

Impact of *Campylobacter jejuni* on the Intestinal barrier function

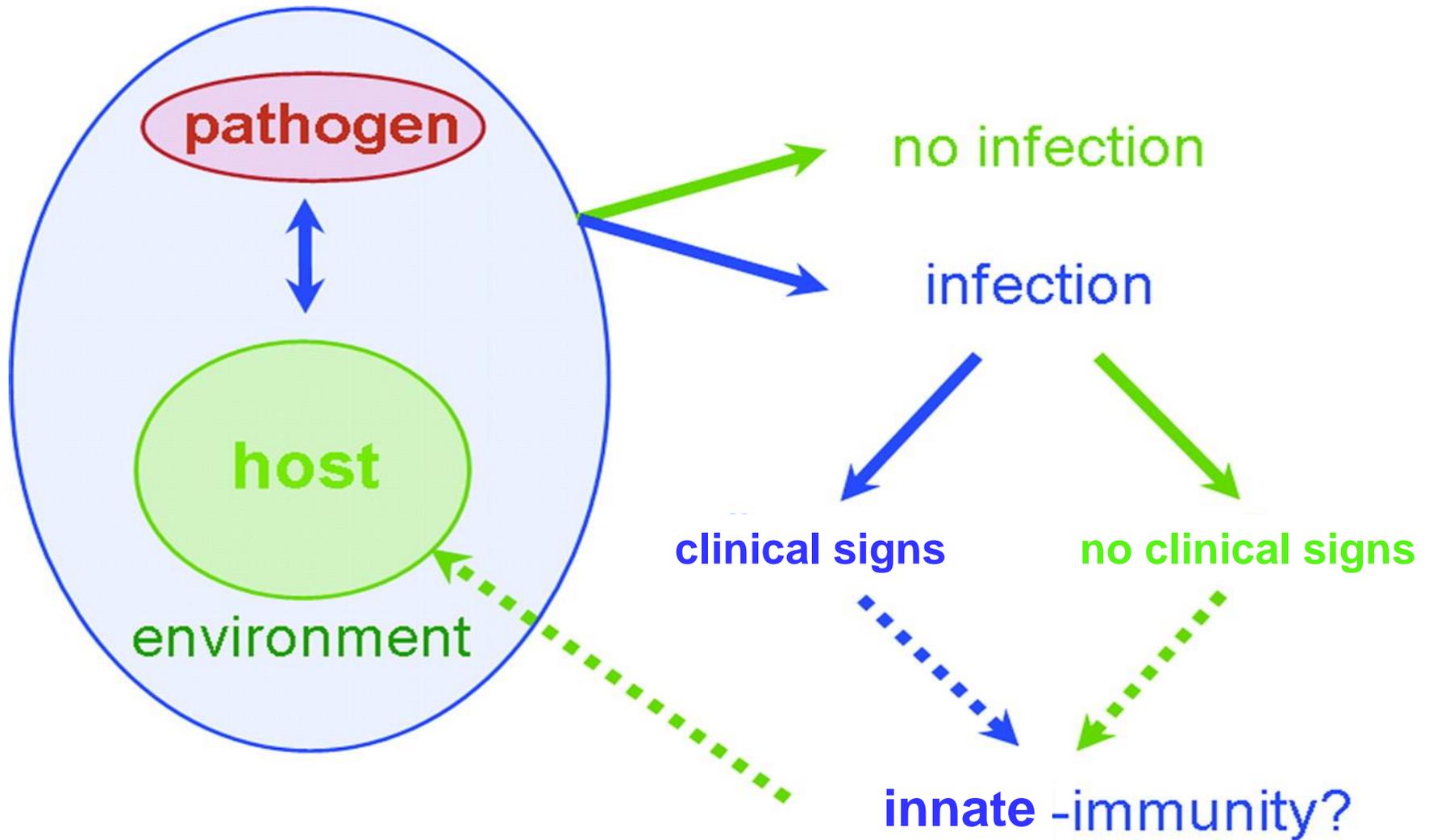
Wageha Awad, A. Molnár*, B. Khayal, C. Hess, J. R. Aschenbach#, K. dubleczy*, M. Hess

