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The mode of the bactericidal action of plaunotol was investigated using its derivatives. The bactericidal activities of plaunotol and its derivatives were related to the hydrophobicity of these compounds. The effects of plaunotol and its derivatives on liposomal membranes prepared from phosphatidylethanolamine and cardiolipin were also related to their bactericidal activities. Plaunotol led to an increase in permeability of the membrane, as evidenced by measurement of the leakage of 260 nm-absorbing material from *H. pylori*. The molecular motion of the spin label was measured from the electron spin resonance spectrum, by determining the order parameter S, an index of membrane fluidity. Plaunotol in-

creased fluidity in *H. pylori* membrane. These results suggested that the mechanism of the bactericidal effect of plaunotol against *H. pylori* may be the membrane fluidity alteration, with associated increased membrane permeability.

The therapeutic efficacy of plaunotol was evaluated in a nude mouse gastritis model. Plaunotol significantly decreased the number of *H. pylori* in the stomach of nude mice. In addition, this compound enhanced the therapeutic activity of amoxicillin or clarithromycin in the infection model. Thus, the activity of plaunotol against *H. pylori* is expected to provide some clinical benefits to treatment with this antiulcer drug for gastroduodenal disease.

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#### Host defense mechanisms and pathogenesis of *Babesia* infection, and analysis of piroplasm surface antigen.

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*Babesia* is a tick-borne intra-erythrocytic protozoa which causes a disease in mammals generally called piroplasmosis. The disease is characterized by fever, anemia, icterus, hepato- and splenomegaly.

The present study was designed to investigate, 1) the immune response in mice experimentally inoculated with *Babesia microti*, 2) the pathogenesis and immune response in horses experimentally inoculated with *B. caballi*, and 3) the identification of the B cell epitope of a 30 kDa *B. equi* merozoite surface antigen to develop sensitive and reliable serodiagnostic method. The results obtained in this study are summa-

rized as follows.

1. CD4<sup>+</sup> T cells and interferon-gamma (IFN- $\gamma$ ) were observed to be involved in protection against infection with *B. microti*. Specific CD4<sup>+</sup> T cells were generated *in vitro* from BALB/c mice recovered from infection and their protective activity was tested *in vivo*. The cells produced varying amounts of IFN- $\gamma$  *in vitro* in response to parasite antigens. In passive transfer experiments, three out of eleven T cell clones tested exerted protective activity in the early phase of infection. Although the protection was partial and short-lived, the results provided direct evidence that CD4<sup>+</sup> T cells play crucial role in

defense against *B. microti*.

2. The role of cytokine and nitric oxide (NO) was studied in *B. caballi* infection in horses. The expression of cytokine mRNA was determined by using reverse transcriptase polymerase chain reaction in *B. caballi*-infected horses for 2 weeks after infection. One horse expressed IFN- $\gamma$ , tumor necrosis factor (TNF- $\alpha$ ) and interleukin-2 mRNAs, and another horse expressed TNF- $\alpha$  mRNA. The expression of interleukin-4 mRNA was not observed in any of the two horses. In the dexamethazone-treated horses, high NO production was observed in the late phase of *B. caballi* infection, although the parasitemia was very low. Treatment of the horse with an inhibitor of NO synthesis showed the decreased NO production and increased parasitemia, however, the horse died with the infection. These results suggested that NO is a critical effector molecule in defense against *B. caballi*. TNF- $\alpha$  and NO may contribute to the pathogene-

sis in *B. caballi* infection.

3. A 30 kDa immunodominant surface antigen (p30) of *B. equi* has been used as a diagnostic antigen. The B cell epitopes on this molecule recognized by infected horse sera and monoclonal antibody (MAb) 36/133.97 against p30, were determined. A synthetic peptide of p30 with amino acid sequence of  $^{123}\text{FYQEVLFKGF}^{\text{EAV}}^{135}$  exhibited strong positive reaction with the infected horse sera. In contrast, MAb 36/133.97 recognized different region of p30, as a peptide synthesized with amino acid sequence of  $^{27}\text{ASGAVVDFQLESI}^{39}$  reacted strongly. In competitive inhibition enzyme-linked immunosorbent assay, the binding of MAb 36/133.97 to recombinant p30 was inhibited by horse antibodies, although they did not recognize same or an overlapping epitope.

The results of the present study has a bearing on the development of diagnostic and preventive methods of Babesia parasite infection.

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## Biodiversity of helminth parasites in Mongolia.

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In this study, the biodiversity and community structure of helminths of wild mammals in Mongolia was investigated, and helminth biodiversity and community in different populations of *Microtus brandti* were analyzed.

The species diversity of helminth parasites was investigated on the basis of collections made during field surveys in 1994-1996 in Mongolia, where 1678 mammals belonging to 50 species

were examined. A total of 76 species of parasites, including 31 species of cestodes, 2 acanthocephala, 42 nematodes and one pentastomid species were identified. Of these, new geographic records were made for 21 species, and new hosts were registered for 26 species. The species determination of some helminths that are undistinguishable using morphological criteria was conducted using DNA study and/or ex-