

Pathogen

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In biology, a **pathogen** (Greek: *πάθος* *pathos* "suffering, passion" and *-γενής* *-genēs* "producer of") in the oldest and broadest sense is anything that can produce disease; the term came into use in the 1880s.^{[1][2]} Typically the term is used to describe an infectious agent such as a virus, bacterium, prion, a fungus, or even another micro-organism.^{[3][4]}

There are several substrates including *pathways* where the pathogens can invade a host. The principal pathways have different episodic time frames, but soil contamination has the longest or most persistent potential for harboring a pathogen. Diseases caused by organisms in humans are known as pathogenic diseases.

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Pathogenicity

Pathogenicity is the potential disease-causing capacity of pathogens. Pathogenicity is related to virulence in meaning, but some authorities have come to distinguish it as a *qualitative* term, whereas the latter is *quantitative*. By this standard, an organism may be said to be pathogenic or non-pathogenic in a particular context, but not "more pathogenic" than another. Such comparisons are described instead in terms of relative virulence. Pathogenicity is also distinct from the transmissibility of the virus, which quantifies the risk of infection.^[5]

A pathogen may be described in terms of its ability to produce toxins, enter tissue, colonize, hijack nutrients, and its ability to immunosuppress the host.

Context-dependent pathogenicity

It is common to speak of an entire species of bacteria as pathogenic when it is identified as the cause of a disease (*cf. Koch's postulates*). However, the modern view is that pathogenicity depends on the microbial ecosystem as a whole. A bacterium may participate in opportunistic infections in immunocompromised hosts, acquire virulence factors by plasmid infection, become transferred to a different site within the host, or respond to changes in the overall numbers of other bacteria present. For example, infection of mesenteric lymph glands of mice with *Yersinia* can clear the way for continuing infection of these sites by *Lactobacillus*, possibly by a mechanism of "immunological scarring".^[6]

Related concepts

Virulence

Virulence (the tendency of a pathogen to cause damage to a host's fitness) evolves when that pathogen can spread from a diseased host, despite that host being very debilitated. Horizontal transmission occurs between hosts of the same species, in contrast to vertical transmission, which tends to evolve symbiosis (after a period of high morbidity and mortality in the population) by linking the pathogen's evolutionary success to the evolutionary success of the host organism.

Evolutionary medicine has found that under horizontal transmission, the host population might never develop tolerance to the pathogen.[citation needed]

Transmission

Transmission of pathogens occurs through many different routes, including airborne, direct or indirect contact, sexual contact, through blood, breast milk, or other body fluids, and through the fecal-oral route.

Types of pathogens

Bacterial

Although the vast majority of bacteria are harmless or beneficial, a relatively small list of pathogenic bacteria can cause infectious diseases. One of the bacterial diseases with the highest disease burden is tuberculosis, caused by the bacterium *Mycobacterium tuberculosis*, which kills about 2 million people a year, mostly in sub-Saharan Africa. Pathogenic bacteria contribute to other globally important diseases, such as pneumonia, which can be caused by bacteria such as *Streptococcus* and *Pseudomonas*, and foodborne illnesses, which can be caused by bacteria such as *Shigella*, *Campylobacter*, and *Salmonella*. Pathogenic bacteria also cause infections such as tetanus, typhoid fever, diphtheria, syphilis, and leprosy.

Bacteria can often be killed by antibiotics because the cell wall on the outside is destroyed, expelling the DNA out of the body of the pathogen, therefore making the pathogen incapable of producing proteins and dies. Bacteria typically range between 1 and 5 micrometers in length. A class of bacteria without cell walls is mycoplasma (a cause of lung infections). A class of bacteria which must live within other cells (obligate intracellular parasitic) is chlamydia (genus), the world leader in causing sexually transmitted infection (STD).

Viral

Some of the diseases that are caused by viral pathogens include smallpox, influenza, mumps, measles, chickenpox, ebola, and rubella.

Pathogenic viruses are diseases mainly those of the families of: Adenoviridae, Picornaviridae, Herpesviridae, Hepadnaviridae, Flaviviridae, Retroviridae, Orthomyxoviridae, Paramyxoviridae, Papovaviridae, Polyomavirus, Rhabdoviridae, Togaviridae. Viruses typically range between 20 and 300 nanometers in length.^[7]

Fungal

Fungi comprise a eukaryotic kingdom of microbes that are usually saprophytes (consume dead organisms) but can cause diseases in humans, animals and plants. Fungi are the most common cause of diseases in crops and other plants. The typical fungal spore size is 1-40 micrometers in length.

Prionic

According to the prion theory, prions are infectious pathogens that do not contain nucleic acids. These abnormally folded proteins are found characteristically in some diseases such as scrapie, bovine spongiform encephalopathy (mad cow disease) and Creutzfeldt–Jakob disease.^[8]

Other parasites

Some eukaryotic organisms, such as protists and helminths, cause disease.

Algal

Examples of algae acting as a mammalian pathogen are known as well, notably the disease protothecosis. Protothecosis is a disease found in dogs, cats, cattle, and humans caused by a type of green alga known as prototheca that lacks chlorophyll.

Treatment and health care

Bacteria are usually treated with antibiotics while viruses are treated with antiviral compounds. Eukaryotic pathogens are typically not susceptible to antibiotics and thus need specific drugs. Infection with many pathogens can be prevented by immunization. A small amount of pathogens are used in vaccines to make immunity stay alert and strengthen defense on the insides to prepare for a larger quantity of the virus ever getting inside. Hygiene is critical for the prevention of infection by pathogens.

See also

- Ecological competence
- Emerging Pathogens Institute
- Germ theory of disease
- Human pathogen
- Pathogen-Host Interaction Database (PHI-base)

References

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4. "MetaPathogen - about various types of pathogenic organisms". Retrieved 15 January 2015.
5. "1.2. Definitions: pathogenicity vs virulence; incidence vs prevalence". COLOSS.
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8. *The prion diseases* (http://www.mad-cow.org/~tom/prionSP.html) STANLEY B. PRUSINER, Scientific American

External links

- Pronunciation Guide to Microorganisms (1) (http://d.umn.edu/~rhicks/genmicro/Pronunciation%20Guide.pdf)
- Pronunciation Guide to Microorganisms (2) (http://rci.rutgers.edu/~microlab/CLASSINFO/IMAGESCI/pronunciation%20guide.pdf)

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