimyiasis** Myiasis of the adult honey bee caused by the larvae of *Senotainia tricuspis* Meigen, *Rondanioestrus apivorus* De Villers, and certain other fly species.

**Aplasia** The entire failure of organs or tissues to develop. The congenital absence of an organ or tissue.

**Aposymbiotic** Separated from its symbionts. Symbiont-free. Usually refers to mutualistic symbionts (see mutualism).

**Apparent infection rate** The increase in disease prevalence per unit of infected host tissue per unit of time (see also Infection Rate)

**Appressorium** Differentiated apical structure on a fungal hypha or germ tube closely applied to the host's outer surface and serving as an organ from which penetration to the host's interior occurs.

**Archaeocyte** An ambocytic cell type found in the parenchyma of sponges. It acts as a phagocyte and encapsulative cell and disposes of phagocytized foreign material by migrating to the exterior of the body of the sponge.

**Arnhart's black-egg disease** See Melanosis.

**Asexual reproduction** Reproduction by means of fission or budding, binary or multiple of a single parental organism or by production of spores.<sup>2</sup>

**Assimilation** The energy requiring formation of autologous organic substances out of internalized inorganic (in case of most of the plants) or organic (in case of fungi, nearly all bacteria animals and humans).

**Asthenobiosis** Comatose condition of insect associated with blockade of epithelium of Malpighian tubules by means of urates. Appearance is characteristic for amoebioses.

**Athrocyte** A cell that removes waste substances and certain foreign material by pinocytosis, storing the material in a granular form in cytoplasmic vacuoles. Those that occur in gills of decapod crustaceans also have been termed nephrocytes or podocytes.

**Atrophy** (1) Decrease in size of a tissue, organ, or part after full development has been obtained. A wasting of tissues, organs, or entire body from disuse, old age, injury, or disease. A condition in which the affected cells undergo degenerative and autolytic changes, become smaller, and have a lessened functional capacity. (2) If there is destruction of some of the cells in a tissue we speak of "quantitative atrophy" (see Hypoplasia (2)).

**Attenuated infection** An infection which is not immediately followed by overt disease. An attenuated infection may follow a phase of overt disease. One usually recognized three types of attenuated infection, i.e., Microbial persistence, Latent infection, and the Carrier state. See also inapparent infection or progressive infection.

**Attenuation** The process of decreasing the virulence of a microorganism.

**Autograft** A tissue graft from one part of the body to another part of the body of the same individual, or between two genetically identical different individuals (identical twins).

**Autoinfection** Transmission of infection from one cell to another in the same host individual in the same or different tissue.

**Autoinfective spore** One of a class of spores designated by function. A spore the specific function of which is to inject its sporoplasm into another host cell of the same or a different tissue. Probably quite common in the microsporidia. 1

**Avidity index** If, in a population of phagocytic cells, the particles inside positive cells are counted, the mean number of particles per cell is recorded as the avidity index. Compare with "Phagocytic index".

**Axenic cultivation** The rearing of one or more individuals of a single species in or on a nonliving medium.

**Axenic** Free from associated organisms.

**Azygospore** A fungal resting spore state of a zygomycete fungus having a thick (bilayered) wall formed without a prior conjugation of gametangia of a zygomycete fungus. While azygospores are usually thought to be of asexual origin, this term refers only to the mode of formation whether or not karyogamy and meiosis occur in them before germination. Also see zygosporium.

## B

**Bacillary necrosis** Synonym Focal Necrosis. Multiple abscesses containing masses of unidentified gram-positive bacteria in the vesicular connective tissues of the Pacific Oyster (Crassostrea gigas). Has been suspected, but not confirmed, to be associated with significant oyster epizootics in Japan and the Pacific Coast of the United States.

**Bacillary paralysis** A disease of silkworm larvae caused by ingestion of spores and parasporal crystals of Bacillus thuringiensis var. alesti Toumanoff and Vago and var. sotto Ishiwata. The sudden onset of general paralysis, a few hours after ingestion of the toxin, is a pathognomonic symptom of the disease. The paralysis is usually irreversible and followed by death. Synonymous with Sotto disease.

**Bacteremia** The presence of bacteria in the hemolymph or blood of invertebrates and other animals, without production of harmful toxins or other deleterious effects.

**Bacterial schlauffsucht** Fatal disease of the Mediterranean flour moth, Anagasta

kuehniella (Zeller), and of other lepidopterous larvae caused by spores and parasporal crystals of Bacillus thuringiensis Berliner.

**Bacteriocyte** A cell containing mutualistic and commensalistic microsymbionts distinctly bacterial in nature. See also Mycetocyte.

**Bacteriophage** A bacteria specific virus, often used as vector for gene transfer and in diagnostics of bacteria.

**Bacteriosis** Any disease caused by the presence of bacteria.

**Baculovirus** Primarily entomopathogenic, rod-shaped, double-stranded DNA virus embedded in proteinaceous occlusion bodies of viral origin that are either 0.5-15 micrometer polyhedra or 300-500 nanometer long granules.

**Bassianolide** A cyclodepsipeptide mycotoxin produced by mycelia of *Beauveria bassiana*, *Lecanicillium lecanii* and other fungal pathogens of the Clavicipitaceae.

**Beauvericin** A cyclodepsipeptide mycotoxin produced by some species of *Beauveria* and *Fusarium*.

**Beauverolide** A family of cyclic depsipeptide mycotoxins isolated from species of *Beauveria* having suppressive effects against immune responses in some insects.

**Bee paralysis** See Acute paralysis, Chronic paralysis.

**Beta-1,3-glucans** Pattern recognition molecule associated with fungi and yeast.

**Bettlach May disease** A paralysis of adult honey bees, reported chiefly from Switzerland, caused by poisonous substances in the pollen of Ranunculus species (buttercups). Buttercup pollen is collected by the bees only when no other forage is available. The poisoned bees cannot fly, twirl rapidly or turn somersaults, and die from 3 to 5 days after feeding on the pollen.

**Binary division** Dividing of a cell into two nearly equal daughter individuals.1

**Binding site** Special region of an enzyme that binds the specific substrate (active centre).

**Bioaccumulation** Enrichment of a substance in organisms by uptake from the surrounding medium or from nutrients.

**Bioassay** Biological assay. The measurement of the potency of any stimulus, physical, chemical, biological, physiological, or psychological, by means of the response which it produces in living matter.

**Biochemical lesion** The initial biochemical change in tissue cells which precedes any damage visible with the light microscope.

**Biocoenosis** Community of all living organisms regularly inhabiting a biotope (life community).

**Biodiversity** Generic term for the entirety and variety of the forms of life in all levels of organisation

**Biological control** The use, by man, or living organisms to control (usually meaning to suppress) undesirable animals and plants. Some authors consider biological control to be a part of natural control, and use the term to refer to the action of parasites, predators, or pathogens on a host or prey population which produces a lower general equilibrium position than would prevail in the absence of these agents. Certain nonorganismal biological factors, such as metabolic and genetic diseases, when used in control may be included in the concept of biological control. That type of biological control involving the use of microorganisms is usually called "Microbial control."

**Biotic insecticide** An organism used to suppress a local insect pest population. To some, the word "insecticide" implies a more-or-less temporary action comparable to that of a chemical insecticide. Others object to the work "insecticide" as minimizing the difference between chemical and biological control and as being a source of confusion with purely chemical products in the minds of growers and others. In the case of a microorganism, the term "microbial insecticide" is sometimes preferred.

**Biotype** A strain of a species with distinct physiological characteristics.

**Black brood** See American foulbrood.

**Black Gill disease** More correctly termed Black Gill Syndrome is a generalized sign of host response, in penaeid shrimp and other decapods, to a variety of infectious and non-infectious insults to gill tissue. The grossly observable blackening has been proven in some cases and suspected in others to result from deposition of melanin by infiltrating hemocytes. Examples of identified causes of the syndrome are heavy metal toxicity (cadmium) and fungus infections (Fusarium sp.).

**Black mat syndrome** Black mat disease. An invasive mycotic infection of tanner crabs, Chionoecetes bairdi Rathbun and C. opilio Fabricius, characterized by black hyphae and fruiting bodies, often dense, encrusting the carapace, and unpigmented hyphae in virtually every organ of the crab. Epidermis and subepidermal tissues are replaced by hyphae in advanced cases. The causative agent is an ascomycete, Trichomarix invadens Hibbits, Sparks, and Hughes.

**Black scale fungus** *Myriangium duriaei* and similar *Myriangium* species.

**Black-egg disease** See Melanosis.

**Blastospores** Small, easily circulated units of vegetative fungal cells formed by budding or dissociation of mycelium at septa, formed in a host's hemocoel or in liquid culture. Note that despite the inclusion of 'spore' in this term, these cells are strictly vegetative and, as such, are physiologically and functionally different from reproductive spores (conidia, etc.).

**Blister disease** A disease of the earthworm *Eisenia foetida* (Savigny), characterized by the appearance on the body wall of blisters filled with yellow, cloudy material. As the disease progresses the blisters break open and the worm fragments and dies.

**Blue disease** A rickettsial disease of the larvae of the Japanese beetle, *Popillia japonica* Newman, and of other related scarab larvae. The causative agent is *Rickettsiella popilliae* (Dutky and Gooden) Philip. The name of the rickettsiosis derives from the bluish appearance of the diseased grubs.

**B-Melanosis** See Melanosis.

**Bonitation** Visual assessment of differences in symptoms, intensity of infestation, phytotoxicity, effects of plant protectants and others.

**Brachyosis** A bacterial disease of certain *Malacosoma* species (tent caterpillars), caused by *Clostridium brevifaciens* Bucher and *Clostridium malacosomae* Bucher. These anaerobic bacteria multiply especially in the anterior half of the larval midgut, causing a form of dysentery, sluggishness, shortening of the larval body, and death of the younger larvae. Older larvae may survive the disease.

**Budding** Dividing of an individual, uninucleate or multinucleate, into two individuals of distinctly unequal size.1

**Bundle virion** See Multicapsid virion.

## C

**Capilliconidium** Special type of passively dispersed secondary conidium of entomophthoralean fungi, which is produced on slender capillary tube (conidiophore) developing on a primary or secondary conidium.

**Capsid** The protein coat or shell of a virus particle. The capsid is a "Surface crystal," built of structure units. The structure units are the smallest functionally equivalent building units of the capsid. The structure unit could be a single polypeptide chain or an aggregate of identical or different polypeptide chains. In a shell with cubic symmetry the structure units can associate in a limited number of ways, forming

symmetric clusters. These clusters are the morphological units which may be seen with the electron microscope, and for which the word capsomere has been proposed. See also Nucleocapsid and Virion.

**Capsomere** A cluster of structure units arranged on the surface of the nucleocapsid, in viruses possessing cubic symmetry. These clusters (capsomeres) may be discerned in electron micrographs of negatively stained preparations. See also Capsid.

**Capsulate** Having a capsule.1

**Capsule** (1) A common and very general term that has been applied to a great variety of unrelated covering devices. (2) A structure composed of hemocytes that have enclosed a foreign body.

**Carbon dioxide sensitivity** A disease of adult fruit flies (*Drosophila*), caused by sigma virus. The presence of sigma virus in a fly is not harmful so long as the insect is not exposed to pure carbon dioxide. However, even a very brief contact with pure carbon dioxide gas is lethal to infected (sensitive) flies. The virus is transmitted to the offspring by the gametes of one or both parents.

**Carrier state** One type of attenuated infection characterized by the presence of a pathogenic microorganism within or upon host tissues. There is no evidence of overt disease in the host, but the pathogen retains its virulence towards other members of the host's species.

**Case fatality rate** The proportion of individuals contracting a disease that die of that disease. 3

**Castration, parasitic** See parasitic castration.

**Catabolism** Energy releasing metabolic degradation.

**Caudal appendage** Almost any posterior extension of an organism's body.2

**Cause specific mortality rate** The mortality rate from a specified cause for a population. The numerator is the number of deaths attributed to a specific cause. The denominator is the at risk population size at the midpoint of the time period. (Source: Principles of Epidemiology. Second Edition. U.S. Department of Health and Human Services, 12/95; IDPH Vital Statistics Report, 1990)

**cDNA (complementary DNA, copy DNA)** A DNA molecule synthesised by a reverse transcriptase using an mRNA molecule as a template. The cDNA molecule is complimentary to the mRNA molecule.

**Cell adhesion factors** An example is peroxinectin, a hemocyte product of arthropods that mediates cell attachment, spreading, encapsulation and degranulation; its activities are concomitant with prophenoloxidase activation.

**Cell culture** This term is used to denote the growing of cells in vitro, including the culture of single cells. In cell cultures the cells are no longer organized into tissues. See also Tissue culture, Organ culture.

**Cellular immunity** Immunity which is mediated by cells in the immediate vicinity of the target; usually involves phagocytic activity and can include extra-cellular processes leading to target cell death.

**Censored data** Data that result when the dependent variable represents the time to a terminal event, but the duration of the study is limited in time. The major example in invertebrate pathology is the determination of host survival time after exposure to a pathogen; animals that do not die by the end of the experiment produce censored data.

**CFU (colony forming units)** Propagation form or cell of a micro-organism, which grows to a colony on the appropriate substrate.

**Chalkbrood fungus** Fungal disease of larval bees, caused by species of the ascomycete genus *Ascospheera*.

**Chalky disease** see Chalkbrood fungus

**Chalky disease** A septicemia of the cicada Okanagana rimosa caused by a nonsporeforming bacterium of the family Corynebacteriaceae.

**Challenge injection** An injection of infective material or of an allergenic substance given to an animal to test for immunity or sensitization. The challenge injection is given after a waiting period, following a series of immunizing or sensitizing injections of the same material.

**Chemotaxis** The migratory response of hemocytes to chemicals produced by invading microorganisms or necrotic tissue, wherein the cells are attracted to and acculate at the site of the reaction.

**Chlamydospore** A fungal resistant stage usually produced by the thickening of the wall on a single cell or small group of vegetative cells and able to act in a spore-like (dispersive, environmentally resistant) manner but that immediately continuing vegetative growth upon 'germination' rather than producing another type or spore or germ tube.

**Chromosome cycle** Haploidy and diploidy in the successive phases of the live cycle and

the processes of change, if any, from one number of chromosome sets to another.<sup>1</sup>

**Chronic paralysis** A fatal disease of adult honey bees and of certain bumblebees, caused by a virus. Affected bees are able to feed normally, but they are feeble and tremble in movement. Their limbs and wings are held slightly spread. Chronically paralyzed bees live for several days after appearance of the symptoms, unlike acutely paralyzed bees (See acute paralysis). Strongly basophilic cytoplasmic inclusions (Morison's cell inclusions) appear in the hindgut epithelium. The virus particles are ovoid and occasionally irregularly shaped, with an average size of 27 by 45 millimicrons. They are found in large numbers in the thoracic and abdominal ganglia of the sick bees. It appears that queens in colonies with chronic paralysis transmit the virus or susceptibility to the disease or both to their offspring.

**Chronic stunt** A viral disease of larvae of the navel orangeworm, *Amyelois transitella*. Infected larvae grow at a slower rate than normal larvae and become distinctly pink. As the disease progresses, the larvae no longer move about and show signs of fat depletion and desiccation. The cadavers are dry. The chronic stunt virus (CSV) is a small isometric RNA virus (diameter 25nm.).

