

Neisseria meningitidis disseminates itself by sending out 'scouts'

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Although, in the majority of cases, the localized presence of *Neisseria meningitidis* in the throat has no consequence, it can sometimes lead to meningitis or septicaemia. The seriousness of these two infections is driving researchers from around the world to improve their understanding of the mode of operation of this bacterium, which, once it leaves its favourite location (the throat) becomes extremely dangerous. The Avenir team directed by Guillaume Duménil within Inserm Mixed Research Unit 970, "Paris centre de recherche cardiovasculaire" at the Université Paris Descartes, has recently discovered how this bacterium disseminates, leaving the throat to pass into the bloodstream. The results of this research have been published in the 11 February 2011 issue of the journal, *Science*.

Neisseria meningitidis is a [bacterium](#) specific to man. It is frequently present in the non-pathogenic state in the throat of healthy carriers (5% to 30% of the population).

Its persistence in the organism can however prove dangerous in some cases. The location where the bacteria multiply, the throat, represents a port of entry, from where it disseminates into the bloodstream and may penetrate into the brain. In both these cases, the infection becomes very serious since it results in septicaemia or meningitis. Unless dealt with quickly, the mortality rate linked to these two infections is very high.

Guillaume Duménil and his Inserm research team were, therefore, interested to understand more about this bacterium which, when it passes

into the bloodstream, becomes very dangerous. "Certain advances made in the past few years provided the starting point for this work, which is published in *Science*", he explained. We know, for example, that *Neisseria meningitidis* are equipped with special structures known as pili. These allow the bacteria to adhere to the cells of the throat and to multiply and form aggregates there. We are closely studying the main protein which makes up the pili; namely, pilin", adds Guillaume Duménil.

The researchers then discovered that the protein underwent various modifications over time. One of these, in particular, has proved more interesting than the others: The addition of a phosphoglycerol. This chemical group once grafted onto the pilin, gives the signal for dissemination.

Bacteria isolated from the colony depart as "scouts"

Following these initial results, the researchers discovered the presence of a gene which enabled the transfer of phosphoglycerol onto the pilin: the gene, *pptB*. This gene only becomes fully functional when the bacteria is in contact with the cells lining the wall of the throat. The frantic activity of the *pptB* gene causes the addition of phosphoglycerol to the pilin. This then loses one of its essential properties: its capacity to form aggregates. As a consequence, some of the bacteria detach themselves from the colony and, little by little, are disseminated. This strategy is used by the bacteria in order to colonize other areas of the throat and to cross the cells lining it. "This phenomena could almost be compared with the formation of metastases in cancer", says Guillaume Duménil.

This is the first time that scientists have been able to accurately identify the chain of events which controls the bacteria in the bloodstream. It is a first step. "We now know how the *Neisseria meningitidis* passes from the throat into the blood. We hope to be able to demonstrate that an identical

process is involved when the bacteria passes from the blood into the brain, instigating meningitis", concludes Guillaume Duménil.

Furthermore, if the researchers were able to find molecules which can block this dissemination, they would have both a preventative tool (blocking colonization from the throat and passage into the bloodstream) and a therapeutic tool (limiting colonization from the blood vessels and transmission into the brain).

Although the strategy developed by *Neisseria meningitidis* ensures its multiplication in the throat, and therefore its survival over the course of evolution, it is also responsible for the death of the host organism and hence its own death. Further proof that living in harmony with a host is not easy.

More information: "Posttranslational Modification of Pili upon Cell Contact Triggers *N. meningitidis* Dissemination" *Science* 11 February 2011

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