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Perspective

Adhesins: The Molecular Glue of Bacterial Pathogens

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DESCRIPTION

Bacterial infections are a major public health concern worldwide, and the ability of bacteria to attach and colonize host tissues is a critical step in the establishment of infection. Adhesins are molecular structures found on the surface of bacterial pathogens that enable them to bind to host cells and tissues. These surface proteins play a crucial role in the pathogenesis of bacterial infections, facilitating colonization, invasion, and dissemination of the bacteria in the host. This article provides an overview of adhesins and their diverse biological functions in bacterial infections.

Adhesins are a class of surface proteins found on the outer membrane of bacterial cells. These proteins have evolved to bind specifically to different host cells and tissues, enabling bacteria to attach and colonize these surfaces. Adhesins are typically composed of multiple domains, including a receptor-binding domain, a stalk or rod domain, and a membrane anchor domain. The receptor-binding domain is responsible for recognizing and binding to specific host cell receptors, while the stalk or rod domain provides flexibility and structural stability to the protein. The membrane anchor domain is responsible for anchoring the adhesin to the bacterial cell surface.

Adhesins play a critical role in the pathogenesis of bacterial infections by facilitating colonization, invasion, and dissemination of bacteria in the host. For example, adhesins produced by Uropathogenic *Escherichia coli* (UPEC) enable the bacteria to adhere to and colonize the urinary tract epithelium, leading to Urinary Tract Infections (UTIs). Adhesins produced by *Helicobacter pylori* enable the bacteria to colonize the gastric mucosa, leading to gastritis and peptic ulcer disease. Adhesins produced by *Streptococcus pneumoniae* enable the bacteria to colonize the nasopharynx, leading to otitis media and pneumonia.

Adhesins have evolved to recognize and bind specifically to different host cell receptors, enabling bacterial pathogens to target specific tissues and organs. For example, the FimH adhesin produced by UPEC recognizes and binds to uroplakin receptors on the surface of bladder epithelial cells. The BabA adhesin produced by *Helicobacter pylori* recognizes and binds to Lewis-b antigens on the surface of gastric epithelial cells. The PspC adhesin produced by *S. pneumoniae* recognizes and binds to the polymeric Immunoglobulin Receptor (pIgR) on the surface of nasopharyngeal epithelial cells.

Adhesins also play a role in the evasion of host immune defenses by bacterial pathogens. For example, the FimH adhesin produced by UPEC can block the activation of complement, a key component of the host immune system. The Hia adhesin produced by *Haemophilus influenzae* can inhibit the activity of neutrophils, a type of white blood cell that plays a critical role in the clearance of bacterial infections.

Adhesins are also important virulence factors in the development of biofilms, which are complex communities of bacteria that are highly resistant to antibiotics and immune defenses. Adhesins enable bacteria to adhere to surfaces and to each other, facilitating the formation of biofilm structures. Biofilms are common in many types of bacterial infections, including UTIs, dental caries, and chronic wound infections.

CONCLUSION

Adhesins are important molecular structures that play a critical role in the pathogenesis of bacterial infections. These surface proteins enable bacterial pathogens to attach and colonize host cells and tissues, evade host immune defenses, and develop biofilms. Understanding the structure and function of adhesins is critical for the development of new strategies to prevent and treat bacterial infections.

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