**Chronic** Of long duration. Not acute. As "chronic disease."

**Ciliatosis** Any disease caused by ciliates (a class of ciliophoran protozoa).

**Cistellae** Flattened vesicles of uniform size and clustered around the polar filament in some microsporidia. Thought to be homologous with the polaroplast of most genera.<sup>1</sup>

**Clear heads, disease of the** See Gattine.

**Cloning** Integration of a gene or a DNA sequence to a vector or into a genome.

**Coagulocyte** A type of hemocyte, more especially a kind of cystocyte, found in insects. These cells burst spontaneously on coming in contact with a foreign surface. Their disintegration leads to formation of islets of coagulation which involve other hemocytes that are near the foreign body, but not in contact with it.

**Codon** Information triplet of three neighbouring bases on the DNA or RNA for one amino acid.

**Coelomocyte** Any cell that occurs normally in the coelomic fluid of coelomate invertebrates. Also referred to as leukocytes or amebocytes.

**Coenocytic** Presence of multiple nuclei in the cytoplasm that is not partitioned by cross-walls, cell membranes, or complete septa. A nonseptate condition also known as "syncytial."<sup>2</sup>

**Collenocyte** A numerous cell type in sponges that is occasionally involved in phagocytosis and encapsulation of foreign material.

**Colony** Permanent or semi-permanent physically very close association of a group of adult individuals in some specific morphological arrangement with various degrees of physiological integration.<sup>2</sup>

**Commensal** Microbe living in or on another organism with a relationship the does not benefit or harm the host.

**Commensalism** A symbiotic relationship in which one of the two partner species benefits, without apparent effects on the other species. See also Symbiosis.

**Communicable disease** See Contagious disease.

**Complement** Complement is a system of enzymes which, upon activation, generates membrane-lytic activity, as well as molecules involved in chemotaxis and enhanced phagocytosis. The classical complement pathway is antibody-dependent and therefore not relevant to invertebrates. However, the alternate complement pathway is activated by bacteria and yeasts, and has been described in several invertebrates

**Complicating disease** A disease supervening during the course of an already existing affection. See also Complication.

**Complication** A morbid process or event occurring during a disease, which is not an essential part of the disease itself, though it may result from it or from independent causes.

**Congenital disease** One that is present in an animal at birth. A congenital disease is not necessarily inherited.

**Conidiospore** see conidium Note: 'Conidiospore' is an inherently redundant term that it not officially recognized or used by mycologists; its use should be avoided!

**Conidium** A nonmotile, asexual fungal spore formed by any of many possible means on some sort of specialized conidiogenous cell, or formed directly in some instances laterally on a hypha.

**Contagious disease** A disease which is naturally transmitted by contact, either direct or mediate. Synonymous with Communicable disease.

**Contamination** Harboring of or contact with microorganisms (or other organisms such as insect parasites) in absence of a relationship which may be considered commensalistic, mutualistic, or parasitic.

**Control** (1, noun) Something that affords a standard of comparison or means of

verification. (2, verb) Control (biological, chemical, etc.) of insects and other undesirable animals -- the maintenance of or the effort to maintain a population density below the point where injury to man's interests occurs.

**Cordycepin** Insecticidal toxin and antibiotic isolated from fungus *Cordyceps militaris*.

**Coremium** (plural: -emia) see Synnema

**Crayfish plague** See Krebspest.

**Crowding effect** Negative effect of overpopulation on propagation and growth of the individuals.

**Cry** Abbreviation for the crystal proteins of *Bacillus thuringiensis*.

**Cryptogramm** Designation of virus structure as four couple of symbols.

**Crystalliferous** Producing or bearing crystals. The term is applied to a number of *Bacillus* species which, in addition to the endospore, produce a discrete, characteristic crystal or crystal-like inclusion in the sporulating cell. One of the best-known crystalliferous bacteria capable of infecting insects is *Bacillus thuringiensis* Berliner.

**Cumulation** See accumulation.

**Cyclops** A deformity of honey bees ("cyclops" bees) of hereditary origin, consisting of a fusion of both compound eyes at the vertex of the head.

**Cyst** (1) A nonmotile, thin-walled resting state of fungi and other microbes and protozoa. *For pathogenic aquatic fungi*, usually a brief transitional stage formed from a flagellate zoospore or planozygote just before germination to initiate penetration of a host. *For protozoa*, usually a dehydrated, environmentally resistant and potentially long-lasting dormant stage in the life cycle. (2) Cyst formation can be a host response.

**Cytocidal** That which kills cells.

**Cytoplasmic polyhedrosis** A viral disease of insects, mainly the larvae of certain lepidoptera, characterized by the formation of polyhedral inclusion bodies (polyhedra) in the cytoplasm of the midgut epithelial cells. See also Polyhedrosis.

**Cyt proteins** Crystalline *Bacillus thuringiensis* proteins possessing hemolytic activity.

**D**

**Dauer stage or dauer larva** A developmentally arrested stage in certain nematodes; in entomopathogenic nematodes it is the only free-living stage and is also known as infective juvenile.

**Defaunate** To remove from an organism its commensalistic or mutualistic microfauna, for which the organism ordinarily serves as a host. Such as removing flagellates from the alimentary tract of termites. See also Commensalism, Mutualism.

**Deficiency disease** A disease resulting from lack of carbohydrates, proteins, amino acids, fatty acids, vitamins, or trace minerals, or other essential constituents and elements of the diet.

**Definitive host** Primary host. When a parasite lives in two or more hosts, this is the host in which the parasitic organism reaches the adult stage and undergoes sexual reproduction.

**Density, population** See Population density.

**Density-dependent factors** Factors whose effects on a population are dependent upon the density of that particular population. Density dependence may be direct or inverse.

**Density-independent factors** Factors whose effects on a population are not dependent upon the density of that particular population.

**Densonucleosis** A fatal disease of larvae of the wax moth, *Galleria mellonella* (Linnaeus), caused by a virus. The agent replicates in most tissues of the insect, with the exception of the midgut and nervous system. The nuclei of the infected cells become progressively larger, lose their characteristic structure and, in histological preparations, they appear as compact, densely stained masses. The virus particles are isometric, with an average diameter of 20 millimicrons.

**Dermo** (Perkinsiosis). A parasitic disease of the American oyster (*Crassostrea virginica*) caused by the protistan parasite *Perkinsus marinus* (formerly *Dermocystidium marinum*).

**Dermomyositis** A disease occurring in several genera of parasitic nematodes. It is characterized by necrotic cuticular lesions. The intestinal bacteria of the host mammals have been implicated as causal agents.

**Destruxins** A group of cyclic depsipeptide mycotoxins produced by some *Metarhizium* isolates and by other fungi and that have some varying insecticidal effects.

**Deuteromycetes, Deuteromycotina, Deuteromycota** Class, Subkingdom, and Kingdom, respectively, of “imperfect” fungi not routinely found to produce a sexual state but forming conidia or only sterile mycelium. Two classes—

Hyphomycetes (including almost all entomopathogenic forms occur) and Coelomycetes (with the conidial apparatus enclosed in a walled fruiting body)—are reocognized (neither class with orders or families recognized) but mycologists are using phylogenetic techniques to remove fungi from this group to classify them appropriately with their phylogenetic relatives in the ascomycetes and, to a lesser extent, basidiomycetes.

**Deutomerite** Nucleus containing, posterior most segment of a septate gregarine.<sup>2</sup>

**Diagnosis** To distinguish one disease from another. The determination of a disease from its signs, symptoms, etiology, pathogenesis, physiopathology, morphopathology, etc.

**Diapedesis** (a leaping through). In human and veterinary pathology, the use of the term is confined to the passage of blood cells, especially erythrocytes, through unruptured vessel walls into tissues. In invertebrate, especially molluscan, pathology the term is also used for the passage of leucocytes which may or may not contain phagocytosed material across epithelial borders to the exterior of the body.

**Diathesis** An inherited constitutional state whereby an individual is especially liable to a certain disease.

**Digenic life cycle** A life cycle that involves two different host species.<sup>2</sup>

**Dihaplophase** That part of a microsporidian life cycle in which each individual is diplokaryotic.<sup>1</sup>

**Dihaplophasic** Diplokaryotic.<sup>1</sup>

**Dimorphosporous** Having in the life cycle two distinctly different morphological types of spores. May be used as a replacement for the ambiguous term “dimorphic”.<sup>1</sup>

**Diplokaryon** A pair of haploid nuclei, more or less intimately associated and functioning together as a diploid nucleus.<sup>1</sup>

**Diplokaryotic** Having one or more diplokarya. Dihaplophasic. <sup>1</sup>

**Diplophase** That part of a life cycle in which the nuclei are diploid. Limited to the zygote in microsporidia.<sup>1</sup>

**Diplosis** Doubling of the chromosome number.<sup>1</sup>

**Direct causes** Those factors or agents which cause disease directly, including poisons, microorganisms, entomophagous parasites, physical or mechanical agents, glandular disturbances and nutritional deficiencies. At times a single agent may be both a predisposing and a direct agent--cold may predispose to bacterial infection

and also be the direct cause of tissue death by freezing. Also called "Primary etiologic factors."

**Disease** Lack of ease. Departure from the state of health or normality. Condition or process that represents the response of an animal's body to injury or insult. A disturbance of function or structure of a tissue or organ of the body, or of the body in general. (See also Syndrome)

**Disinfect** To eliminate pathogenic organisms or render them inert.

**Disintegration, watery** See Watery disintegration.

**Disporoblastic** Pertaining to a sporont that produces two sporoblasts. 1

**Disposition** The genetically determined susceptibility of a species to a damage factor.

**Dissimilation** The energy generating degradation process of the metabolism.

**Distal** Situated away from the point of attachment or origin. Recommended for use in reference to organelles associated with the coiled polar filament, in microsporidia as the distal (rather than "posterior") part of the polaroplast. 1

**DNA** (deoxyribonucleic acid). Polymer compound of deoxyribonucleotides. The nucleotides consist of an organic base (adenine, thymine, guanine or cytosine), a sugar molecule (desoxyribose) and a phosphoric acid. The genetic information is encoded by the sequence of the different bases.

**Drone broodiness** See Morbid drone-laying.

**Drone-laying** See Morbid drone-laying.

**Droopy wing syndrome** A disease of adults of the Mediterranean fruit fly, Ceratitis capitata. The disease, of unknown etiology, is characterized by the insect's inability to fly and by the abnormal resting position of the wings. Various flight muscles of droopy-winged individuals are missing or underdeveloped.

**Dustable powder** Special powder formulation of microorganisms used in biological control.

**Dutch shell disease** Similar to or the same as Maladie du pied.

**Dysentery** A term given to a number of disorders marked by lesions of the alimentary canal and often attended by abnormal frequency and liquidity of fecal discharges. In sericultural practice the term flacherie has been used for certain forms of dysentery of the silkworm larvae.

## E

**Eclipse period** In the developmental cycle of viruses, a phase or period, occurring immediately after infection (i.e., immediately after a virus enters the host cell), in which infective particles cannot be detected. The phase during which the infected host cell contains no material capable of infecting another cell or another host.

**ED<sub>50</sub>** See Median effective dose.

**Effectiveness** Efficacy. A product's ability to produce the specified action, e.g., the ability of a microbial preparation to actually control the intended target pest.

**EIA** (Enzyme immuno assay). Quantitative determination of biologically active substances (e.g. Hormones, Pharmaka, Viruses, Antibodies) in liquids containing antigens labelled with enzymes.

**ELISA** (Enzyme linked immuno sorbent assay). A technique to detect or quantify specific serum antibodies based on tagging the antigen-antibody complex.

**Encapsulation** The process of forming a capsule of hemocytes around material recognized as non-self; an immune response to material too large to be phagocytosed by individual hemocytes.

**Encystment** The formation, by a parasite, of a covering or a protective wall around itself. Among fungi, only flagellate, wall-less cells such as zoospores are referred to as undergoing encystment.

**Endogenous virus** Virus in which the principal mode of transmission is from parent to progeny. An endogenous virus is postulated to be produced by a gene which may be part of the genetic complement of each member of a species. The potential for virus production would always be present in each member of the species, but virus proliferation would be suppressed by cellular controls, in healthy individuals. Compare with Exogenous virus.

**Endospore** The chitinous inner spore coat of the microsporidian spore. 1

**Endotoxins** Substances produced by microorganisms which are not secreted into the surrounding medium but are confined within the microbial cell. They are released after autolysis.

**Enterolith** An intestinal calculus. A concretion formed in the intestinal tract.

**Enterolithiasis** The presence of calculi (enteroliths) in the intestinal tract of an animal. Rectal enteroliths occur as single or agglomerated spherical or polymorphous concretions in adult queen honey bees.

**Entomogenous** Adjective describing a microbe developing on or in insects without specifically indicating whether the relationship is commensal, parasitic, or pathogenic.

**Entomoparasitic** Parasitic to insects; a relationship between an insect and an organism in which the organism benefits at the host insect's expense; host mortality is not necessarily a requirement for the parasite's development.

**Entomopathogen** A microbe affecting insects (or in a more general sense, other terrestrial arthropods including arachnids), usually causing mortality in the host (as opposed to a more benign relationship).

**Entomopathogenic nematode** In insect nematology, the term is specifically used to refer to parasitic nematodes that are mutualistically associated with bacterial symbionts; all life-stages of the nematode, except for the dauer stage, are found inside the insect host; examples are Steinernematidae and Heterorhabditidae.

**Entomopathogenic** Refers to microorganisms and viruses capable of causing disease in an insect host.

**Entomophagous** Insectivorous. Refers to the consumption of insects or their parts.

**Entomophilic** Used to cover the associations between insects and plant microorganisms, insects and protozoa, and insects and nematodes. "insect-loving."

**Entomophyte or Entophyte** A plant living within or on the body of an insect.

**Entomophytic** Refers to almost any relationship between plant microorganisms (bacteria and fungi) and insects. Do not use when referring to protozoa.

**Enzootic disease** A disease (usually in low prevalence) which is constantly present in a population.

**Epimorphic regeneration** (epimorphosis) Replacement mediated by undifferentiated cells at the site of the injury or lost body part. Undifferentiated cells may originate by the dedifferentiation of previously existing specialized cells or from a reserve of pluripotent cells from embryonic stages.

**Episome** An element which carries genetic material, is able to transmit inheritable traits and to alternate between autonomous and integrated states in the host cell. In the integrated state an episome is physically associated with a chromosome, where as in the alternative, autonomous state it is extrachromosomal. The infecting genome of certain viruses may integrate with the host chromosome, and thus such viral genes are also episomal genes (e.g., the temperate bacteriophages in the lysogenic cycle have an integrated genome, which is termed prophage, in the host chromosome).

**Epitope** Region of a macro-molecule which is detected by antibodies.

**Epizootic wave** A disease phenomenon in animal populations characterized by important attributes, as the number of individual organisms afflicted by a given disease in a certain area, and the manner in which this number increases and decreases in a given period of time.

**Epizootic** An outbreak of disease in which there is an unusually large number of cases. A disease or a phase of a disease of high morbidity and one that is only irregularly present in recognizable form. See also Panzootic.

**Epizootiology** The field concerned with the study of diseases of animals on the basis of mass phenomena. Concerned with diseases as they occur in groups of animals (including invertebrates) rather than in the individual animal.

**Eradication** The removal of all recognizable units of the infecting agent from the host. Consequently, the reappearance of the infecting agent in the host should be traceable to exogenous reinfection. Also, the complete removal, destruction, or extirpation of a living organism from its environment.

