Making good use of viruses

ASK A SCIENTIST

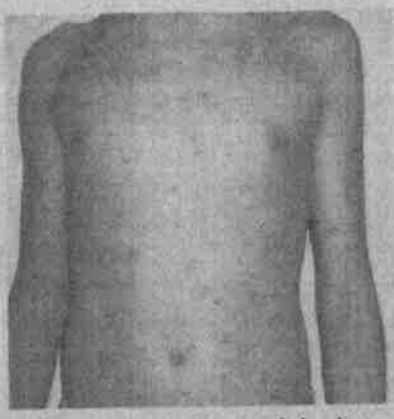
John McDowall, of Featherston, asked:

We have now accepted that, as far as bacteria are concerned, some are "good" and can assist our body, while others are "bad" and can make us ill or even kill us. Does the same dichotomy exist for viruses?

Andrew Mercer, a virologist at the University of Otago, responded:

There are certainly viruses that are bad for us, from Ebola to Zika, smallpox to influenza. However, there is some good news associated with viruses.

First, we can make good use of viruses. For example, we use live viruses as vaccines to induce protection against infection by a similar but more dangerous virus. The classic example is immunisation with vaccinia virus to protect against smallpox, a highly successful practice that led to the elimination of a devastating disease. The chickenpox vaccine is an example of the use of a live, but weakened virus to protect against an important disease. Another example of beneficial viruses is their use as delivery machines. An example here is the use of a live recombinant virus to deliver a rabies vaccine to wild animals. And there is real potential to use viruses to deliver cancer vaccines and in gene therapy. Bacteriophage therapy is another example of beneficial viruses.



Immunisation with vaccinia virus will protect against smallpox.

Bacteriophages are viruses of bacteria and they can kill infected bacteria. This has led to the use of bacteriophages to treat human bacterial infections, particularly when the bacteria are resistant to antibiotics.

So there are clear examples of beneficial use of viruses but are there instances where both the infected individual and the virus gain benefits? Here the picture is less clear but we can say "yes" for some species and "perhaps" for humans.

A well-studied example is polydnavirus infection of parasitoid wasps. When these wasps lay their eggs in insect larvae they also transmit the virus, which expresses genes that prevent the larvae from killing the wasp eggs. On the other hand, functions essential for virus replication are provided by the wasp, so both the wasp and the virus benefit from this infection.

For human viruses the evidence is, as yet, less clear but there are hints. For example, GB virus-C seems to cause no obvious clinical symptoms, but there is evidence that HIV patients co-infected with GBV-C show slower progression of disease, perhaps because GBV-C is able to reduce HIV replication.

Although we have had great success identifying and combating many viruses causing important human diseases, we still have a limited understanding of all the viruses existing in and on us, including viruses of micro-organisms living with us.

With technological advances we are just beginning to understand this human virome. It seems inevitable more examples of both "bad" viruses and "good" viruses will be discovered as we gain deeper understanding of this enormous, complex ecosystem.

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