Clinic for Avian, Reptile and Fish Medicine, Department for Farm Animals and Veterinary Public Health, University of Veterinary Medicine, Vienna, Austria

***Department of Animal Science and Animal Husbandry, Georgikon Faculty, University of Pannonia, Keszthely, Hungary**

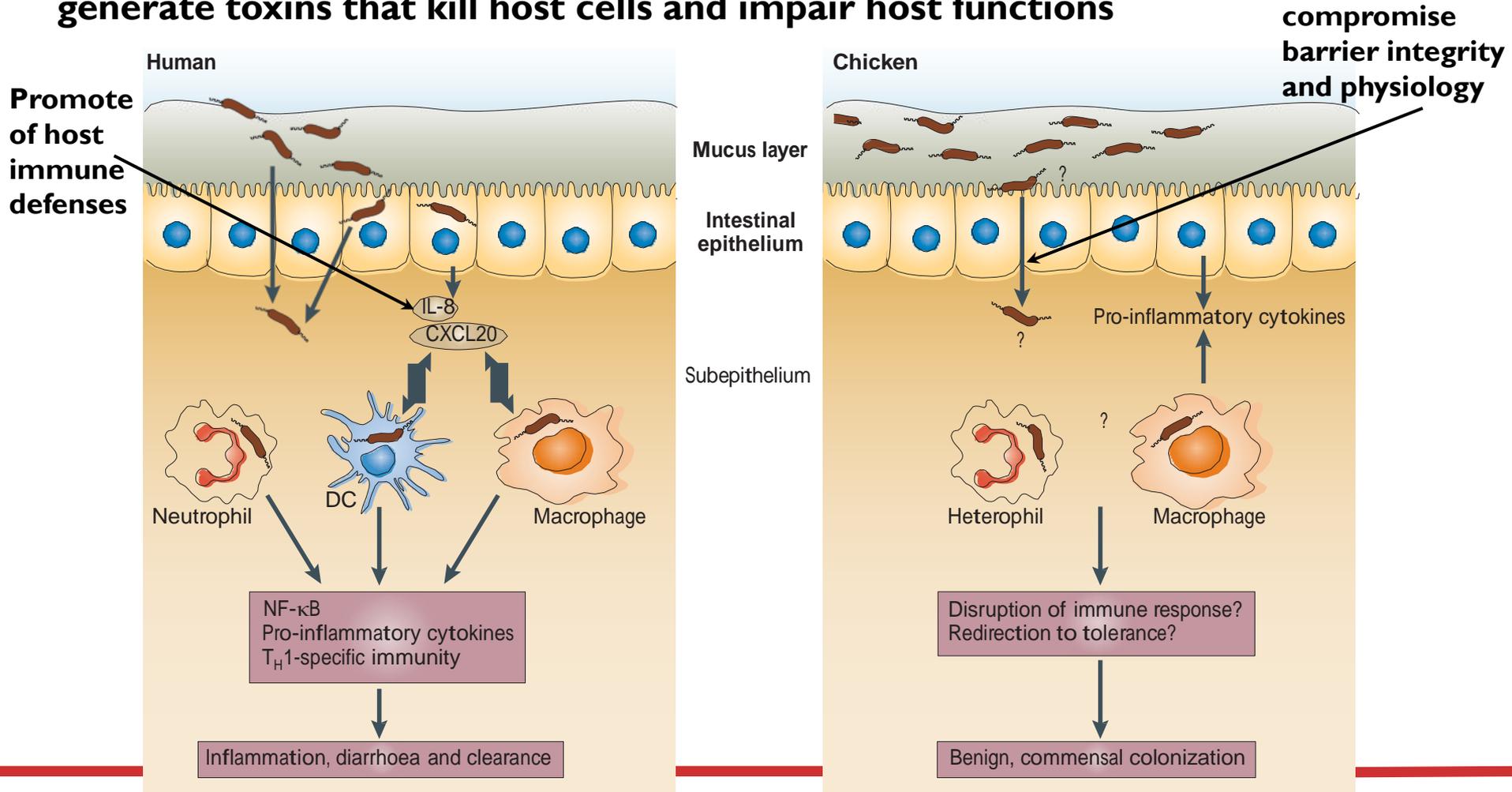
Institute of Veterinary Physiology, Department of Veterinary Medicine, Free University of Berlin, Berlin, Germany