**ET<sub>50</sub>** See Median effective time.

**Etiology** The study of the causes of disease.

**European foulbrood** A disease of larval honey bees caused by Streptococcus pluton (White). Mortality is high among 4- or 5-day-old larvae in typical epizootic outbreaks of the disease, but occasionally, sealed brood may die, too. Fairly common secondary invaders of the diseased larvae are Streptococcus faecalis Andrewes and Horder and Bacillus alvei Cheshire and Cheyne, both of which are responsible for the foul odors emanating from the dead larvae. The disease is usually enzootic throughout the beekeeping areas of the world, with well-defined seasonal epizootics at the beginning of nectar flows. Synonymous with New York bee disease, Melting brood.

**Euryxenous** Having a broad host range.<sup>2</sup>

**Exogenous cycle** Part of the life cycle of a parasitic organism taking place outside the host.<sup>2</sup>

**Exogenous virus** Virus transmitted between members of a species by contagion. Compare with Endogenous virus.

**Exospore** The proteinaceous outer spore coat of the microsporidian spore.<sup>1</sup>

**Explant** An excised fragment of a tissue or an organ used to initiate an in vitro culture.

**Explosive corpuscles** Hemocytes in crustaceans that burst, releasing cell contents that lead to clotting of the plasma. See Fibrin-ferment.

**Extotoxins** (also called "Ectotoxins," "True toxins," and "Soluble toxins") Poisonous substances produced by the microbial cell and liberated into the surrounding environment, without destruction of the cell.

**Extrusion apparatus** In microsporidia, vehicle for injecting a sporoplasm into a host cell. It is composed of polar sac, polar aperture, polaroplast, polar tube and posterior vacuole.<sup>1</sup>

## **F**

**Fecund** Capable of producing many offspring. Fecund emphasizes abundance or rapidity in bearing offspring. (Fecundity is the power of a species to multiply rapidly.) Compare with Fertile.

**Fertile** Capable of producing living offspring. Also said of females capable of becoming fertilized. Compare with Fecund.

**Fibrin-ferment** A substance found within the crustacean hemocytes called explosive corpuscles that acts on a fibrinogenlike substance in the plasma, causing it to coagulate.

**Fission** Cell division.<sup>2</sup>

**Fixed macrophage** A stationary phagocytic cell, especially in the arthropods. When occurring in groups these cells are called phagocytic organs or lymphoid organs.

**Flacherie, touffe** See Touffe flacherie.

**Flacherie, Viral** See Viral flacherie.

**Flacherie** A term used to describe the flaccid condition (flaccidity) seen in silkworm larvae suffering from dysentery. The affected larvae appear flabby, weak, withered, or loose-hanging. Death is rapidly followed by a darkening of the body and decomposition of the larval tissues. Many of the early pathologists used the word flacherie indiscriminately for various maladies of differing etiology, in different species of insects, implying "a diseased condition accompanied by diarrhea." In modern usage the term should be accompanied by a modifier, to denote one type of flacherie as distinct from another of differing etiology as, e.g., Viral flacherie, Touffe flacherie.

**Flagellosis** Infection with a flagellate protozoan.

**Focal necrosis** A type of bacterial disease in oysters from Japan and areas of Washington State. Infections occur as pockets of bacteria-filled abscesses and are thought to cause mortality in affected oysters.

**Foot disease in oysters** See *Maladie dupied*.

**Foulbrood** See American foulbrood, European foulbrood.

**FP variant** Few polyhedra variant. A plaque variant of certain nucleopolyhedrosis viruses which forms few or no polyhedra in the nuclei of susceptible cells in vitro. Compare with MP variant.

## G

**Gaffkemia, Gaffkaemia** A highly fatal disease of the American lobster, Homarus americanus Milne-Edwards, held in artificial ponds. The causative organism, Aerococcus viridans var. Homari (Hitchner and Sniezko), is a gram-positive micrococcus and is found in the hemolymph and hemocytes of the lobsters. The disease has been produced experimentally in certain crabs.

**Gametangium** Among fungi, an organ functioning as a sexual organ that either fuses with another gametangium or in which the cytoplasm cleaves (as a special class of sporangium) to produce gametes that are released into the environment. Gametangial nuclei are either initially haploid or are diploid and undergo meiosis.

**Gamete** A differentiated sex cell or sex nucleus capable of fusing with another compatible cell or nucleus in sexual reproduction.

**Gametocyst** Cyst formed by the union of two gregarine gamonts, with secretion of a wall around them.<sup>2</sup>

**Gametogony** Production of gametes in the final stages of the haplophase. Preferable to “gametogenesis” which usually implies gamete production accompanied by meiosis.<sup>1</sup>

**Gametophyte** Haploid generation in the life cycle of a fungus with alternating haploid and diploid generations; gametes are produced by this stage.

**Gamont** The cell or stage in the life cycle that will produce one or more gamonts.<sup>2</sup>

**Gas-bubble disease** A condition in which the blood is filled with bubbles of gas. Caused by exposure to water supersaturated with air or other gases. It is known to occur in aquatic arthropods and mollusks.

**Gattine** A term used to describe a type of Flacherie of silkworm larvae, said to be

caused by a virus and a concomitant infection by enterococci closely related to Streptococcus faecal Andrewes and Horder. However, the viral origin of gattine remains in doubt. Certain climatic and nutritional conditions are also known to act as predisposing factors necessary for the proliferation of the enterococci and production of overt disease. The cephalic end of the affected silkworms frequently becomes swollen and almost translucent--thus gattine is also known as disease of the clear heads.

**Gene bank** Public data base for DNA and RNA sequences.

**Gene expression** Synthesis of the functioning product of a gene.

**Gene** DNA segment, which encodes one protein.

**Genome** The genetic material of an organism. More specifically, a set of chromosomes with the genes they contain. The haploid karyotype.

**Genomics** Molecular research of the genome.

**Genotype** All the genes of one organism in its entirety.

**Germination ability** Capacity or ability of seeds or spores to germinate.

**GMO** (Genetically modified organism) Organism with artificial modified genetic material, which doesn't occur naturally in that species.

**Gnotobiotics** Field of biology concerned with breeding or culturing of organisms by themselves or in association with other completely known kinds of organisms. (Adj. gnotobiotic).

**Gradation** The time interval between one lowest point of the density of an animal population and the next, thus including one full wave of the numerical fluctuation of the population.

**Granulin** The protein of the crystalline body (capsule) surrounding the granulosis virus rod. Synonymous with, but preferred to, "capsule protein," "matrix protein," "inclusion-body protein," and "proteinic crystal."

**Granulocyte** A type of leucocyte or hemocyte that is distinguished cytochemically by the presence of basophilic and/or acidophilic cytoplasmic granules. Compared to hyalinocytes, these cells are larger and have smaller nucleocytoplasmic ratios. See also leucocyte.

**Granulosis** A virus disease of certain insects characterized by the presence of minute granular inclusions (capsules) in infected cells. (One speaks of a "granulosis virus" but the inclusion body itself is referred to as a "capsule.")

**Graphytosis** A disease of May beetle, *Melolontha melolontha*, caused by bacterium *Bacillus tracheitis*.

**Grasserie** Nucleopolyhedrosis of the silkworm, *Bombyx mori* (Linnaeus). See also Jaundice.

**Gray crab disease** A disease of the blue crab, *Callinectes sapidus* Rathbun, characterized by progressive weakness leading to death. Sick and dead crabs are often grayish in appearance. The disease occurs in crabs held in shedding tanks. It is caused by a protozoan, *Paramoeba pernicioso*, which is found in large numbers in the body fluids and tissues. Synonymous with "Paramoeba disease", and "Paramoebiasis".

**Green muscardine fungus** Fungi, usually species of *Metarhizium* or *Nomuraea*, producing a mycosis of various insects whose mycotized bodies are covered by a mass of green spores.

**Gregarinosis** A disease caused by a gregarine.

**Gross pathology** The study of macroscopic structural lesions. Abnormalities of gross structure. Distinguished from histopathology.

## H

**Hairless-black syndrome** A syndrome characteristic of a disease of adult honey bees. Sick adult bees tremble, become paralyzed, and frequently withdraw from the main cluster to remote parts of the hive, where they die. Some sick bees are attacked by their hive mates and become denuded of hair and shiny black. In rare instances these bees are eventually stung to death. Histological lesions occur in the intestinal epithelium and in thoracic and abdominal nerve ganglia. Morison's cell inclusions have been observed in the hindgut epithelium of sick bees. A virus similar to the agent of chronic bee paralysis has been isolated from bees suffering from hairless-black syndrome.

**Haplophase** That part of the life cycle in which all of the nuclei are haploid. Haploid phase.<sup>1</sup>

**Haplophasic** Having only unpaired (haploid) nuclei.<sup>1</sup>

**Haplois** Reduction of the chromosome number from diploid to haploid.<sup>1</sup>

**Healthy** A healthy animal is one so well-adjusted to its internal milieu and to its external environment that it is capable of carrying on all the functions ultimately necessary for its maintenance, growth, and multiplication with the least expenditure of energy.

**Heidenreich's disease** Also called Histolytic disease. A lethal disease of larvae of rhinoceros beetles (*Oryctes*). The etiology of Heidenreich's disease is unknown, but many of its symptoms and signs are very similar to those of a viral disease (Watery disintegration or Wassersucht) of cockchafer grubs (*Melolontha*). The diseased larva fails to accumulate lipids, and its body becomes translucent, especially in the abdomen. The fat body and muscles become atrophic and eventually necrotic. Necrosis can be observed also in the integument. As disease progresses, the larva ceases to move.

**Hemagglutinin** A molecule (e.g. an antibody) which agglutinates vertebrate erythrocytes by combining with surface membrane-bound receptors (determinants).

**Hemocoel** The main body cavity of an invertebrate with an open circulatory system, such that the fluid, pumped by the heart, leaves open-ended arteries and percolates between major organs in the body cavity before returning to the heart.

**Hemocyte** A colorless blood cell. See Leucocyte for a complete description.

**Hemocytic infiltration** The migration of hemocytes into tissues containing foci of infection, injury or necrosis.

**Hemolymph** The body fluid of an invertebrate with a hemocoel.

**Heritability** The heritability is the proportion of the phenotypic variation in a population that is due to the genetic variation. Variation among individuals may be due to genetic and/or environmental factors. Heritability  $H^2$  equals variance of the genotype divided by variance of the phenotype.

**Heteroecism** The necessity of two host species for the completion of the life cycle of certain fungi (e.g., *Coelomomyces* species, in which the diploid and haploid states affect mosquitoes and copepods, respectively).

**Heterogenic.** Used to describe parasitic protozoa whose life cycles manifest an alteration of sexual and asexual generations.<sup>2</sup>

**Heterokaryon** (Heterocaryon) – Somatic cell hybrid containing two (or more) genetically distinct nuclei, usually forming after hyphal anastomoses (fusions) among compatible but genetically different strains of the same species.

**Heterokaryotic** Possessing more than one kind of nucleus (e.g. micro- and macronuclei).<sup>2</sup>

**Heterosporous** Having more than one kind of spore. Often used to replace the ambiguous terms “dimorphic”, “trimorphic”, or “polymorphic”.<sup>1</sup>

**Heterothallic** Fungal species whose sexual reproduction requires matings between two

individuals having different but compatible mating types.

**Hexamitiasis infection** Caused by species of Hexamita. Although well-known as pathogens of wild fowl, certain Hexamita have been indicted as the cause of mortalities in several species of oysters. Some authors consider Hexamita to be only fortuitous secondary invaders in dead or dying oyster. See also Pit disease.

**Histochemistry** The microscopic study of the chemical characteristics of tissues, through the use of substances (dyes, etc.) producing identifying chemical reactions.

**Histolytic disease** See Heidenreich's disease.

**Histopathology** A study of abnormal microscopic changes in the tissue structure of an invertebrate animal (or other organism).

**H-melanosis** See Melanosis.

**Holidic** Pertaining to a medium (used for growing organisms) whose intended constituents, other than purified inert materials, have exactly known chemical structure before the medium is compounded. See also Meridic, Oligidic.

**Holomorph** Among the pleomorphic fungi (ascomycetes and their conidial states), the term referring to the entire life history of the fungus representing both teleomorph and any and all anamorphs.

**Homeosis** Heteromorphosis. Heteromorphous regeneration. During regeneration, the replacement of an organ or appendage by one belonging to another region of the body. See also Teratology.

**Homeotic mutation** A mutation that causes the formation of an organ or appendage in a segment in which it does not usually appear.

**Homokaryotic** Possessing only one kind of nucleus.<sup>2</sup>

**Homothallic** Fungal species whose sexual reproduction can be accomplished by a single genotype without requirement of mating with a second individual with a different but compatible mating types.

**Horizontal transmission** The transmission of an infectious agent through space, from one individual host to another, except direct transmission from parent to offspring (see Vertical transmission). Horizontal transmission may be accomplished by means of vectors or by means of the dissemination of infectious particles by physical agents, such as wind and rain. Compare with Vertical transmission.

**Host** An invertebrate that harbors or nourishes another organism. See Accidental host, Alternate host, Definitive host, Intermediate host, Natural host, Normal host, Host

of choice, Primary host, Secondary host, Substitute host, Transport host, Typical host.

**Host of choice** A host that is biologically, technically, and economically preferable for large-scale propagation of a pathogenic microorganism. The host of choice can be the natural host or a substitute host.

**Humoral immunity** Immunity which is mediated by substances in solution in the blood or hemolymph. While being ultimately of cellular origin, such substances are either released well before encounter with their target or are released by cells located in a position spatially separate from their target.

**Hyaline** Glassy, clear, transparent.<sup>2</sup>

**Hyalinocyte** A type of leucocyte or hemocyte that is characterized by the absence of cytoplasmic granules. Compared to granulocytes, these cells are smaller and have larger nucleocytoplasmic ratios. See also leucocyte.

**Hybridoma cell** Cell, which is a product of a cell fusion of special cancer cells (myeloma cells) and antibody producing cells (B-lymphocytes). Hybridoma cells are used to produce monoclonal antibodies.

**Hyperaminoacidemia** Presence of amino acids in the blood or hemolymph in excess of the normal amount. E.g., silk retention in silkworms produces a lethal increase of amino acids in the hemolymph of the insects. See Silk toxicity.

**Hyperplasia** An increase in the number of functional units of an organ (organelles, cells, tissues), excluding tumor formation, whereby the bulk of the organ is increased in response to increased functional demands. See also Hypertrophy.

**Hypertrophy** An increase in size (weight) and functional capacity of an organ or tissue, without an increase in the number of structural units upon which their functions depend. Hypertrophy is usually stimulated by increased functional demands. See also Hyperplasia.

**Hyphomycetes, hyphomycete, hyphomycetous** Class (followed by two adjectival forms) of conidial fungi including many entomopathogenic species that are primarily anamorphs (conidial stages) of ascomycete fungi in the Clavicipitaceae (Sordariomycetes: Hypocreales).

**Hypoplasia** (1) A defective or incomplete development of an organ system, organ, or tissue. A hypoplastic organ or tissue is one that never reaches normal size. (2) Sometimes used to indicate an atrophy caused by the destruction of some of the elements (e.g., cells) rather than a general reduction in size (= "Quantitative atrophy").

## I

**ICP** (Insecticidal crystal protein) Proteins included in a crystal inclusion body of the bacterium *Bacillus thuringiensis* that is toxic to insects

**Immunity** Species-determined inherent resistance to a disease agent.

**Immunization** The process of increasing the resistance of the host.

**Immunogen** It appears that an immune response in an invertebrate is not the consequence of an antigen-antibody-globulin reaction but more likely the result of the production of some other principle in the host. Thus the term "immunogen" may be used to replace "antigen" when describing the stimulus to immune response by an invertebrate.

