Mothers pass on disease clues to offspring

January 5 2009

(PhysOrg.com) -- When there is a threat of disease during pregnancy, mothers produce less aggressive sons with more efficient immune systems, researchers at The University of Nottingham have discovered.

The study provides the first evidence for a transgenerational effect on immune response based on environmental cues — with maternal perception of disease risk in the immediate environment potentially determining offspring disease resistance and social dominance. The results are published in *Proceedings of the Royal Society B*, the Royal Society's flagship biological research journal.

Pregnant female mice were housed next to males infected with Babesia microti, which is a mild blood parasite causing few symptoms, but some anaemia. The partitioned cages allowed the females to see, hear and smell their infected neighbours, but not touch them, ensuring that the disease did not spread. Researchers then measured the effect of these 'ambient cues' on maternal physiology and behaviour, along with the social behaviour and immune response to disease challenge in the adult offspring.

The dams (female mice that had given birth) were found to have increased blood serum levels of corticosterone after being housed next to the infected males — double the amount found in dams housed next to a control group of males that were not infected. Corticosterone is a stress hormone known to have effects on foetal and new-born development.

The offspring of the dams exposed to infected neighbours were

significantly less aggressive as adults than the control group offspring. In the final part of the experiment, all offspring were infected with B microti to see if the ambient exposure affected their immunity. The offspring which had developed in the diseased environment showed an earlier onset, peak and clearance of the infection than the offspring from the control dams.

The research group in the University's School of Biology have studied many populations of mice, and noted that aggression is associated with social dominance and territory acquisition — and consequently increased access to mating opportunities. However, studies in a wide range of species have shown that the benefits of aggressive behaviour are counter balanced by reduced resistance to disease. The results of this new study support the existence of a 'trade off' between social dominance and disease resistance.

"It seems that the mothers in our study are priming offspring for the environment they will live in. When the risk of disease is high, improved immunity may outweigh any costs associated with reduced social dominance." said Dr Olivia Curno, who led the research funded by the Biotechnology and Biological Sciences Research Council (BBSRC).

"It is unlikely that mice are the only species with this fascinating ability. Therefore our work may have important implications for our understanding of epidemiological processes and individual disease susceptibility in general. Future investigation should explore exactly how the females detect disease in their neighbours and use this information so cleverly."

The finding that mice show a stress response to other infected mice in the room suggests that the welfare of bystander animals should be considered when planning experimental work. Perhaps most importantly, the results begin to question the accuracy of the many experimental set-

ups where co-housed control animals are considered "untreated", when in fact they may be responding in complex physiological and behavioural ways to their treated neighbours.

Source: University of Nottingham