

## 7 Summary

### **Effects of *Bacillus cereus variatio toyoi* on the transport physiologic parameter of the middle of the Jejunum in piglets aged 2 to 8 weeks**

Already at the beginning of the 20th century Metchnikoff developed a first concept of probiotic effects. Since then, the effects of probiotics on animals and humans have been under research. Recently, their study has been intensified, due to the prohibition of antibiotics as a food supplement since January 2006. However, for probiotics to serve as alternative growth promoters there is still some research to be done to elucidate the mechanisms behind their effects.

In this thesis the Ussing chamber method was used to investigate if supplementing the feed of sows (starting on the 24th day after mating) and of the piglets with the probiotic strain *Bacillus cereus var. toyoi* has an influence on the transport and barrier functions of the jejunum epithelium in piglets.

To do so, absorptive and secretory transport effects as well as the passive permeability of the jejunum epithelium in pigs aged 14, 28, 35 and 56 days were examined. For the Na<sup>+</sup>-coupled nutrient absorption, glucose with concentrations of 0,5 mM, 1,0 mM, 4,0 mM and 10,0 mM and l-glutamine with a concentration of 12 mM were used. PGE<sub>2</sub> was used as a model for the secretion with concentrations of 0,05 μM, 0,1 μM, 0,5 μM and 1,0 μM. Electrogenic responses to the substances employed were estimated using the short circuit reaction  $\Delta I_{sc}$ . Furthermore, the barrier function of the epithelium was examined by measuring flux rates with the model substance <sup>3</sup>H-mannitol and by measuring transepithelial resistance R<sub>t</sub>.

Special attention was devoted to the development of the transport mechanisms during the piglets' development, including the influence of weaning, and, as part thereof, the influence on the kinetic parameters of the Michaelis-Menten constant K<sub>m</sub> and the maximal transport speed V<sub>max</sub> of both the Na<sup>+</sup>-coupled glucose transport, and the PGE<sub>2</sub>-stimulated ion secretion.

Fourteen days old piglets differ from older ones predominantly in exhibiting a higher short circuit reaction to PGE<sub>2</sub> and a lower short circuit reaction to glucose and l-glutamine. *Bacillus cereus var. toyoi* lowers the secretion and partly enhances the absorption in this age group.

In piglets 28 days of age (directly before weaning), *Bacillus cereus var. toyoi* enhances the sensitivity of the PGE<sub>2</sub>-stimulated secretion. One week after weaning (piglets aged 35 days), the difference in sensitivity is smaller between the control and the probiotic group but in both groups the absolute sensitivity is higher than the week before. At the age of 56 days, the difference between the feeding groups, which both exhibit very low absolute sensitivities, is the smallest. All in all, the piglets 35 days of age in the probiotic group, 7 days after weaning, are in the range of the high secretory readiness displayed by 14-days-old piglets of both groups.

The clearest effect *Bacillus cereus var. toyoi* seems to produce is to decrease variations between the piglets in terms of the cellular transport mechanisms of Na<sup>+</sup>-coupled glucose- and l-glutamine absorption and PGE<sub>2</sub>-stimulated secretion.

In contrast, *Bacillus cereus* var. *toyoi* does not seem to have a stabilising or harmonising effect on the barrier function of the pig's jejunum.

The significance of and possible conclusions from the results is discussed, and an outlook is given on the aspects further research needs to address.

The observations suggest that the harmonising effect on the sometimes very large interindividual variations may be the main effect of *Bacillus cereus* var. *toyoi*. This could be interpreted as an indication for a 'stabilising' effect on the microecology of the intestine, including the ingesta with its microbiology and the intestinal wall with its physiologic mechanisms.