

A particular target for *Anaplasma* infection: Norwegian lambs

msp2(p44), which, for example, contained more than ten different sequence variants in the first fever peak from one of the infected animals.

In addition to the diversity, Granquist *et al.* also detected different quantities of those distinct sequences. Hence, they were also able to show that the clones could either vary enormously or be quite similar.

Success with a loose programme

Up until now, most experiments had been performed with *Anaplasma marginale*, which infects cattle. Infections of sheep by the related "Norwegian" strains of *Anaplasma phagocytophilum*, however, are also very common. By comparing the "Norwegian" sequences with the ones of *A. phagocytophilum* strains from the US, the scientists found very little similarity in the highly variable regions of the msp2(p44) expression site, whilst the different strains shared rather conserved sequences throughout the rest of their genomes.

Since the rickettsemias in the Norwegian study showed a very apparent cyclic nature, it would be logical to assume that

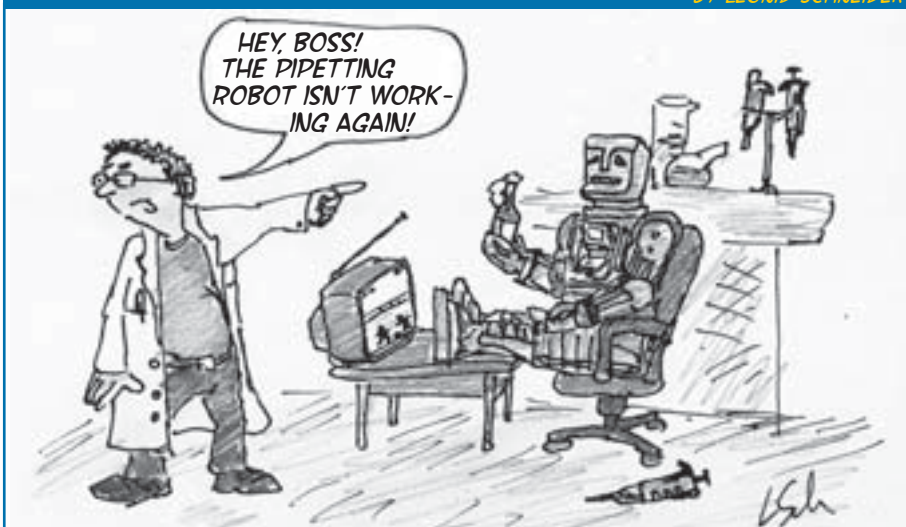
the pathogens probably escape from their hosts' immune systems by altering their surface antigens. That way, they are able to remain unidentified by inflammatory mechanisms even at later stages of infection. Granquist confirms, "sometimes for years."

Tick-borne pathogens may survive in the host for that long in order to be transmitted between sheep through feeding ticks. The Norwegian study now yields the suggestion that a loosely programmed order of outer membrane protein expression repeatedly makes the antigens "invisible", since certain variants of the outer membrane expression sites sometimes occur in different individuals but at similar stadiums of infection. Interestingly, body temperature and occurrence of neutropenia did not depend on certain levels of rickettsemia during persistence of infection. That means that in the end the most dangerous period is the initial phase of infection because, as already said, this is the point at which secondary infection is most probable. "And usually these secondary infections cause much more damage than *Anaplasma* alone," says Granquist.

DANIELA KAULFUS

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