



Example of reduction (Project 105-06, Ruggli and Summerfield)

By using cells instead of pigs, it is possible to estimate the virulence of the classical swine fever virus.

Classical swine fever (CSF) is a highly contagious disease in pigs. It can cause enormous losses for farmers, since any infection in a herd means that the whole herd has to be destroyed. The causes of this disease are various types of CSF viruses, some of which are extremely virulent while others hardly cause a reaction in the host animal.

Until now, to determine the virulence of the type of virus involved it has been necessary to infect live pigs with the virus. The aim of the research carried out at the Institute of Virology and Immunoprophylaxis (IVI) in Mittelhäusern was to replace in vivo testing by an in vitro system. A combination of specialised cell cultures and further biological parameters promises to be suitable for determining the virulence of CSF viruses. Cells instead of pigs – a progress from the point of view of the 3R principles.

The interaction between the CSF viruses and the immune system in pigs is, to say the least, complex. Until now it has not been possible to say whether a certain CSF virus is highly virulent or not on the basis of its genotype; it has been necessary to study its interaction with cells.

Preliminary studies with cultures of cell lines that are routinely used in diagnostic laboratories have shown that the cells often tend to reproduce preferably mutated viruses which adapt easily to the conditions in the cultures. Viruses that have not mutated in this way are often not apparent, which skews the results. The first step was therefore to find pig cells which allowed the individual lines to reproduce with no mutation. The researchers succeeded in identifying such cells, infecting them with various CSF virus strains and visualising the consequences of different degrees of virulence using staining – the larger the staining dots, the more virulent the strain of the virus. This method provided the initial results.

In order to further improve the diagnosis, one needs to know what kind of reactions the viruses will cause in other major cells in the animal. Accordingly, macrophages and interferon-producing cells isolated from porcine blood were infected. Measurements made using flow cytometry showed that the virulent viruses reproduced more strongly and more quickly in these cells than less virulent strains. This can be measured by measuring the quantities of virus protein and the immune response of the cell; highly virulent viruses produce more virus protein and a more marked immune response in the cell than less virulent strains. In addition, these measurements indicated the degree of virulence of a given virus strain.

These studies involving three different types of cells enabled the research team to predict the virulence of CSF virus strains with such precision that in most cases it was not necessary to carry out any in vivo testing. This system opens up new possibilities in basic research for gaining a better understanding of the virulence of CSF viruses, and without resorting to infecting live animals.

http://www.forschung3r.ch/en/projects/pr_105_06.html

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