**Imperfect fungi** A fungal state without any apparent sexual reproductive apparatus but that reproduces by means of asexual spores or as a sterile mycelium. (see Deuteromycetes and Hyphomycetes)

**In vitro** In the "test tube," or other artificial environment. Outside a living organism.

**In vivo** In the living organism.

**Inanition** Exhaustion from lack of nutrients. The physical condition resulting from the complete lack of nutrients.

**Inapparent infection** An infection which gives no overt sign of its presence. (In human medicine the word "subclinical" may be used as an alternative.) See also "Attenuated infection."

**Inborn disease** See Inherited disease.

**Incidence (of a disease)** The number of new cases of a particular disease within a given period of time, in a population being studied. For example, in a population of 1,000 lepidopteran larvae there may be 20 new cases of cytoplasmic polyhedrosis discovered on a certain day. These 20 cases represent the incidence of cytoplasmic polyhedrosis for that day. The incidence rate is 2 percent. Compare with Prevalence (of a disease).

**Incitant** A factor that incites or activates occult pathogens.

**Inclusion body** A localized intracellular lesion specifically associated with viral infection.

**Incubation period** The period of time elapsing between entrance or introduction of microorganisms in the animal body and the development of symptoms and signs of

an infectious disease.

**Independence or independent effect** The total effect of two pathogens or agents on a host is equal to the effect of the most active agent alone.

**Induction** The activation of an occult pathogen, leading to progressive infection and disease. In particular, the provoked transformation of a provirus into a virulent (cytotoxic) virus.

**Infaunate** To introduce a commensal or mutualistic microfauna into an organism that is capable of serving as a host. The introduction of certain flagellates or ciliates in a defaunated termite constitutes an infaunation.

**Infect** Individual cells or groups of microbial cells complete entry to a host, overcome the host's defensive reactions, and then initiate a disease of the affected host.

**Infection rate** The increase in disease prevalence per unit of inoculum per unit of time; this term is often used mistakenly in place of "prevalence."

**Infection, Attenuated** See Attenuated infection.

**Infection, mixed** See Mixed infection.

**Infection, progressive** See Progressive infection.

**Infection, Secondary** See Secondary infection.

**Infection** The introduction or entry of a pathogenic microorganism into a susceptible host, resulting in the presence of the microorganism within the body of the host, whether or not this causes detectable pathologic effects (or overt disease). In the case of the viruses, an infection has been defined as the introduction into a cell or an organism of an entity able to multiply, able to produce disease, and able to reproduce organized infective entities. See also Attenuated infection, Progressive infection, Secondary infection, Autoinfection, Reinfection, Superinfection, Mixed infection.

**Infectious disease** Disease caused by the actions of a living organism.

**Infective phase** The last phase of the developmental cycle of a virus, in which the virus acquires infectivity. The end result of the assembling of the genome and proteins of a virus during the maturation phase.

**Infective unit** Among pathogenic eukaryotes, the particular spore or other cell type that, after contact with or ingestion by a susceptible host, is able to cause infection and disease.

**Infectivity** The quality of being infective. The ability to produce infection.

**Infestation** The living in or on a host by metazoan parasites, such as an infestation of flies by mites. Some authors limit "infest" and "infestation" to external organisms, in most cases visible to the naked eye.

**Inflammation** When cells are injured or destroyed in many invertebrates an immediate protective response, termed inflammation, occurs at the site of injury. The inflammatory response destroys, dilutes or isolates the injurious agent and damaged or dead cells. Phagocytosis, diapedesis and encapsulation are important parts of the response. The pattern of response, when it occurs, is basically similar, regardless of the nature of the injurious agent, the site of the injury, or the taxonomic position of the injured organism. The successful conclusion of the inflammatory response is usually arrived at by one of three processes. (1) Resolution (a return of the tissues to normal, when no loss of tissue occurred), (2) Regeneration (a return to normal, in which lost tissue is replaced), or (3) Repair (when there has been considerable tissue damage, the lost tissue does not regenerate but is replaced by scar like tissue). Although most medical dictionaries and human pathology textbooks define inflammation as the local reaction of tissues to injury, some invertebrate pathologists object to the use of the term in reference to invertebrates because not all the cardinal signs of inflammation (redness, swelling, heat, pain and loss of function) occur in the reaction to injury in invertebrates. While the cardinal signs are included in most definitions, they are descriptive of the process in mammals and birds rather than essential parts of the definition.

**Inherited disease** A disease which arises from the germ plasm of the parent. Abnormal characters or qualities determined by inheritance and transmitted from parent to offspring. Synonymous with Inborn disease.

**Injection** The act of introducing a fluid into a vessel, cavity, or tissue of an organism, through a puncture in the integument, by means of a suitable instrument (e.g., microinjector). Compare with inoculation.

**Inoculation** The act of introducing a microorganism (in particular, a pathogenic microorganism) or virus into (or placing it onto) an organism or substrate. When working with organisms, this term covers all routes of administration, including injection and microfeeding.

**Inoculum** The microorganisms used in inoculation.

**Inquiline** An organism that lives habitually on or within the body of another, or in its nest or abode, without benefit or damage to either. See Inquilinism.

**Inquilinism** A type of symbiotic relationship in which one of the two partners

(Inquiline) lives habitually on or within the body of the other partner, or in its nest or abode. This relationship is not obligate, and either of the two partners benefits or suffers harm.

**Insert (DNA)** Exogenous DNA integrated into a cloning vector.

**Integrated virus** See Episome.

**Interface** A surface regarded as the common boundary of two bodies or spaces. In microsporidia the boundary is in some cases the outer surface of the parasite plasmalemma and in other cases an envelope external to that plasmalemma.1

**Interfacial envelope** An envelope of any composition or origin that is situated between the plasmalemma of the parasite and the hyaloplasm of the host cell.1

**Intermediate host** Secondary host. Alternate host. When a parasite lives in two or more host species, this is the host species in which immature intermediate, or asexual stages of the parasite occur.

**Intoxication** Poisoning. Includes poisoning by toxins.

**Intrahemocoelic** Within the hemocoel or perivisceral cavity of an invertebrate. As in "intrahemocoelic injection."

**Invasion** The penetration by a microorganism of the integument and other epithelial barriers of the body of a host organism. "Primary invasiveness" is a property of pathogenic microorganisms.

**Invertebrate collagen** Fibrous supporting material that stains like vertebrate collagen and exhibits varying periodicities unlike that of vertebrate collagen. Sometimes produced following injury in mollusks, echinoderms and some other groups.

**Iridescent virus disease** A disease of Diptera, Lepidoptera, and Coleoptera, caused by large icosahedral viruses. The larval fat body appears to be the principal site of virus multiplication, but the virus seems to multiply also in other tissues. Multiplication of the virus is confined to the cytoplasm. Diseased larvae show a marked opalescence, which is particularly intense in the fat body. The pellets of virus purified by centrifugation reflect strongly iridescent light. The virions are about 130 millimicrons in diameter.

**Isle of Wight disease** Under this name were included several maladies of adult honey bees having analogous symptoms and said to have reached epizootic proportions in the British Isles between 1905 and 1919. Some authors believe that the acarine disease was the principal, if not the only, constituent of the Isle of Wight disease. Other authors believe that the Isle of Wight disease might have been a type of dysentery or some malady of the digestive system caused by poisoning or

malnutrition. Use of this disease name is not recommended. See Acarine disease.

**Isolate** (1, noun) pure culture of microorganism obtained from some natural substrate.  
(2, verb) To separate, to free from contaminants. To obtain in pure (or axenic) culture, i.e., free from associated (micro) organisms.

## J

**Japanese gypsy-moth disease** A disease of larvae of Porthetria dispar (Linnaeus) presumable caused by the bacterium Streptococcus disparis Glaser. The affected larvae cease to eat and become diarrheic. In the late stages of the disease, the Streptococcus is found in the hemocoel and the insect's muscle tissue gradually disintegrates in a rather characteristic fashion.

**Jaundice** Nucleopolyhedrosis of the silkworm, Bombyx mori (Linnaeus). See also Grasserie.

**Juvenile stage** This term denotes any postembryonic stage in the development of an organism that precedes the sexually mature adult stage. The term "juvenile" implies a form similar to the adult, except as regards size and the reproductive structures, whereas the term "Larva" implies a postembryonic stage that differs markedly from the parents in morphology. A larva attains the adult morphology by a process of metamorphosis.

## K

**Karyogamy** Fusion of two haploid nuclei to form a synkaryon or zygote.1

**Koch's postulates** A stepwise procedure for establishing a suspected causal relation between a given microorganism and a particular disease: 1) the microorganism must be present in every case of the disease; 2) the microorganism must be isolated in pure culture; 3) the microorganism in pure culture must give rise to the disease when a susceptible animal is exposed to it; 3) the same microorganism must be present in, and recoverable from, the experimentally diseased animal.

**Krebspest** A disease of the European freshwater crayfish, Astacus fluviatilis Fabricius. In the 1800's, a prolonged epizootic of krebspest virtually wiped out commercial use of Astacus. It is caused by a fungus, Aphanomyces astaci Schikora, which has a predilection for nervous tissue.

## L

**Lag phase** Latent period at the beginning of the growth phase of microorganisms.

**Larval equivalent** In a given host-pathogen system, the mean number of pathogen units that can be produced in one living host, usually the larva of a holometabolous

insect, under mass-rearing conditions; this is usually for the purpose of field application of the pathogen units for the purpose of microbial control, e.g., spraying at 250 larval equivalents (L.E.) per hectare.

**Latent infection** An inapparent infection in which the pathogen is still present in a noninfective phase, and in which a certain pathogen-host equilibrium is established. The adjective "latent" is reserved to qualify "infection," thus one speaks of "a latent infection" but not of "a latent virus" (see Occult virus).

**LC<sub>50</sub>** See Median lethal concentration.

**LD<sub>50</sub>** See Median lethal dose.

**Lectin** A molecule which carries sites which combine with carbohydrate moieties (which may or may not be membrane bound).

**Lesion** (1) A wound or injury. (2) Any more or less circumscribed pathologic change in the tissues, including a change or loss of function. See also Biochemical lesion.

**Leucocyte** (Leukocyte, Hemocyte, and Amebocyte). A general term for colorless blood cells in non-arthropod invertebrates that do not contain a respiratory pigment. Such cells are typically capable of amoeboid movement and phagocytic activity during some stage(s) of their development. They wander freely through the hemolymph, loose connective tissue and epithelial surfaces, especially in mollusks. Leucocytes are considered to be multifunctional, participating in a variety of activities including wound repair, shell repair, gamete resorption, calcium and other ion transport, glycogen storage and transport, initiation of encapsulation and cellular immune reactions. Leucocytes and hemocytes are currently classified as either granulocytes or hyalinocytes depending on the presence or absence of cytoplasmic granules (see those entries for a complete description).

**Leukocyte** See Leucocyte, Coelomocyte and Hemocyte.

**Leukocytosis** Especially in bivalve mollusks, the local increase in numbers of blood cells in tissues or blood vessels through migration. It is a response to injuries caused by physical or biological agents. Also termed Leukocytic infiltration.

**Leukoderma** A disease, possibly microbial in origin, of *Achatina fulica* Bowdich, the giant African snail, and perhaps of other snails. It is characterized by destruction of dermal melanophores and of other superficial tissues. Visceral lesions may also occur.

**Life cycle** The complete sequence (or series of sequences) of morphological patterns within the cyclic development of an organism. Although in higher animals it starts with the zygote and ends with production of a new generation of gametes, in microsporidia the situation is more complicated. In species with diplokarya the life

cycle seems logically to start with formation of the first diplokaryotic cell (meront) by plamogamy and nuclear association. In species without diplokarya the logical starting place is less evident. In microsporidia generally, it is convenient, if not otherwise logical, to treat the sporoplasm that infects a new host individual as the starting point of the life cycle. 1

**Linthal bees** See White head.

**Lipopolysaccharides** Cell wall components and pattern recognition molecules typical of Gram negative bacteria.

**Lorsch disease** A rickettsial disease of the larvae of may beetles and june beetles (species of Melolontha and of Amphimallon), as well as other related scarab larvae. The causative agent is Rickettsiella Melolonthae (Krieg) Philip.

**LT<sub>50</sub>** See Median lethal time.

**Lysozyme** A cationic, low molecular weight enzyme found in hemocytes and secretions of many invertebrates that mediates lysis and destruction of bacteria.

## M

**Macroconidium** (plural: -ia) Among fungi, a term referring either to the larger of two morphologically distinguished and markedly different sized conidial types produced by some fungi (e.g., species of *Fusarium*).

**Macrogamete** Larger one of the pair of anisogametes considered female.

**Macronucleus** Transcriptionally active nucleus of ciliates, responsible for organism's phenotype.

**Maladie a fuseaux** See Spheroidosis.

**Maladie du pain d'epices** Gingerbread disease. In oysters, involving the shell, and caused by activities of species of Cliona, boring sponges.

**Maladie du pied** A disease of European oysters, Ostrea edulis Linnaeus. The etiologic agent, apparently a boring fungus, causes formation of rubbery spots on the shell, pathological changes in the tissues, and calcareous deposits on the adductor muscle scar. Death is caused by improper shell closure.

**Malaya disease** A lethal disease of larvae of the Indian rhinoceros beetle, Oryctes rhinoceros (Linnaeus), caused by a virus. The diseased larvae cease to feed, and they appear shiny, turgid (dropsied), with enlarged, waxen abdomens. Rectal prolapse may occur. In the last stages of the disease, just before death, the larvae are totally lethargic. Virus multiplication occurs chiefly in the nuclei of the fat-

body cells. The rod-shaped virions measure approximately 70 by 200 millimicrons.

**Malpeque bay disease** An infectious disease of undetermined etiology of the American oyster (Crassostrea virginica) in the Gulf of St. Lawrence, Canada. First appeared as an epizootic causing mass mortalities in Malpeque Bay, Prince Edward Island, in 1915. Is characterized grossly by marked weight loss in affected oysters, stunted growth, yellow-green pustules, spawning failures and high mortalities. Genetically resistant strains of C. virginica have arisen from survivors of the epizootics, but imported stocks continue to suffer high mortality rates.

**MAP kinases** Mitogen activated protein kinases are involved in molecular signal transduction pathways; they play roles in diverse pathological physiological responses.

**Maturation immunity** A decrease in susceptibility coincident with the development of an animal to maturity.

**Maturation phase** In virus infections, a phase or period following the eclipse period, during which infective particles are completed. See also vegetative phase.

**Maximal nonlethal dose** The dose which will just fail to kill all or most of the subjects of a given species or strain. (The use of this term is not recommended, as it does not take account of the variation in tolerance within a species or strain.)

**May disease** Rather than a single disease, may disease is a group of maladies of adult honey bees having similar syndromes but different etiologies. Saccharomyces apiculatus Hansen, for instance, has been found in bees afflicted with constipation, and it has been considered as the sole cause of a may disease. Collection of buttercup pollen may be the cause of another malady called Bettlach may disease.

**Maya's disease** A lethal disease of larvae, pupae, and adults of rhinoceros beetles (Oryctes) and of other scarabs. The etiology of Maya's disease is unknown. The appearance of a multitude of spheroid vacuolated inclusions in the fat body of diseased insects is the most striking sign of the malady. Large numbers of these inclusions may entirely fill the volume of the fat body, pericardial cells, and tracheal matrix. In adults, the thoracic muscles are also affected.