Campylobacter infection



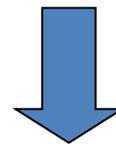
Campylobacter Infection

Campylobacter can attach to and invade intestinal epithelial cells and generate toxins that kill host cells and impair host functions



Hypothesis and objectives

- **In-apparent infection of chickens with *C. jejuni* may disturb the normal physiological functions of the gut**
- **Demonstration of the host response in latent infections with *C. jejuni***
- **Identification of functional changes within the intestinal epithelium associated with *C. jejuni* infection by applying the Ussing chamber technique**



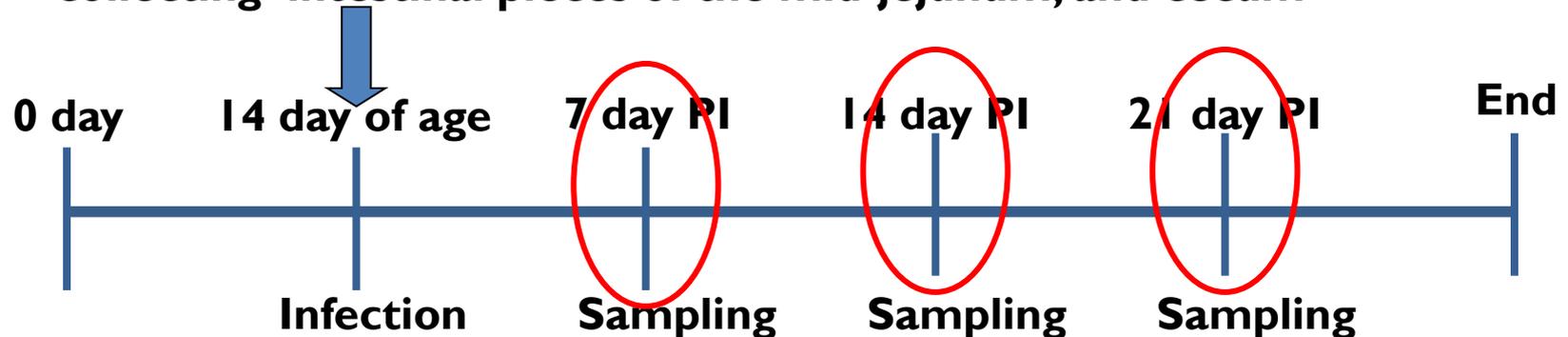
- bacterial colonization
- histology
- viscosity

Study Design

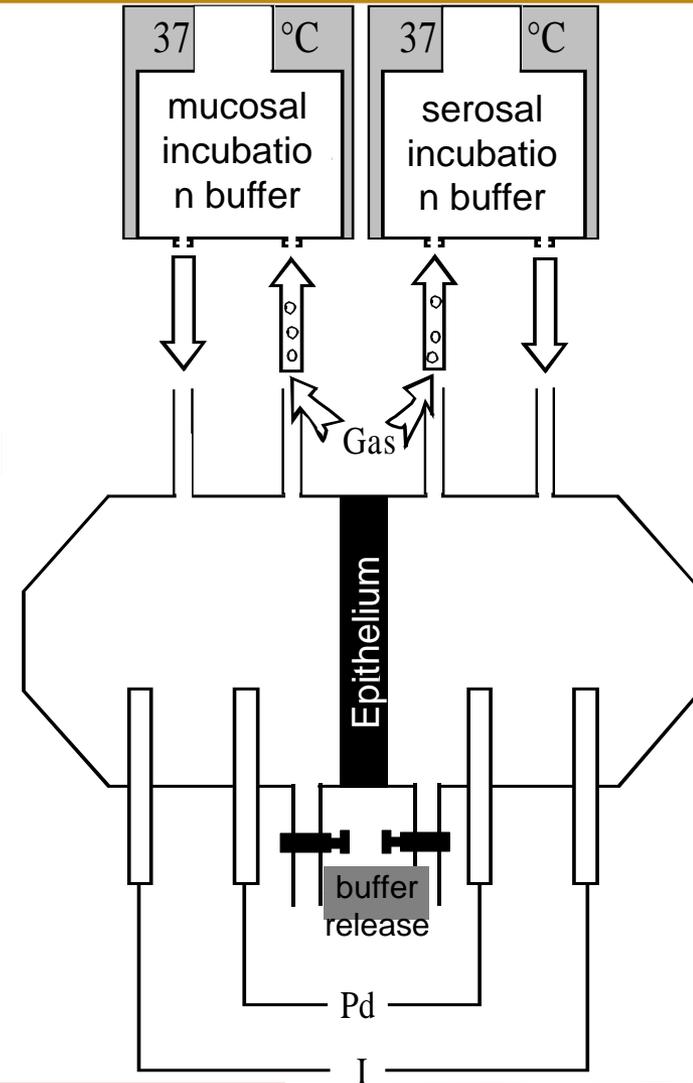
- One day-old-broiler chicks were randomly divided into 2 groups (control and infected group)
- All birds were tested for the free of *C. jejuni*
- Body weight was determined weekly
- At 14 days of age, one group of birds was infected orally with *C. jejuni* (reference strain NCTC 12744) with the dose of 10^8 CFU/bird



