

## CSIR NET Life Science Unit 4

### Host-Parasite Interaction

#### **Introduction**

In host-parasite interaction, signal events originate from both types of cells which initiate the contribution in infection. This interaction occurs at the surface of the host cell and pathogen and involves quite a complex mechanism. Many biochemical complex molecules can be found in the microbial surfaces like adhesins, that contribute to the virulence of the said pathogen.

**Host** - *Host is an organism where the parasite grows and multiply.*

#### **Type of host**

1. **Definitive host** - if a parasite attains their sexual maturation in host than host is called as definitive host.

Example. Mosquito for *Plasmodium*

1. **Intermediate host** - if a parasite has short life span in host which is nutritionally or environmentally suitable for parasite then the host is called as intermediate host.

Example. Humans for Tape worm

1. **Paratenic host** - when a parasite utilise host as vehicle then it is known as a transfer or paratenic host.

Example. Humans for larva migration

#### **Host Parasitic Interaction - How It Proceeds?**

- Host parasitic interaction is a dynamic type of interaction, which depends on the properties of host and parasite both.
- Parasites contain certain molecules which act as determinants for virulence of pathogens, these determinants allow the pathogen to invade and cause damage in host cell and break the resistance/ defence barrier of the host. Host parasite interaction is an interrelation between host and pathogen population; for e.g. many of pathogenic bacteria exist as obligate parasite as they can be usually found associated with a host.

- Some mobile genetic elements, known as pathogenicity island (PAI) play a pivotal role in bacterial virulence. PAI has one or more than one virulent gene, these PAI are only present in pathogens and absent in nonpathogens. These occupy large genomic region and mostly located in adjacent tRNA and associated with mobile genetic element (like transposons) which makes them highly unstable. Examples of some pathogenicity island are given in the table below.

Groups of virulence factors encoded by PAI<sup>d</sup>

Group	Examples of virulence factors	PAI
Iron uptake systems	FyuA, aerobactin, Sit, Pit2ABCD	HPI, SPI-1, PPI-1, SHI-2, 3, PAII <sub>CFT073</sub> , PAI III, IV <sub>536</sub>
Adhesins	Type 4 pili, P-Pili, S- and P-fimbriae, Sap adhesin, Hek adhesin, AfaE-III, Iha, TcpA	Major PAI, PAI I, II <sub>CFT073</sub> , PAI I-IV <sub>536</sub> , PAI I, II <sub>796</sub> , PAI-I <sub>AL863</sub> , TAI, VPI-1
Pore-forming toxins	Listeriolysin, alpha-hemolysin, RTX-like exotoxin	LIPI-1, PAI I <sub>536</sub> , PAI II <sub>536</sub> , O=28
Second-messenger pathway toxins	CNF-1	PAII <sub>C5</sub> , PAI II <sub>796</sub>
Proteins causing apoptosis	SipB	SPI-1
Superantigens	TSST-1, ET	SAPII, SAPI2, SAPIbov, <i>etd</i>
Secreted lipases	PlcA, PlcB, SmlC	LIPI-1, LIPI-2
Secreted proteases	EspC, SigA, Pic, ShetA1, Mop, BFT	SHI-1, EspC PAI, VPI-1, BFP AI
O antigens	GtrA, GtrB, Gtr	SHI-O
Proteins transported by type I, III, IV, and V protein secretion systems	Alpha-hemolysin, EspI, EspC, SigA, Cag, Tir, EspB, G, F, Map, SptP, Sse, Ste, SopD, SopE, SopE2, PipB, SifA, SpiC, EspC, CagA	SHI-1, PAI I, II <sub>536</sub> , PAI I, PAI, II <sub>796</sub> , LPA, EspC PAI, SHI-1, SPI-1, SPI-3, SPI-5, LEE, <i>cag</i> PAI
Antibiotic resistance phenotype	Pse-1, FloR, AadA2, Sull, TetR, G	SGI-1

## Types of Interaction between host and parasite

Following relations are found between host and parasite:

### A. Positive interaction

Example. Symbiotic association or mutualism like common microflora of the body.

### B. Negative interaction

Example. Parasitism; two types of parasitism are observed: exoparasitism and endoparasitism. like Dermatophytes, influenza virus.

### The strategy of Host-Parasite relationship

In host-parasite relationship two types of biophysical functions are observed:

1. Invasion of parasite, through which parasite invade into host and continue multiplication
  2. Resistance or defence mechanism of host by which host resist the infection of parasite.
- Several pathogenic bacteria have specific protein and enzyme which help them to spread infection in host for example, M protein and Coagulase found in *Staphylococcus aureus*; Exo and endotoxins of bacteria; Flagella and cilia of bacteria; Capsule of bacteria, Spike of virus. Some hosts also give suitable environment for germination of parasite and some work as vectors eg. *Plasmodium sp.*
  - In a host parasite relation, both functions counter each other to maintain the balance in the relationship. When parasite is able to grow and multiply within host that stage is called as infection.
  - **Infection** - Boarding, lodging and multiplication of parasite into host body is termed infection, and when it affects the function of host body known as disease.
  - **Pathogenicity** - Ability of parasite causing disease is known as pathogenicity.
  - **Virulence** - Degree of pathogenicity is known as virulence.

Following significant characters are observed in a typical host-parasite relationship as shown in the figure.