**Mechanical vector** See Transport host.

**Median effective dose** The dose which will produce a response in half the test subjects. The chief characteristic of this dose is that it is an indirect measure of the mean tolerance of a batch of test subjects. Its symbol is ED<sub>50</sub>. The median lethal dose (LD<sub>50</sub>) is a special case, in which death is the response.

**Median effective time** The time at which a response occurs in half the test subjects after exposure to a pathogenic (including toxicological) stimulus. Its symbol is ET<sub>50</sub>.

The median survival time ( $ST_{50}$ ) is a special case, in which death is the response. (Estimation of this parameter by probit analysis, general linear models, and certain other statistical methods is generally invalid because the data are usually censored [see censored data] and assumptions of independence and normal distribution of data are almost always violated.) (See survival data).

**Median lethal concentration** A concentration of a pathogen or agent which will produce death in half the test subjects; the experimental method is not sufficiently accurate to determine the precise dose to which the test animals were exposed. Its symbol is  $LC_{50}$ . (contrast with median lethal dose)

**Median lethal dose** A more restricted concept of Median effective dose. The dose which will produce death in half the test subjects. Its symbol is  $LD_{50}$ .

**Median lethal time** In a time-dependent biological assay procedure, this is the period of exposure to a pathogenic (including toxicological) stimulus which will produce death in half the test subjects. The length of exposure is a direct measure of dosage, and an increase in the period of exposure results in an increase in uptake and true dose in the same ratio. Its symbol is  $LT_{50}$ , not to be confused with the Median Survival time ( $ST_{50}$ ). (Estimation of this parameter by probit analysis, general linear models, and certain other statistical methods is generally invalid because the data are usually censored [see censored data] and assumptions of independence and normal distribution of data are almost always violated.) (See survival data).

**Median survival time** A restricted concept of median effective time. The time at which death occurs in half the test subjects after exposure to a pathogenic (including toxicological) stimulus. Its symbol is  $ST_{50}$ , not a direct measure of dosage, and it is not to be confused with the Median Lethal Time ( $LT_{50}$ ), which is a direct measure of dosage. (Estimation of this parameter by probit analysis, general linear models, and certain other statistical methods is generally invalid because the data are usually censored [see censored data] and assumptions of independence and normal distribution of data are almost always violated.) (See survival data).

**Meiospore** A spore usually containing a single haploid nucleus (rarely two or more nuclei), and formed on or in the cell in which meiosis occurred, an usually formed shortly after completion of meiosis. In some organisms, one or more mitotic divisions may occur before meiospores form. Examples of meiospores among fungi include ascospores and basidiospores.

**Melanization** Deposition of the dark pigment, melanin, and associated materials on the surfaces of foreign objects, both biotic and abiotic. Often accomplished by hemocytes as a response to injury or to the presence of a parasite. Common in arthropods.

**Melting brood** See European foulbrood.

**Meridic** Pertaining to a medium (used for growing organisms) in which the chemical identity of certain, but not all, of the absolutely essential molecules has been established. See also holidic and oligidic.

**Merogonial plasmodium** A presporogonic individual with more than two diplokarya, rarely more than eight, as the result of delayed cytokinesis during merogony.1

**Merogony** An indeterminate series of binary divisions of diplokaryotic cells (meronts), sometimes with delayed cytokinesis and production of transitory paucinucleate plasmodia.1

**Meront** In microsporidia, diplokaryotic presporogonic stages of variable size.1

**Merozoite** Stage of an intracellular sporozoan that is produced by merogony and develops into a meronts or gamont.2

**Metabolism** The entirety of biochemical proceedings of an organism needed for the vital process and new cell substances

**Metabolite** Low molecular nutrient or product participating in metabolism.

**Metabolome** The entirety of all metabolites of an organism or cell.

**Metabolomics** Research dealing with metabolites.

**Metastasis** (1) The transfer of pathogenic microorganisms to parts of the body remote from the original foci of infection. (2) The transfer of malignant tumor cells from one organ or part to another, where they grow and form secondary tumors. (3) A secondary tumor. Plural, metastases.

**Metastasize** To form metastases.

**Microbial control** That part of biological control concerned with controlling insects (or other organisms) by the use of microorganisms (including viruses). Pathogens may exert their controlling effect by means of their invasive properties, by toxins, enzymes, and other substance. Some authors limit the term to that phase of biological control concerned with the use of microorganisms for the control of insects (or other forms of life).

**Microbial insecticide** A pathogenic microorganism or its products (toxins, etc.) used to suppress an insect population. The terms "microbial pesticide," "biotic insecticide," and "microbial control product" are also used. (See also Biotic insecticide.)

**Microbial persistence** A phenomenon characterized by the continued presence of a pathogenic microorganism within the host in the absence of overt disease but following an episode of overt disease.

**Microbiota** The combined microflora and microfauna of an organism. Or, the microflora or microfauna considered separately.

**Microconidium** (plural: -ia) Among fungi, a term referring either to (a) the smaller of two morphologically distinguished and markedly different sized conidial types produced by, for example, species of *Fusarium* (whose macroconidia are multicellular and curved).

**Microfeeding** A term sometimes used to designate forced feeding of small volumes of solutions or suspensions to insects and other small animals. Peroral inoculation, using microcatheters. By some, microfeeding is used to indicate active eating of small measured amounts of fluids or solids.

**Microgamete** Smaller one of the pair of anisogametes considered male.<sup>2</sup>

**Microinjector** A device for injecting measured, minute amounts of fluids. Composed usually of a fine metal or glass needle adapted to a syringe, and of a mechanism for the advancement of the piston (micrometer or ratchet).

**Micronucleus** Transcriptionally inactive nucleus of ciliates, serving as a repository of the unaltered germ line. Typically smaller than macronucleus.<sup>2</sup>

**Micropyle** Opening in the wall of a sporozoan oocyst.<sup>2</sup>

**Microsporidiosis** Infection with microsporidia.

**Microsymbiont** This term is sometimes used to designate the smaller organism, or microorganism of a symbiotic association. See also Symbiont.

**Mictosporoblastic** Pertaining to a microsporidian sporont that produces a variable number of sporoblasts.<sup>1</sup>

**Milky disease** Any of a group of maladies of scarabaeid larvae, caused by species of the genus Bacillus. Type A milky disease of the white grub of the Japanese beetle (Popillia japonica Newman) is caused by Bacillus popilliae Dutky, whereas type B milky disease (marked by extensive formation of blood clots, impairment of circulation, and gangrene of the appendages) is caused by Bacillus lentimorbus Dutky. Milky diseases of types A and B occur in numerous other species of scarabs. As the disease progresses, the bacteria multiply and sporulate in the insects' blood to produce marked turbidity of the normally clear fluid. The milkyness of the blood at this stage is the basis for the name "milky" disease.

**Minimal lethal dose** According to the most common use in the literature, this is the dose just sufficient to kill all or most subjects of a given species or strain. The use of this term is not recommended (see Maximal nonlethal dose).

**Mitotic recombination** (= parasexuality) When genetic recombination occurs in vegetative cells of fungi (or other organisms), usually understood to involve nuclear fusions followed by (presumably) meiotic rehaploidizations that do not occur in the usual sexual organs.

**Mixed infection** Concurrent infection by two or more pathogenic microorganisms. Compare with secondary infection.

**Mode of action** The manner or way of a bioactive substance to be active.

**Molecular modelling** Term for the computer-based calculation and preparation of molecular structures.

**Monoclonal Antibody** Antibodies of the same kind reacting with the same antigenic determinant.

**Monoinfection** Infection by one species of pathogen.

**Monoxenous** Having a single taxonomic species of host (i.e. "host species-specific").<sup>2</sup>

**Morbid drone-laying** A disease of queen honey bees, of unknown etiology. Properly mated queens, in the first or second year of life and long before their supply of spermatozoa is exhausted, become drone layers ("drone-broody" queens) and lay unfertilized eggs into the cells reserved for worker bees. The epithelial cells of the spermatheca of the affected queens contain intranuclear acidophilic inclusion bodies. The spermatozoa within such spermathecae curl into ringlets and degenerate. Each ringlet consists of only one spermatozoon (Arnhart's "ringelsamen"). Drone broodiness.

**Morbidity** See Incidence (of a disease).

**Moribund** Dying. Near death.

**Morison's cell inclusions** Strongly basophilic cytoplasmic inclusions appearing in the hindgut epithelium of bees showing symptoms of chronic paralysis. The inclusions are largest in the cells immediately posterior to the openings of the malpighian tubules.

**Morphallactic regeneration** (morphallaxis) The process by which damaged tissues of lost parts are renewed or replaced by reorganization of the renewing part(s) of the body of an organism. This is achieved simply by reorganizing the old tissues directly into the new without augmenting the number of remaining cells. It involves the rearrangement of remaining parts so as to remodel an amputated structure into an integrated morphological whole.

**Morphopathology** That branch of pathology dealing with the morbid changes occurring in the structure of cells, tissues, and organs, as distinguished from physiopathology.

**Mortality rate** Death rate. The number of deaths per unit population during a given period of time. If all deaths from all causes are counted (e.g., during 1 month), the rate is referred to as the "crude mortality rate" or "crude death rate." Often the death rates are calculated for specific causes, and they are referred to as "cause-specific mortality rates."

**MP variant** Many polyhedra variant. A plaque variant of certain nucleopolyhedrosis viruses which forms many polyhedra in the nuclei of susceptible cells in vitro. Compare with FP variant.

**MSX disease** A code name, meaning "multinucleated sphere of unknown affinities." Found in the American oyster, *Crassostrea virginica*, on the Middle Atlantic Coast of the U.S.A. caused by *Haplosporidium nelsoni*, which lives in the connective tissues surrounding the gut. MSX disease is a cause of serious mortalities in high-salinity areas during late summer and early fall.

**Mucocalyx** A mucus layer on the surface of the exospore in some species of microsporidia.<sup>1</sup>

**Multicapsid virion** A cluster of nucleocapsids enclosed within a single envelope. Also designated Multiple-capsid virion or Bundle virion (e.g. some baculovirus).

**Multiple division** Simultaneous division of a plasmodium into as many uninucleate cells as there were nuclei in the parent body.<sup>1</sup>

**Multiple-capsid virion** See Multicapsid virion.

**Multisite inhibitor** Inhibitory substance with an effect on different molecular targets.

**Multivoltine** (plurivoltine) Species with several generations per year are multivoltine.

**Mummification** Dehydration of animal body after death.

**Muscardine fungus** An old and now little used term generally referring to fungi that substantially or completely cover a mycotized host cadaver; the term is usually modified as "[white, green, red, yellow or some other color] muscardine" to refer to particular types of mycoses. A mycosis of silkworm larvae, muscardine of the silkworm, is caused by *Beauveria bassiana* (Balsamo) Vuillemin. In sericultural practice, the disease is transmitted from one generation of silkworms to the next by the conidia which have accumulated in neglected rearing rooms. Agostino Bassi, the "founder of parasitology," was the first to prove, in 1834, that the muscardine of the silkworm is contagious and that the fungus is the causative agent of the disease.

**Mutagen** Mutation inducing agents.

**Mutation** Modification of the heritable information of an organism.

**Mutualism** A symbiotic relationship between two different species in which both jointly benefit. Usually obligatory.

**Mycelia Sterilia** An antiquated and no longer officially recognized term for (usually basidiomycetous or ascomycetous) fungal mycelia that do not produce any sorts of spores and are, therefore, not subject to standard identifications. If referring to a single such fungus, it should be referred to as a sterile mycelium.

**Mycelium** Mass of hyphae constituting the body of a fungus.

**Mycethemia** The presence of a fungus or some of its stages in the circulating blood of an animal.

**Mycetocyte** A cell containing intracellular microsymbionts. One of many cells making up the mycetome.

**Mycetome** An organ in a variety of invertebrates (especially in Hemiptera) whose cells contain fastidious, mutualistic or commensalistic bacteria; mycetomes are usually modifications of cells in the fat body. The cells making up the mycetome and containing the bacteria are known as mycetocytes.

**Mycobiota** Community of fungi.

**Mycoinsecticide** Insecticide based on a fungal active ingredient.

**Mycopesticide** Pesticide based on a fungal active ingredient.

**Mycosis** Fungal disease. Any disease caused by the presence of fungi.

**Mycotoxicosis** A disease caused by the action of a mycotoxin. See Toxinosis, Toxemia.

**Mycotoxin** A toxin produced by fungi.

**Myiasis** A condition deriving from infestation by parasitic flies. See also Apimyiasis.

## N

**Natural host** A host in which the pathogenic microorganism (or parasite) is commonly found and in which the pathogen can complete its development. The term "natural host" implies that the host is the usual one and is synonymous with "typical host."

**Necrotize** To kill cells and tissues in a living organism.

**Nematodiasis** Infection by a nematode parasite.

**Nematophagous** A broad term referring to a microbe (fungus, bacterium, etc.) routinely able to utilize nematodes as a food source. Most often used in reference to fungi that are either predatory (see predaceous) or are endoparasites (endopathogens) that enter through the gut or cuticle, develop internally, and then usually sporulate outside the diseased cadaver of the host.

**Neoplasm** An abnormal mass of tissue not required for the repair of organs, the growth of which exceeds and is uncoordinated with that of the normal tissues and persists in the same excessive manner after cessation of the stimulus which evoked the changes in growth pattern. Neoplasms may be benign or malignant. "Cancer" refers to any type of malignant neoplasm.

**New York bee disease** See European foulbrood.

**Nick translation** A procedure for the radioactive labelling of the DNA

**Nodule formation** In arthropods, this process is performed by hemocytes through a mixture of phagocytosis, aggregation and encapsulation. A clump of hemocytes and debris forms in the blood and at its fullest expression the nodule consists of a lamellated capsule of hemocytes merging into a center of degenerating hemocytes, foreign particles and other debris that is often clothed in melanin.

**Nodule** See Nodule formation.

**Noninclusion** See Nonoccluded.

**Noninfectious disease** any disease in which a living microorganism is not involved.

**Nonoccluded** Said of those viruses in which the virions are not occluded in a dense protein crystal. Preferable to "noninclusion.":

**Nonpermissive cells** Cells that accept viral nucleic acid into their genome but do not permit the assemble of infectious virions.

**Nonvirion antigen** A protein produced by a cell that has been infected by a virus. The antigen, while specific for that virus, is not a structural part of the virus itself.

**Normal host** This ambiguous term should be avoided. It has been used as a synonym for "Typical host" and "Natural host," which are the preferred terms.

**Northern blot** A procedure to transfer RNA from a gel to another matrix e.g. Nitrocellulose.

**Nosema disease** Infection of adult bees by Nosema apis Zander. The microsporidan develops in the cytoplasm of the midgut epithelial cells. It causes no outward symptoms but appreciably shortens the lives of bees. Infected colonies can survive indefinitely, but sometimes become severely infected, dwindle and die. "Nosema disease" is sometimes used in referring to diseases caused by other species of nosema infecting other species of insects. Nosemosis is a preferred term in these instances.

**Nosemosis** Infection with microsporidia of the genus Nosema.

**Nosography** A branch of pathology that deals with the description of diseases.

**Nosology** A branch of pathology that deals with the classification of diseases. A treatise comprising such a classification.

