10.1D: Koch’s Postulates

LEARNING OBJECTIVES

- List Koch’s postulates

Koch’s postulates are four criteria designed to establish a causal relationship between a causative microbe and a disease. The postulates were formulated by Robert Koch and Friedrich Loeffler in 1884 and refined and published by Koch in 1890. Koch applied the postulates to establish the etiology of anthrax and tuberculosis, but they have been generalized to other diseases.

Figure: Robert Koch: Robert Koch circa 1900. Koch’s postulates are four criteria designed in the 1880’s to establish a causal relationship between a causative microbe and a disease.
Koch’s postulates were developed in the 19th century as general guidelines to identify pathogens that could be isolated with the techniques of the day. Even in Koch’s time, it was recognized that some infectious agents were clearly responsible for disease even though they did not fulfill all of the postulates. Attempts to rigidly apply Koch’s postulates to the diagnosis of viral diseases in the late 19th century, at a time when viruses could not be seen or isolated in culture, may have impeded the early development of the field of virology. Currently, a number of infectious agents are accepted as the cause of disease despite their not fulfilling all of Koch’s postulates. Therefore, while Koch’s postulates retain historical importance and continue to inform the approach to microbiologic diagnosis, fulfillment of all four postulates is not required to demonstrate causality.

Koch’s postulates

Koch’s postulates are the following:

1. The microorganism must be found in abundance in all organisms suffering from the disease, but should not be found in healthy organisms.
2. The microorganism must be isolated from a diseased organism and grown in pure culture.
3. The cultured microorganism should cause disease when introduced into a healthy organism.
4. The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

Koch’s postulates have also influenced scientists who examine microbial pathogenesis from a molecular point of view. In the 1980s, a molecular version of Koch’s postulates was developed to guide the identification of microbial genes encoding virulence factors.

Key Points

- The postulates were formulated by Robert Koch and Friedrich Loeffler in 1884 and refined and published by Koch in 1890.
- Postulate 1: The microorganism must be found in abundance in all organisms suffering from the disease, but should not be found in healthy organisms.
- Postulate 2: The microorganism must be isolated from a diseased organism and grown in pure culture.
- Postulate 3: The cultured microorganism should cause disease when introduced into a healthy organism.
- Postulate 4: The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

Key Terms

- **Koch’s postulates**: four criteria designed to establish a causal relationship between a causative microbe and a disease
- **postulate**: A fundamental element; a basic principle.