

# Violent sex acts boost insect's immunity system

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The long-held idea that only vertebrates have sophisticated adaptive immune systems that can protect them for life against many pathogens after being infected by them just once has been revised in recent years. It turns out that many insects also have a form of immune memory that protects them against reinvasion by a pathogen they have previously encountered. This was just one of the striking discoveries discussed at the recent conference on Innate Immunity and the Environment, organised by the European Science Foundation (ESF).

Ironically the conference was set up to discuss innate immunity involving generic response to pathogens, rather than specific actions based on memory of past infections as in adaptive immunity. Yet the real highlight of the conference was the presentation of new research showing that insects and higher vertebrates, including humans, have much more similar immune systems than was thought, according to the conference chair professor Paul Schmid-Hempel from the Institute of Integrative Biology in Zurich. It is not just insect immune memories, but also how they recognize pathogens, that have close analogues in vertebrates, said Schmid-Hempel.

Insect innate immunity was also discussed in the context of sex, where the issue lies for females in distinguishing between hostile pathogens and male sperm, which is also after all foreign tissue. The point here is that for some insects sex is a violent act causing wounds that become infected and require a swift and powerful immune response, as Schmid-Hempel indicated. “The topic was the traumatic insemination performed

by some insect males, such as bedbugs, where the male injects sperm into the female through her body wall and certain sites,” said Schmid-Hempel. “It has now been shown these sites are very immuno-active, and that this feature is essential to keep out infections that typically enter via the insemination act. In essence, it is about the general problem that insemination may also transfer disease and, at the same time, sperm is an antigen (non-self) for any female with all its potential immunological complications.”

The conference was the first of two organised by the ESF on innate immunity’s relationship with the environment, with the second staged for 2009. The stage was set for some further research that will be presented at that second conference, including important work on the “hygiene hypothesis”, applicable at least to humans, which states that too much cleanliness is actually bad for the developing immune system in children. “There is a growing awareness and consent that early exposure to antigens/pathogens is important for the full capacity of the immune system,” said Schmid-Hempel. Although this hypothesis has yet to be finally proven, especially since the underlying molecular mechanisms are imperfectly understood, there is accumulating evidence that excessive hygiene is bad for children.

The conference also tackled the controversial and difficult subject of how and when adaptive immunity evolved from innate immunity in vertebrates (and possibly, as is now starting to be believed, analogues in insects as well). One new suggestion is that vertebrate adaptive immunity first evolved in co-evolution with parasitic flatworms, aided by frequent genome duplication and the need to reduce metabolic costs of immune defences. A similar process might have taken place in insects as they faced particular parasitic groups. But as Schmid-Hempel pointed out, these remain areas of huge disagreement, with here too further discussion likely at the 2009 conference.

Other topics for further research and discussion at the 2009 conference were identified, including the detailed innate immune mechanisms underlying defence against different classes of pathogen, especially viruses and protozoa (the agent of malaria). Much also remains to be discovered about the underlying population genetics of immunity.

The research conference, “The impact of the environment on innate immunity: at the defence frontier – the biology of innate immunity” was held April 22-27 2007 at the Obergurgl University Centre near Innsbruck in Austria. A wide range of topics relating to innate immunity and its subsequent extension into adaptive immunity were presented and discussed.

Source: European Science Foundation

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