**Nuclear association** Pairing of two haploid nuclei following plasmogamy, at the end of the haplophase, to form a diplokaryon. A form of diploisis in the microsporidia.1

**Nuclear disassociation** Separating of the two members of a diplokaryon to form two independent haploid nuclei. One of two methods of haploisis in microsporidia, the other being meiosis.1

**Nuclear polyhedrosis** See Nucleopolyhedrosis.

**Nuclease** Catabolic enzyme hydrolysing phosphodiester bonds in nucleic acid.

**Nucleocapsid** The structure composed of the capsid with the enclosed viral nucleic acid. Some nucleocapsids are naked, others are enclosed in an envelope (or limiting membrane). See also Capsomere, Virion.

**Nucleopolyhedrosis** A viral disease of insects, mainly the larvae of certain lepidoptera and hymenoptera, characterized by the formation of polyhedral inclusion bodies (polyhedra) in the nuclei of the infected cells. The virus multiplies in the epidermis, tracheal matrix, fat body, and blood cells of lepidopterous larvae. In hymenopterous larvae the virus proliferates in the midgut epithelium. The disease is usually fatal. Synonymous with Nuclear polyhedrosis. See also Grasserie, Jaundice, Polyhedrosis, Wilt Disease, Wipfelkrankheit.

## O

**Occluded** Viruses in which the virions are occluded in a dense protein crystal, large enough to be visible in the light microscope (e.g., polyhedrosis viruses, granulosis viruses).

**Occlusion body** A virus-directed structure that is assembled within the infected cell and

contains or occludes infectious virus particles or virions. Occlusion bodies may contain one or many virions depending on the type of virus. In the case of the Baculoviridae, occlusion bodies are assembled in the nucleus (NPVs) or the mixed nuclear-cytoplasmic contents after loss of the nuclear membranes. Baculovirus occlusion bodies may contain one or many virions.

**Occult virus** A special phase of some viruses, characteristic of latent infections, in which the pathogenic agent is presumed to differ from the infective phase, and in which virions cannot be detected. Synonymous with but preferable to "hidden virus" and "masked virus" (see Latent infection). The occult phase of a virus should not be confused with the eclipse, which is a normal phenomenon during viral replication.

**Octosporoblastic** Pertaining to a microsporidian sporont that produces eight sporoblasts.1

**Oligidic** Pertaining to a medium (used for growing organisms) consisting wholly or largely of crude materials, in which no molecule (other than water) has been established as an absolute nutritional requirement. See also Holidic, Meridic.

**Oomycetes** A large group of pseudofungi once treated among true fungi but now classified in the Kingdom Chromista (= Straminipila) because one of the two flagella on their zoospores and planogametes is of the tinsel-type (covered with hair-like mastigonemes).

**Oospore** Thick-walled spore which develops in the female gametangium of oomycetes (*Lagenidium*, *Pythium*, *Saprolegnia*, etc.) through either fertilization or parthenogenesis.

**Oosporein** A red pigment produced by numerous fungi (especially ascomycete entomopathogens related to *Cordyceps*) that may cause a strong pink to red coloration of infected hosts or of culture media.

**Operculum** Lid or covering flap found in various groups of protozoa.2

**Organ culture** The maintenance or growth of organ primordia or the whole or parts of an organ in vitro in a way that may allow differentiation and preservation of the architecture and/or function. See also Cell culture, Tissue culture.

**Overt disease** A disease with detectable pathologic effects.

## P

**Pansporoblast** In distinction from the sporoblasts which result from the segmentation of the pansporoblast. Exact synonym of "sporont" as used with the microsporidia, the latter term now preferred.1

**Pansporoblast[ic] membrane** An interfacial envelope produced by the pansporoblast (sporonts).<sup>1</sup>

**Panzootic** Denoting a disease affecting all, or a large proportion of the animals of a region. Extensively epizootic.

**Paralysis, acute** See acute paralysis.

**Paralysis, bacillary** See bacillary paralysis.

**Paralysis, chronic** See chronic paralysis.

**Paramoeba disease** See Paramoebiasis.

**Paramoebiasis** A disease of the blue crab, Callinectes sapidus Rathbun, that causes severe mortalities in crabs captured during the early summer in certain high-salinity areas along the mid-Atlantic coast. It is caused by a protozoan, Paramoeba pernicioso Sprague, Beckett, and Sawyer. The parasites live in connective tissues and hemal spaces, spilling over in large numbers into the circulating blood during the terminal phase of the disease.

**Paramural body** A sac-like invagination of the plasmalemma of a dividing individual, containing a whorl of tubular structures, adhering to the cleavage furrow and participating in the cleavage process.<sup>1</sup>

**Parasagittal section** A section of an animal parallel to the sagittal section.

**Parasexuality** see **Mitotic recombination**

**Parasite** An organism that lives at its host's expense, obtaining nutriment from the living substance of the latter, depriving it of useful substance, or exerting other harmful influence upon the host.

**Parasitic** Microbe living in or on another organism at the expense of that host, usually invading the host body and causing disease. A functional distinction is made, however, since parasites will not usually cause the mortality of the host.

**Parasitic castration** Any process that interferes with or inhibits the production of nature ova or spermatozoa in the gonads of an organism. (The term is not limited to meaning the sudden and complete extirpation of the gonads.)

**Parasitism** A symbiotic relationship between individuals of two different species in which the host is harmed and the parasite benefits.

**Parasitoid** An insect with a larval stage that feeds inside or outside of a host insect's

body resulting in the death of the host. The adult parasitoids are free-living.

**Parasitophorous vacuole** A cavity of within a cell, containing parasites. The vacuole is surrounded by a membrane of host cell origin. 1

**Parasporal body** A particle which lies alongside the spore or is included in the sporangium along with the spore, formed during sporulation of a number of Bacillus species. If the inclusion is a crystalloid, the species is called crystalliferous.

**Paratop** Part of an antibody which binds the epitope of the antigene. Antigenic determinant.

**Paroxysm** A sudden onset of symptoms, especially in diseases with recurrent manifestations.

**Patent infection** An overt infection displaying distinctive signs and symptoms of the disease.

**Pathobiology** The discipline concerned with resolving the fundamental nature, causes, processes, and effects of disease. Pathobiology is not purely a descriptive and/or diagnostic science, but one concerned with all of the factors contributing to and resulting from disease. If biology is defined as that branch of science which deals with the origin, structure, functions, and life history of organisms, then pathobiology might be defined as "biology of the abnormal." Synonymous with Pathology (1).

**Pathogen, facultative** A pathogen that can infect and multiply in host animals but is also capable of multiplying in the environment; facultative pathogens generally are readily cultured *in vitro*.

**Pathogen, obligate** A pathogen that can multiply in nature only within the bodies of specific hosts in which it causes specific diseases. Obligate pathogens usually have a narrow host range and can be cultured *in vitro* only with difficulty, if at all; therefore, some mechanism must exist for their transmission from one host generation to another.

**Pathogen, opportunistic** A microorganism which does not ordinarily cause disease but which, under certain conditions (e.g., impaired host immunity), becomes pathogenic.

**Pathogen, potential** 1) A microorganism that has no method of invading or infecting a host but can multiply and cause disease if it gains entrance, for example, through a wound; potential pathogens generally grow readily in culture and do not cause specific diseases in specific hosts (modified from Bucher 1963). 2) a secondary invader.

**Pathogen** A specific cause of disease. A microorganism capable of producing disease under normal conditions of host resistance and rarely living in close association with the host without producing disease. Any microorganism, virus, substance, or factor causing disease.

**Pathogenesis** The origination and development of a disease or morbid process.

**Pathogenic** Any microbe producing disease, especially when that disease is routinely lethal to the host. (See parasitic and commensal).

**Pathogenicity** The quality or state of being pathogenic. The potential ability to produce disease. Applied to groups or species of microorganisms, whereas virulence is used in the sense of degree of pathogenicity. Pathogenicity is often considered the genetically determined ability to produce disease, and virulence as disease-producing ability that is not genetically determined. Pathogenicity is qualitative, an all-or-none concept. See also Virulence.

**Pathognomonic** A pathognomonic symptom (or diagnostic symptom) is one that points with certainty to a particular disease or malfunction. Such a special symptom indicates an aberration or disturbance of a particular nature by which a disease may be definitely recognized.

**Pathology** The science that deals with all aspects of disease. The study of the cause, nature, processes, and effects of disease. Any branch of science, or any technique or method or body of facts that contributes to our knowledge of the nature and constitution of disease belongs in the broad realm of pathology. "Invertebrate pathology" refers to all aspects of disease (including abnormalities) which occur in invertebrate animals. Similarly, "insect pathology" is that branch of entomology or invertebrate pathology that embraces the general principles of pathology as they may be applied to insects. If biology is defined as that branch of science which deals with the origin, structure, functions, and life history of organisms, then pathology might be defined as "biology of the abnormal." For each branch of biology there is a corresponding branch of pathology. Also, in a more limited sense, pathology refers to the structural and functional changes from the normal. Also in a limited sense, general pathology treats of disturbances which are common to various tissues and organs of the body, such as degenerative processes, pigmentations, mineral deposits, circulatory disturbances, specific and nonspecific inflammations, progressive tissue changes such as hyperplasia and hypertrophy, and tumors.

**Pathomorphism** Abnormal morphology caused any infection or other factors.

**Pattern recognition molecules** Proteins that recognize and respond to the presence of signature molecules on the surfaces of bacteria, fungi and yeast, thereby eliciting a defensive response.

**PCR (Polymerase chain reaction)** Method developed by the chemist K.B. Mullis to duplicate DNA segments.

**Pebrine** A disease of the silkworm, Bombyx mori (Linnaeus), caused by the microsporidian Nosema bombycis Naegeli. The appearance of dark pepperlike spots on the integument of the diseased larvae is a characteristic sign of the infection. Numerous epizootic outbreaks of the disease occurred in the second half of the 19th century.

**Peptidoglycans** Cell wall components and pattern recognition molecules typical of Gram positive bacteria.

**Per os** By way of or through the mouth. See Peroral. As in per os administration of a drug.

**Pericardial cells** Groups of cells found in insects and some crustaceans. They lie adjacent to the heart and function in both phagocytosis and pinocytosis.

**Period of lethal infections** In cases of progressive infection, the time interval between invasion by a microorganism and death of the host.

**Permissive cells** Cells that support productive infection by a virus leading to complete viral replication and assembly of infectious virions.

**Perora** By way of or through the mouth. See also Per os. As in peroral inoculation.

**Persistence** Term for the durability of organisms or substances. Often used in the context of the decrease of plant protectants after application.

**Phagocytes** (cells which devour) Fixed or moving cells capable of engulfing and/or destroying some microorganisms and inanimate particles.

**Phagocytic index** In a population of phagocytic cells, the percentage of cells that have taken up particles by phagocytosis is recorded as the phagocytic index. Compare with avidity index.

**Phagocytosis** The process of ingestion and digestion by cells, especially the ingestion or engulfing of microorganisms and other small particles by blood cells.

**Phagostimulant** Feeding stimulant. A substance increasing the uptake of e.g. a plant protectant.

**Phenoloxidase** An enzyme found in the hemocytes and plasma of many invertebrates that is involved in melanization reactions associated with foreign body responses, formation of nodules and capsules, and wounds. This process is considered to be a

component of an important defense system of insects and crustaceans. This system plays roles both in non-self recognition and in immune effector functions.

**Phoresy** A type of symbiotic relationship in which one organism associates with another species in order to obtain transportation. See also Transport host.

**Physiopathology** Pathophysiology. Pathological physiology. The study of abnormal function. Involving pathological alteration of bodily function.

**Pickling** Treatment of the surface of seeds with a pickle (substance to modify the surface) in order to protect the seeds.

**Pit disease** A disease of oysters, in holding pits. Caused by species of Hexamita. See also Hexamitiasis infection.

**Planozygote** A biflagellate zygote of chytridiomycete fungi formed by the fusion of two uniflagellate haploid (plano)gametes.

**Plasma** The fluid portion of the hemolymph in which the hemocytes are suspended, often obtained by centrifuging anticoagulant-treated hemolymph.

**Plasmodium** A syncytium, especially in the case of Protista. In microsporidia, a plasmodium with relatively few nuclei, as a merogonial plasmodium with eight diplokarya, is often characterized as “paucinucleate”. A plasmodium with a relatively large number of nuclei has been characterized as plurinucleate.<sup>1</sup>

**Plasmogamy** Cytoplasmic fusion of gametes without karyogamy (nuclear fusion).<sup>1</sup>

**Plasmotomy** Dividing of a plasmodium into smaller plasmodia. <sup>1</sup>

**Polar cap** A chromophilic body at the anterior end of the microsporidian spore and contained within the polar sac.<sup>1</sup>

**Polar filament** A filiform organelle inside the microsporidian spore, attached anteriorly, extending backward and typically coiling several times just inside the spore wall. A part of the extrusion apparatus that everts and inoculates the sporoplasm into a host cell.<sup>1</sup>

**Polar sac** In microsporidia, the inflated central part of the anchoring disc of the spore, containing the polar cap.<sup>1</sup>

**Polar tube** Used instead of the usual term “polar filament” because this organelle was found to be tubular when everted. The terms are used interchangeably.<sup>1</sup>

**Polar vesicles** A group of vesicles near the spindle plaque.<sup>1</sup>

**Polaroplast** In microsporidia, a complex of smooth membranes surrounding the base of the polar filament and arranged in layers or vesicles at right angles to it.1

**Polyclonal** A serum with polyclonal antibodies contains antibodies of different hybridoma cells.

**Polyhedrin** The protein of the crystalline body (polyhedron) surrounding the polyhedrosis virions. C-polyhedrin and N-polyhedrin designate the polyhedrin of cytoplasmic polyhedrosis virus and of nucleopolyhedrosis virus, respectively. Synonymous with, but preferred to, polyhedron protein, matrix protein, inclusion-body protein, and proteinic crystal.

**Polyhedron** Crystallike inclusion body (enclosing a number of polyhedrosis-virus particles) produced in the cells of tissues affected by certain insect viruses. Ordinarily the polyhedrosis-virus particles formed in the nuclei of the host cells are rod-shaped while those formed in the cytoplasm are polyhedral or approximately spherical. (See also Polyhedrosis.) Plural, polyhedra.

**Polyhedrosis** A virus disease of certain insects characterized by the formation of polyhedral inclusions in the tissues of the infected insect. If the inclusion bodies (polyhedra) are formed in the nuclei of the infected cells, the disease is known as a "nuclear polyhedrosis" or "nucleopolyhedrosis." If the inclusions are formed in the cytoplasm, the disease is known as a "cytoplasmic polyhedrosis." (One does not speak of a "polyhedral disease" since this literally means "a many-sided disease." Also one speaks of a "polyhedrosis virus" and not of a "polyhedral virus," much as one says "encephalitis virus.") Plural, polyhedroses.

**Polymorphic life cycle** A life cycle consisting of different morphological forms.2

**Polysporoblastic** Pertaining to a sporont that produces numerous sporoblasts.1

**Population density** The number of individuals of one population per unit area or volume.

**Population** A group of individuals of the same species set in a frame that is limited and defined with regard to both time and space.

**Portal of entry** Point at which the invading microbe enters the body of the animal.

**Post mortem** After death. As in post-mortem examination, post mortem changes.

**Posterior end** Refers to the end of a spore opposite that from which the polar filament becomes everted.1

**Posterior vacuole** A large clear area in the posterior part of most microsporidian spores. Formed during sporogenesis, probably with participation of the Golgi apparatus.1

**Posteriosome** An electron dense body, variable in size, commonly present in the posterior vacuole of a microsporidian spore. Perhaps a secretion from the Golgi apparatus and involved in the extrusion process.<sup>1</sup>

**Potency** See Activity titer.

**Precipitation** Serological reaction with suspended viruses or microorganisms leading to visible complexation.

**Predaceous fungi** Fungi which can form special devices (constricting rings, adhesive networks or adhesive pegs, for instance) for to entrap and then to kill and to invade the trapped host (a nematode or other small invertebrate) as a food source.

