

Prepositions

Written by Tim Inglis

Preposition n. *Grammar.* Word showing the relation between other words, such as *in, for, on, from*

Before 1397

preposicioun

, borrowed from Old French

preposicion

, and directly from Latin

praepositi?nem

(nominative

praepositi?

) a putting before but in the sense of a preposition

praepositio

is a loan translation of Greek

prósthesis

), from

praeponere

put before (

prae

before +

p?nere

put, set, place). [abridged from

Chambers Dictionary of Etymology

, 1988]

Prepositions are small words we generally take for granted. There are of particular importance in the language of infection since they pack a lot of meaning into a small syllable. It is clear from contemporary languages that prepositions are used widely to indicate three dimensional spatial relationships, including relative distance. They also serve to indicate destination and, by implication, purpose or intent. The priobes we've considered in previous instalments exist in a three dimensional world populated by other biological objects organised at different levels of spatial complexity. Only very rarely can they be considered as a single cell or particle. But for the sake of argument, let's start with a single bacterial cell; a staphylococcus. After replication, other staphylococcal cells will be beside, next to, above, below, behind, in front of and at a distance from the initial staphylococcus. The material that holds all those staphylococci in place is an extracellular matrix. It keeps these bacteria in their place. If you want to find out just how effective the matrix is, try eliminating staphylococci from an infected intravenous catheter by either antibiotic treatment.

Many bacteria produce extracellular matrix, often in the form of complex polysaccharides as they settle into a biofilm; a highly organised three dimensional layer of living material. With time, the living cells adapt to a range of different biological functions including long term survival, biofilm cohesion, adhesion to abiotic surfaces, and the establishment of satellite colonies after separation from the parent biofilm through the effects of mass transfer phenomena at the biofilm fluid interface. Biofilms can be polymicrobial, have channels and other internal structure, depend on intercellular communication (signalling e.g. through quorum sensing) and can be regarded as a form of

prototype multicellular tissue.

Vir

uses demonstrate a different interpretation of prepositions as a result of their smaller scale and their high degree of molecular efficiency. Since they are obligate intracellular parasites, they must bind to, enter into and replicate inside other cells. Their spatial relationships operate at a smaller level of biological organisation where they exploit the molecular machinery of their cellular host. When viral replication occurs at a high rate, whole plaques of viral particles can be seen within the host cell under the electron microscope. Spatial organisation at this scale depends on the geometry of viral particles. On release from the host cell, some viruses pick up an envelope that contains the molecules they need to adhere to their next victim.

On a much larger scale bacteria have adherence organelles in the form of pili/fimbriae on their external surface. The motility organelles known as flagella can act as anchors for adherence to eukaryotic cell surfaces, though their main function is as a form of self-propulsion through liquids. The bacterial flagellum can be considered the ultimate microbial preposition for its ability to reposition its owner anywhere it needs to be, whether near to or far from its friends. Motile protozoa also have flagella. These motility organs respond to external stimuli so that propulsion is directed towards a nutrient source or otherwise favourable environment and away from noxious stimuli.

Prepositions are usually small words, a feature they carry across a range of different languages. Some of the most used are among the smallest words we commonly use, such as on and in. These two prepositions in particular have a special place in the language of infection. If you think about it 'in' has been inserted into the beginning of a series of words connected with infection such as invade, inoculated, ingest and inhale, indicating the importance of this one preposition for conveying the meaning of an active process. Clearly it is so important that it forms the prefix of infection. Contrast 'in' with 'on'. Now, there is only a one vowel difference, a single shift in letter between these two words, yet that tiny change makes all the difference between something innocuously located on a body surface, external to the living tissue, and burrowing its way into or among the body's cells. Much time and effort has been devoted to understanding how and why a probe changes its behaviour from passive hitchhiker to violent robber or murderer. That change can be summarised by swapping prepositions. It never does to underestimate the power of words.

MicroGnome, NOV-2010.