Koch's Postulates Encyclopedia Article

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Koch's Postulates

Koch's postulates are a series of conditions that must be met for a microorganism to be considered the cause of a disease. German microbiologist **Robert Koch** (1843-1910) proposed the postulates in 1890.

Koch originally proposed the postulates in reference to bacterial diseases. However, with some qualifications, the postulates can be applied to diseases caused by **viruses** and other infectious agents as well.

According to the original postulates, there are four conditions that must be met for an organism to be the cause of a disease. Firstly, the organism must be present in every case of the disease. If not, the organism is a secondary cause of the infection, or is coincidentally present while having no active role in the infection. Secondly, the organism must be able to be isolated from the host and grown in the artificial and controlled conditions of the laboratory. Being able to obtain the microbe in a pure form is necessary for the third postulate that stipulates that the disease must be reproduced when the isolated organism is introduced into another, healthy host. The fourth postulate stipulates that the same organism must be able to be recovered and purified from the host that was experimentally infected.

Since the proposal and general acceptance of the postulates, they have proven to have a number of limitations. For example, infections organisms such as some the bacterium *Mycobacterium leprae*, some viruses, and **prions** cannot be grown in artificial laboratory media. Additionally, the postulates are fulfilled for a human disease-causing microorganism by using test animals. While a microorganism can be isolated from a human, the subsequent use of the organism to infect a healthy person is unethical. Fulfillment of Koch's postulates requires the use of an animal that mimics the human infection as closely as is possible.

Another limitation of Koch's postulates concerns instances where a microorganism that is normally part of the normal flora of a host becomes capable of causing disease when introduced into a different environment in the host (e.g., *Staphylococcus aureus*), or when the host's **immune system** is malfunctioning (e.g., *Serratia marcescens*.

Despite these limitations, Koch's postulates have been very useful in clarifying the relationship between **microorganisms** and disease.