**Predisposing factors** Factors which, by their actions, render an organism specially susceptible to a certain disease. Conferring a tendency to disease. Similar to secondary etiologic factors.

**Prevalence (of a disease)** The total number of cases of a particular disease at a given moment of time, in a given population. For example, a yearly survey of a cockchafer population may show a total of 150 cases of Lorsch disease per 1,000 insects (these may be recent as well as old, chronic infections). These 150 cases represent the prevalence of Lorsch disease in that particular population at the time the survey was conducted. The prevalence rate is 15 percent. Compare with Incidence (of a disease).

**Primary conidium** a conidium produced directly from the main body of the fungus (especially of Entomophthorales), and that is forcibly or passively dispersed; when no germ tube is produced, often able to produce some type of secondary conidium (see Capilliconidium).

**Primary culture** A culture started from cells, tissues, or organs taken directly from organisms. It does not include cultures started from explants of tumors developed by injecting cultured cells into animals. Such cultures would be considered more properly as continuations of the injected cell line or strain. A primary culture may be regarded as such until it is subcultured for the first time. It then becomes a "cell line." See also Cell culture, Organ culture, Tissue culture.

**Primary etiologic factors** See Direct causes.

**Primary host** See definitive host.

**Prodromal** Relating to prodromes or the initial stage of a disease.

**Prodrome** A premonitory symptom or sign, indicating the onset of a disease.

**Prognosis** Forecast of the probable course of a disease.

**Progressive infection** An interaction between an infectious agent and its host, resulting in overt disease of the host. See also Infection and Attenuated infection.

**Promotor** DNA segment indicating the starting point for the transcription.

**Prophenoloxidase** An inactive form of phenoloxidase, its activation mediated by serine proteases triggers a cascade of defense reactions. The serine proteases are activated by components of microbial cell walls such as lipopolysaccharides, beta-glucans and peptidoglycans.

**Proteome** The complex protein pattern of an organism or cell.

**Proteomics** The science of the complex protein expression of a cell or organism.

**Protomerite** Anucleate portion or segment of the trophont stage of a septate pregarine that is positioned between the epimerite and the deutomerite.<sup>2</sup>

**Protozoiasis** Any disease caused by protozoa.

**Provirus** A noninfectious intracellular form of a virus. The genetic material (genome) of a virus--essentially a nucleic acid. It is perpetuated in stable association with the internal structure of the host cell, and for this reason has, so far, not been directly detectable. One of three phases (proviral, vegetative, and infective) in which a virus may exist. (Prophage, which is the nucleic acid of bacteriophage in lysogenic bacteria, is a provirus.)

**Pseudotumor** Preferred term for a "melanotic tumor" of certain insects, especially Drosophila, composed of hemocytes or fat body cells.

**PTGS** (Post transcriptional gene silencing). Selective inactivation of the gene expression after the transcription.

**Purple brood** The unsealed brood of honey bees foraging on southern leatherwood, Cyrilla racemiflora Linnaeus, sometimes turns purple and dies. Poisoned purple brood usually appears in early summer.

## Q

**QPX** Quahog parasite unknown. A protistan parasite responsible for high mortalities in hard clams (*Mercenaria mercenaria*) in Atlantic Canada and the East Coast of the USA. It is a thraustochytrid member of phylum Labyrinthulomycota.

**Quantitative atrophy** See Hypoplasia (2).

## R

**Rate** A measure of the frequency of an event in a defined population; the components of a rate are: the numerator (number of events); the denominator (population at risk of experiencing the event); and the specified time in which the events occur. 3

**Reactive oxygen species** Cytotoxic oxygen intermediates such as superoxide, hydrogen peroxide, singlet oxygen and hydroxyl radicals that are produced by the hemocytes of many invertebrates; they are involved in antimicrobial defense responses.

**Recombinant antibody** Antibody with different binding sites.

**Recombinant DNA** An artificial DNA sequence resulting from the combining of two other DNA sequences in a plasmid.

**Recombinant organism** An organism in which the DNA has been modified by joining together segments of DNA of different origin.

**Red muscardine** A little used reference to various insect mycoses caused by species of hyphomycete fungi, mostly species of *Sorospora*, characterized by the appearance of pink to brick-red colors in masses of chlamydospores filling the body of affected hosts. Certain strains of *Beauveria bassiana* are responsible for a red muscardine on silkworm larvae if the mycelia of those strains produce much red pigment.

**Refaunation** Reintroduction of mutualistic fauna in a host deprived of such fauna. See also Mutualism, Defaunation, Infaunation, Transfaunation.

**Regeneration** See also Wound repair. The complete restoration of damaged tissue, organs, or lost body parts; regarded primarily as a device by which functional competence is recovered.

**Reinfection** A second infection by the same microorganism or virus, after recovery from or during the course of a primary infection. See also Secondary infection, Superinfection.

**Replication, virus** The unique mechanism by which viruses multiply; the synthesis of new virions inside living host cells. Within a host cell, disappearance of the virion as a structural entity, release of the viral genetic material, integration of such material into the biochemical machinery of the cell, synthesis of viral components, and assembly of complete virions are essential steps of viral replication.

**Reservoir (of infection)** Living or nonliving material in or on which an infectious agent

multiplies and or develops and is dependent for its survival in nature. 3

**Resistance** The evolution of an ability in a group of invertebrates to tolerate doses of a pathogen that would prove lethal to most of the individuals in a reference population of the same species.

**Resistance ratio** An estimate of the degree of a host population's resistance to a pathogen, calculated as the LD<sub>50</sub> of the resistant population divided by the LD<sub>50</sub> of the susceptible or reference population. (see resistance and LD<sub>50</sub>)

**Respiratory burst** The increased respiration of hemocytes accompanying phagocytosis or appropriate membrane perturbation. The increased cellular oxygen is converted to superoxide by activated NADPH oxidase, giving rise to a series of antimicrobial oxygen intermediates.

**Resting spore** A thick-walled fungal spore stage (e.g., zygospore, azygospore, oospore, resistant sporangium, etc.) able to endure drought and other unfavorable conditions, and normally remaining quiescent for some time before it germinates.

**Restriction endonucleases** Enzymes capable of cutting DNA molecules.

**Restriction enzymes** See restriction endonucleases.

**RFLP** (Restriction fragment length polymorphism). Differences in the length of particular restriction fragments of the DNA of different organisms based on different DNA sequences detected by gel electrophoresis. Used for the determination of the genetic relationship.

**Rickettsiosis** Infection with rickettsiae. E.g., Blue disease and Lorsch disease are rickettsioses.

**Rigor** Rigidity, stiffness. "Rigor mortis" is the rigidity of muscles after death.

**RNA** (ribonucleic acid). Polynucleotide which is made of a pentose (ribose), a purin- (adenine, guanine) or pyrimidinbase (cytosine, uracil) and a phosphoric acid. Alternating connections between phosphoric acid and ribose lead to a straight molecule. Within the process of the protein bio synthesis, the transfer RNA (t-RNA) functions as donator for amino acids, the messenger RNA (m-RNA) transfers the information of the genes and the ribosomal RNA (r-RNA) is a component of the ribosomes.

**Ropy brood** See American foulbrood.

**S**

**Sacbrood** A lethal disease of larvae of the honey bee, caused by a virus. Infected larvae die in the prepupal stage after they have spun their cocoons. The virus infection appears to disturb the endocrine balance. There is an unusual amount of fluid accumulating between the last larval skin and the prematurely darkened pupal skin. The presence of this fluid causes a flabby, sac-like appearance. After death, the larval remains dry to a scale. The virus occurs in the cytoplasm of the fat body cells. The isometric virions have a diameter of 28 millimicrons. The disease is prevalent in the spring and has been reported from Europe, North America, New Zealand, and Australia.

**Sacculinization** A condition occurring in decapod crustaceans following parasitization by species of *Sacculina*, rhizocephalan crustaceans. *Sacculina* interferes with the hormonal system of the host. The gonads do not develop and secondary sexual characteristics are absent or abnormal.

**Sagittal section** A section of an animal, or part of it, in a median longitudinal plane, dividing the animal into two lateral halves (right and left halves). Sections parallel to this median section are called parasagittal sections.

**Sappe disease** A bacterial flacherie of the silkworm. "Sappe," as the disease is known in certain regions of India, means "sluggish." Sluggishness and general listlessness are among the early symptoms of the disease.

**Schizogony** Term restricted primarily to mean formation of uninucleate (haplophasic) daughter cells among sporozoan groups by multiple fission.<sup>1</sup>

**Schizont** A stage that undergoes schizogony (multiple fission).<sup>1</sup>

**Schlauffsucht, bacterial** See Bacterial schlauffsucht.

**Sclerotium** A hard mass of fungal hyphae serving as a resting stage to survive unfavorable environmental conditions and usually giving rise to a conidial state or to an erect stroma bearing the sexual state of a fungus (especially of ascomycetes in the Clavicipitaceae such as *Cordyceps* species).

**Secondary conidium** Any of several types of fungal spores, especially in the Entomophthorales or upon germination of ascospores of entomopathogenic ascomycetes such as *Cordyceps* species, formed on and forcibly discharged (or passively dispersed) directly from another spore type but usually from another conidium or an ascospore.

**Secondary etiologic factors** See Predisposing factors.

**Secondary host** See intermediate host.

**Secondary infection** An infection occurring in an animal already infected by a pathogenic microorganism or a virus of different kind.

**Secondary infective form** In microsporidia, sporoplasms discharged by a morphologically identifiable class of spores that develop early in the life cycle and function as autoinfective spores.1

**Selection** Artificial selection involves the selection of individual organisms with special character for reproduction in order to fix this character genetically in the population. Natural selection occurs when the environment favors the survival and reproduction of one phenotype over another.

**Semiology** See Symptomatology.

**Septate** Condition of having partitions that separate parts of the body into segments.2

**Septicemia** A morbid condition caused by the multiplication of microorganisms in the blood.

**Sequel (or sequela)** An after-effect of disease or injury. A morbid condition arising as a consequence of a previous disease.

**Serodiagnosis** Diagnosis made by means of reaction taking place in the blood serum.

**Serologic assay** Detection test for antigens with the help of specific antibodies.

**Serum** The cell-free portion of the hemolymph obtained after clotting.

**Shell disease, in blue crab** A disease of Callinectes sapidus Rathbun, characterized by superficial necrosis of the exoskeleton. Chitinoclastic bacteria have been isolated from the lesions, but a causal relationship has not been established.

**Shell disease in lobsters** Softening of the exoskeleton, caused by chitinivorous bacteria. Reported from Homarus americanus Milne-Edwards in artificial holding ponds.

**Shell disease in oysters** Similar to or the same as Maladie du pied.

**Shortworm** With this term sericulturists denote silkworms which do not emit a normal silk thread and die without being able to spin a normal cocoon. See Silk toxicity.

**Shwartzmanlike reaction** As applied to invertebrates, more especially arthropods, it is the extensive intravascular clotting of the liquid phase of the blood, due to the presence of endotoxin. In Limulus the mechanism involves release of hemocyte granules and subsequent extracellular gelation.

**Sigma Virus** The agent of carbon dioxide sensitivity in various species of fruit flies. The virion is cylindrical, with one hemispherical end. Average size is 70 by 180 millimicrons.

**Sign** Any objective aberration or manifestation of disease indicated by a change in structure.

**Silk toxicity** A term used to describe a lethal hyperaminoacidemia in the silkworm, caused by silk retention. The inability to emit silk is related to structural and functional lesions in the silk glands, caused by endocrine disturbances, genetic factors, or infectious microorganisms.

**Single-strand** Term for molecules of nucleic acids, which only consist of one polynucleotide chain.

**Somatic death** Death of the entire organism as opposed to necrosis or death of individual cells. In protozoa, of course, the two are synonymous. The precise moment of somatic death is frequently difficult to identify or define because it typically occurs after necrosis of significant areas of vital tissue, but other tissues remain alive and functional. While this is also true of vertebrates, somatic death is usually a much more gradual process in invertebrates. Somatic death is best defined as that point in the life of the organism when necrosis becomes irreversible with no possibility of return to normal functioning by the organism.

**Sotto disease** See Paralysis, bacillary.

**Southern blot** A DNA detection method (named after its inventor Southern) which combines a good separation using the gel electrophoresis and a high sensitivity of the nucleic acid hybridization.

**Specificity** Extent of specialization in host range. A pathogen with only one species of host has high specificity.

**Spheroidosis** A disease of larvae of species of Lepidoptera and Coleoptera, caused by an agent of the poxvirus group. During the course of the disease, large numbers of virus-containing crystals, called spheroids, appear in the cytoplasm of the fat body cells, hence the disease name. Occasionally, fusiform bodies (spindles), devoid of virus particles, also appear in the cytoplasm of infected cells. Thus the disease is also known as "Spindle virosis" and "Maladie a fuseaux."

**Spindle plaque** An electron dense and laminated body that lies on the nuclear membrane and to which the intranuclear microtubules are attached. 1

**Spindle virosis** See Spheroidosis.

**Spiroplasmosis** A disease of arthropods caused by spiroplasma.

**Sponge disease** See Wasting disease.

**Sponge Epizootic** See Wasting disease.

**Sporangium** (plural: -ia) For fungi, a sac-like structure in which protoplasmic contents are converted into one or more spores of asexual or sexual origin.

**Spore morphogenesis** Sporogenesis. Transformation of a sporoblast into a spore.1

**Spore** A generalized term for specialized reproductive (non-vegetative) structures produced by some bacteria or protozoans, and by all fungi, algae, and lower plants. Spores, whether derived from mitotic or meiotic processes, usually function as environmentally resistant, dispersive units. Among pathogenic microbes, spores (or the structures resulting from their germination) are usually the infective units.

**Sporoblast** The product of sporogony. A cell which develops directly into a spore.1

**Sporogenesis** Spore morphogenesis. Transformation of a sporoblast into a spore.1

**Sporogonial plasmodium** Multinucleate body that divides into sporoblasts. Not to be confused with "sporont".1

**Sporogony** Dividing of a sporont or a sporogonial plasmodium into sporoblasts.1

**Sporont** A cell, uninucleate or diplokaryotic, that divides directly or with the intervention of a plasmodial stage into sporoblasts. Pansporoblast. Not to be confused with "sporogonial plasmodium".1

**Sporophorous vesicle** An envelope, usually produced by a sporont, that contains spores.1

**Sporophyte** Diploid generation in the life cycle of a fungus with alternating haploid and diploid generations; meiospores are produced by this stage.

**Sporoplasm** The generative portion of the spore.1

**Sporozoite** Motile infective stage in gregarine and coccidian life cycles that is produced by sporogony and usually takes place within an envelope or shell.2

**Sporulation** Sporogony plus spore morphogenesis. The process of spore formation.1

**Sporulation** Formation or release of spores.

**Spread** See Dispersal.

**Spring disease** A disease of the cutworm *Euxoa segetum* (Denis and Schiffermueller), caused by *Pseudomonas septica* Bergey et al.

**Spring swindling** See May disease.

**SSO disease** Code name, meaning "sea side organism." A disease of the American oyster, *Crassostrea virginica* (Gmelin), found along the Middle Atlantic Coast of the United States. Caused by the haplosporidian *Minchinia costalis* (Wood and Andrews) which is found in the connective tissues. Occurs in spring and early summer.

