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Routes to the development of a parapoxvirus vaccine for red squirrels

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Introduction

A pox virus, until recently known as a parapox virus, is believed to be an important factor in the gradual replacement of the native red squirrel by the introduced grey squirrel. It is becoming increasingly clear that grey squirrels can act as carriers of this infection, which is generally fatal to red squirrels. The development of a vaccine, to confer immunity on either red or grey squirrels, has been proposed as a conservation tool.

What was done

English Nature commissioned a review of the causative organism and other vaccines developed against viruses in the same family. The review also considered the ways in which a vaccine against squirrel pox virus might be developed and the timescale and costs involved in developing such a vaccine.

Results and conclusions

The poxviridae are a family of large double-stranded DNA viruses which infect both vertebrate and invertebrate hosts. The poxviruses are unique amongst viruses in that transcription, replication and assembly of the virus all occur within the host cell cytoplasm. Poxviruses have been shown to be related antigenically, with the greatest degree of cross-reactivity being found within the individual genera.

A review of existing knowledge of this family, and the vaccines that have been developed against them reached the following conclusions:

- It is possible to vaccinate against poxvirus disease. Therefore it should be possible to develop a candidate vaccine against the squirrel PPV.
- The candidate vaccine is likely to be a "live" poxvirus, as no inactivated poxvirus vaccines and no subunit vaccines have ever been used effectively against a poxvirus infection.
- The candidate vaccine is unlikely to be a heterologous virus as there is no evidence that poxviruses from the other genera will protect against infection with a parapoxvirus. Equally there is no evidence to support the view that vaccination with another parapoxvirus is likely to be effective in protecting against the squirrel PPV.

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- The candidate vaccine is most likely to be an avirulent or partially attenuated strain of the squirrel PPV.
- Delivery of a vaccine in the first instance may be more effective if it is targeted to particular at risk populations.

Developing a vaccine by recombinant DNA techniques represent the more expensive approach and costs for a 5-year project were estimated at about £5-600,000. The development of a vaccine based entirely on the adaptation of the wild-type virus to cell culture and its subsequent in vitro propagation would be a less expensive alternative to the recombinant approach costed above, though the chances of success using this approach may be less than that expected from the recombinant route. For a similar 5-year projects, cost of about £450,000 were suggested. In neither case can success be guaranteed.

English Nature's viewpoint

Work completed since this contract has illustrated the significance of this viral disease in the demise of the red squirrel and emphasised the need to reduce its impact. The development of a vaccine could be an important tool in tackling this problem, but the costs of developing a vaccine with no commercial potential are very significant and well beyond the reach of the conservation agencies alone.

Selected references

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