**ST<sub>50</sub>** See Median Survival time.

**Stabilate** A population of organisms viably preserved on a unique occasion. Since reproduction is arrested by preservation, deviation of biological characteristics is therefore eliminated. There will be only so many examples of the stabilate as there were individual samples of the population preserved on that unique occasion.

**Stenoxenous** A parasite having a narrow host range.<sup>2</sup>

**Sterilization** The destruction of all microorganisms in or about an object, as by steam (flowing or pressurized), chemical agents (alcohol, phenol, heavy metals, ethylene oxide gas), high velocity electron bombardment, heat, or ultraviolet light radiation.  
3

**Stone brood** A disease of larval and adult bees, caused by the fungi *Aspergillus flavus* or, less often, *A. fumigatus*. Diseased larvae usually die in the sealed stage, before pupation. Both fungi can cause respiratory illnesses in humans or birds.

**Strain** Pure culture of microorganism with relatively constant properties for which many individual isolates (from a specific time, place, or substrate) may be examples.

**Strain** A population of homogeneous organisms possessing a set of defined characteristics; in bacteriology, the set of descendants that retains the characteristics of the ancestor; members of a strain that subsequently differ from the original isolate are regarded as belonging either to a sub-strain of the original strain, or to a new strain. 3

**Stress** A state manifested by a syndrome or bodily changes, caused by some force, condition, or circumstance (i.e., by a stressor) in or on an organism or on one of its physiological or anatomical systems.

**Stressor** Any stimulus, or succession of stimuli, that tends to disrupt the normal

homeostasis of an animal. Stressors are factors that produce stress.

**Stroma** (pl: **-mata**) -- A dense, tissue-like mass of fungal cells in or on which sporulating structures occur. Among entomopathogenic fungi, for example, *Cordyceps* species produce one or more erect, stalked stromata bearing perithecia, asci and ascospores, and arising from a **sclerotium** inside the cadaver of the infected host.

**Sublethal effect** One that is not fatal; insufficient to cause death.

**Subpersistent** More or less persistent. In microsporidia, often used to characterize an interfacial envelope produced by the sporont and persisting long enough to contain spores.<sup>1</sup>

**Substitute host** A host, other than the natural host, chosen for laboratory propagation of a pathogenic microorganism or parasite. A substitute host is not necessarily a host of choice.

**Superinfection** A fresh infection added to one of the same nature already present. See also Reinfection, Secondary infection.

**Survival data** The lifetime or length of time until the occurrence of an event, such as death after exposure to a pathogen. Survival analysis procedures have been developed to account for censored data (see which), which are an intrinsic characteristic of survival data.

**Susceptibility** Susceptible. The state of being readily affected or acted upon by an injurious agent. A susceptible organism is one which is not known to have become immune to a disease by either natural or artificial means. See also Immunity, Resistance.

**Symbiosis** The living together of individuals of two different species. Especially the living together of dissimilar organisms in a more or less intimate association (as in Mutualism, Commensalism, and Parasitism).

**Symbiont** An organism living in symbiosis. Frequently, those microorganisms associated in a regular mutualistic manner with insects and other invertebrates. (see also microsymbiont) Usually preferred to "symbiote."

**Symptom** Any objective aberration in function (including behavior), indicating disease. (See also Sign.)

**Symptomatology** The science of the symptoms and signs of disease. Also, the study of the aggregate of the symptoms and signs of a disease. Semiology.

**Synanamorph** An alternative anamorphic (conidial) state of a single ascomycete

fungus that produces two or more morphologically and/or temporally distinct anamorphic (conidial) states, each of which is entitled to bear its own valid name under the rules of the International Code of Botanical Nomenclature.

**Synporium** An animal association formed owing to unfavorable environmental conditions or disease.

**Synaptonemal complex** A particular configuration of chromosomes in the prophase of meiosis that is demonstrable with electron microscopy as group of three parallel elements, a very thin central element and two broader lateral elements.<sup>1</sup>

**Syndrome** A group of signs and symptoms characteristic of a particular disease. A running together or concurrence of symptoms associated with any morbid process. There is a trend toward considering as a "disease entity" any morbid process that has a specific cause, while a "syndrome" reflects not so much specific disease factors as a chain of disrupted physiological processes. Thus, the same syndrome may arise from many different causes.

**Synergism or synergistic effect** (synonym: potentiation) A cooperative action of two pathogens or agents, such that the total effect is greater or more prolonged than the sum of effects of the two taken independently.

**Syngamy** Fusion of haploid gametes or gametic cells in sexual reproduction.<sup>2</sup>

**Synnema** (plural: -nemata) A loose to tightly bundled, thin to thick, usually erect fascicle of fungal hyphae on whose surface asexual spores (conidia) are formed. Coremium (-ia) is similar but less common term for such a structure.

**Synxenic cultivation** The rearing of one or more individuals of a single species in association with one or more known species of organisms. One speaks of monoxenic, dixenic, trixenic, or polyxenic conditions according to the number of associated known species (one, two, three, or more).

**Syzygy** Association side-by-side or end-to-end of gamonts (especially of gregarines) prior to formation of gametocysts and gametes.<sup>2</sup>

## T

**Teratism** See Teratosis.

**Teratology** The science concerned with malformations and monstrosities. Serious deviations from normal structure. These abnormalities may be classified into various types or groups. Among the more common types of teratological changes in insects, for example, are prothetely (imaginal organs appearing in larvae), hysterotely (larval structures appearing in adults), and homoeosis (one anatomical structure assuming the likeness of another).

**Teratosis** A developmental anomaly in an organism. An irreversible error of development. A malformation.

**Terminal disease** A disease which ends the life of an organism. It is often superimposed on some other ailment.

**Tetrasporoblastic** Pertaining to a sporont that produces four sporoblasts.1

**Tissue culture** Animal tissue culture is concerned with the study of cells, tissues and organs explanted from animals and maintained or grown in vitro for more than 24 hours. Dependent upon whether cells, tissues, or organs are to be maintained or grown, two methodological approaches have been developed, cell culture and organ culture. See also Explant, Primary culture.

**Titre** A titer (or titre) is the unit in which the analytical detection of many substances is expressed. It is the result of a titration.

**Touffe flacherie** A noninfectious flacherie of the silkworm known to appear in rearing establishments after sudden abnormal increases in environmental temperature and humidity ("touffe" meaning "wisps of heat"). Fifth-instar larvae are particularly affected by the touffe flacherie.

**Touffe** See Touffe flacherie.

**Toxemia** A condition produced by the dissemination of toxins in the blood.

**Toxinosis** Any disease caused by the action of a toxin.

**Transcriptome** The transcriptome is the set of all mRNA molecules in a cell or population for a given set of environmental circumstances

**Transcriptomics** Transcriptomics depicts the expression level of genes, often using techniques capable of sampling tens of thousands of different mRNA molecules at a time (DNA microarrays).

**Transfaunation** Transfer of symbiotic fauna (usually mutualistic protozoa) from one host to another. See also Mutualism, Defaunate, Infaunate, Refaunation.

**Transgenic plant** Plants to which genetic information has been transferred from other organisms.

**Transmission** (of disease) The conveyance of disease from one individual host to another. The transfer or transport of an infectious agent from reservoir to susceptible host.

**Transmission, horizontal** See Horizontal transmission.

**Transmission, vertical** See Vertical transmission.

**Transmission** the process by which a pathogen or parasite is passed from one host to another.

**Transovarial spore** A functional category of spore because it is responsible for the infection of the filial generation within the ovaries.<sup>1</sup>

**Transovarian transmission** A mode of trans-ovum transmission in which the passage of microorganisms from mother to egg is known to occur within the ovary.

**Trans-ovum transmission** The transmission of microorganisms from one generation to the next by way of the egg. Transovarian transmission is a special case of trans-ovum transmission.

**Transport host** One partner in a phoretic relationship. The animal which transports a pathogenic microorganism to which it is nonsusceptible. Also, a mechanical vector. See also phoresy.

**Transstadial transmission** The transmission of microorganisms from one stage of the host to the next, throughout part or all of the host's life cycle.

**Transverse section** A section of an animal, or part of it, in a plane at right angle to the main (long) axis of the body or of the part.

**Trauma** Wounds or injuries caused directly by violent contact of external objects with the body of the animal.

**Trophont and Trophozoite** Mature, vegetative, feeding, adult stage in the life cycle of ciliated protozoa.<sup>2</sup>

**Tumefaction** (1) A term proposed for those abnormal tissue formations in insects and other invertebrates which have characteristics in common with vertebrate neoplasms but whose precise nature is unknown. (2) A tumor.

**Tumor** (1) any swelling, whether edema or a mass resulting from malformation, inflammation, or repair. Not a preferred term in this meaning. (2) A neoplasm.

**Typical host** A host in which the pathogenic microorganism (or parasite) is commonly found. Synonymous with natural host.

## U

**Unicapsid virion** A single nucleocapsid enclosed within an envelope. Compare with

multicapsid virion.

**Univoltine** Species with only one generation per year are univoltine

**Urn cells** A mucociliated bicellular organelle found in sipunculid worms. The cells swim through the coelomic fluid, acting as scavengers by accumulating foreign matter and subsequently disposing of it.

## V

**Variability** Ability of organisms to change morphological or physiological characteristics.

**Variety** Taxonomic category on the subspecies level.

**Vector** An arthropod or other animal carrying a microorganism pathogenic for members of another species. The vector may or may not be essential for the completion of the life cycle of the pathogenic microorganism. If it is not essential, one speaks of "mechanical vector" or Transport host.

**Vegetative phase** In virus infection, the period during which there is an actual multiplication of viral material. The phase preceding the final infective phase. The sum of the eclipse period and the maturation phase. (In the case of bacteriophage the interval between virus adsorption and lysis of the bacterium is sometimes called the "latent period.") Some authorities dislike the use of the term in relation to viruses because of plant-cell connotations.

**Vertical transmission** The direct transmission of an infectious agent through time, from one generation to the next, from parent to offspring. See also Inherited disease, Trans-ovum transmission. Compare with Horizontal transmission.

**Viable** Capable of living. Capable of growing or developing.

**Viral flacherie** An infectious flacherie of silkworm larvae caused by a small nonoccluded virus.

**Viremia** The presence of virus in the hemolymph or blood.

**Virion, bundle** See Multicapsid virion.

**Virion** The mature virus, the ultimate phase of viral development. The virion is either a naked or an enveloped nucleocapsid. The term "virus" embraces all phases of the viral development, and it includes the virion.

**Virosis** Any disease caused by a virus.

**Virulence factors** Properties of pathogenic microorganisms that permit them to avoid detection or subvert the proper functioning of the immune defense system.

**Virulence** The disease-producing power of a microorganism, i.e., the ability of a microorganism to invade and injure the tissues of its host. The relative capacity of a microorganism to overcome the body defenses of the host. The degree of pathogenicity within a group or species. Virulence can be quantified. Thus, one may speak of avirulent, virulent, and highly virulent strains within a group or species of microorganisms that are said to be pathogenic. According to some authors, disease-producing ability that is not genetically determined. See also Pathogenicity.

**Virus, Endogenous** See Endogenous virus.

## W

**Waldtracht disease** Poisoning of adult honey bees foraging on honeydew from conifers, usually spruce. The poisoned bees first show agitation, then they become incapable of flight, crawl rapidly in front of the hive, and die.

**Wassersucht** See Watery disintegration.

**Wasting disease** A disease of many species of sponges, characterized by destruction of the internal tissues. The fungus *Spongiophaga communis* Carter is implicated as a causal agent. An epizootic of wasting disease nearly wiped out commercial sponges in the Caribbean in 1938-40. Synonymous with Sponge disease, Sponge epizootic.

**Water disintegration** Also called Wassersucht. A lethal disease of cockchafer grubs (*Melolontha*) caused by a virus. The diseased larva appears transparent, especially in the abdomen, following atrophy and disintegration of its fat body. As the disease progresses, the muscles as well as other tissues become atrophic. The virus particles are isometric, 60 to 70 millimicrons in diameter, and are found in the cytoplasm of fat body cells. There are some similarities between this disease and Heidenreich's disease.

**Western blot** A procedure to transfer proteins from a gel to an other matrix e.g. nitrocellulose.

**Wettable powder** Water dispersible powder (formulation of micro organisms used in biological control).

**White head** An abnormality occurring during the development of honey bees, characterized by lack of brown pigment in the cuticle of the head and of the first pair of legs. Absence of oxygen has been considered a factor responsible for the lack of pigmentation in "white-headed" or "linthal" bees. As a result of an

imperfect pupal molt, both prothoracic tracheae of these abnormal bees are obstructed and, consequently, the oxygen flow to the prothorax and head is arrested. The head does not develop normally, and death usually occurs at the end of the pupal period.

**White muscardine fungus** Now little used name of a mycosis of various insects caused by *Beauveria bassiana* or other basically colorless fungi in the Hyphomycetes (or anamorphic Clavicipitaceae).

**White-halo fungus** *Verticillium lecanii* (now classified in the genus *Lecanicillium* and recognized as a species complex including at least *L. lecanii*, *L. muscarium*, and *L. longisporum*).

**Wilt disease** (1) Nucleopolyhedrosis of gypsy-moth caterpillars, *Porthetria dispar* (Linnaeus). (2) Nucleopolyhedrosis of lepidopteran larvae. Not a preferred term.

**Wipfelkrankheit** A nucleopolyhedrosis of the larva of the nun moth, *Lymantria Monacha* Linnaeus. The characteristic of diseased caterpillars to proceed to the tops (wipfel) of trees caused the malady to known in Germany by the name "Wipfelkrankheit" or "Wipfelsucht."

**Wound repair** See also Inflammation and Regeneration. A result of inflammation in which there is healing with or without regeneration. In repair, the injured tissue either becomes replaced with a scar, or it is restored to its original state by the regenerative abilities of that tissue. The outcome of the reparative process at the injury site may be either a tissue that is indistinguishable from the original, or a scar that diminishes the functional capacity of the damaged tissue.

## X

**Xenic cultivation** The rearing of one or more individuals of one species in association with an unknown number of species of other organisms.

**Xenograft** A tissue or organ graft between members of two different species.

**Xenoma** (also, Xenom). Xenoma tumor A symbiotic complex formed by hypertrophying host cells and multiplying intracellular parasites, such as certain microsporidia.

**Xenoparasitic complex** An association of parasite and host cell so intimate that it is morphologically and physiologically an indivisible unit, essentially an autonomous organism. Synonym of "xenoma".1

## Y

**Yeasts** Fungal growth form in which single cells multiply asexually by budding (rarely

by other means); usually referring to ascomycetous fungi but without any inherent taxonomic meaning or limitation.

## **Z**

**Zoonosis** Any disease in man acquired from one of the lower animals, including invertebrates.

**Zoosporangium** sporangium of chytridiomycetes or oomycetes in which motile (uni- or biflagellate) zoospores are formed.

**Zoospore** a motile, uniflagellate (chytridiomycete) or biflagellate (oomycete), wall-less (protoplastic), spore acting as an asexual propagule or, in some instances, as a motile gamete.

**Zygospor** A fungal resting spore state of a zygomycete fungus having a thick (bilayered) wall formed after conjugation of gametangia. While zygospor

es are usually thought to be of sexual origin, the term refers only to the mode of formation whether or not karyogamy and meiosis occur in them before germination Also see azygospor

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