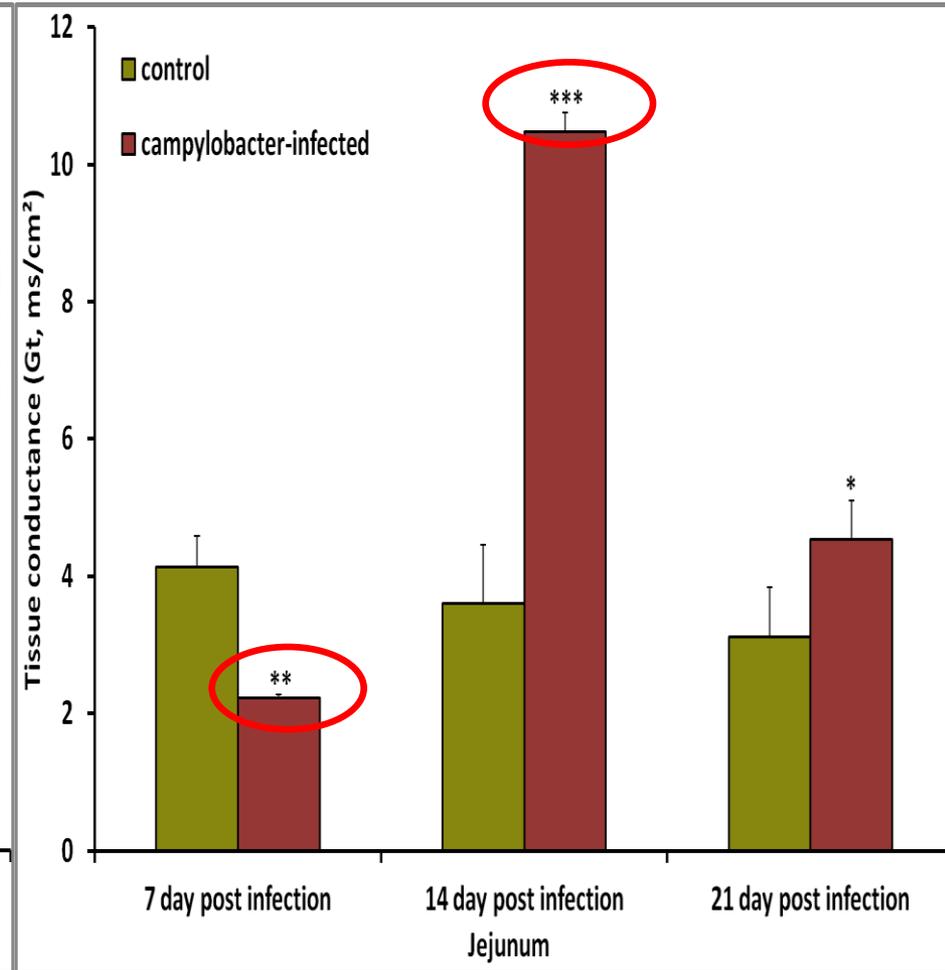
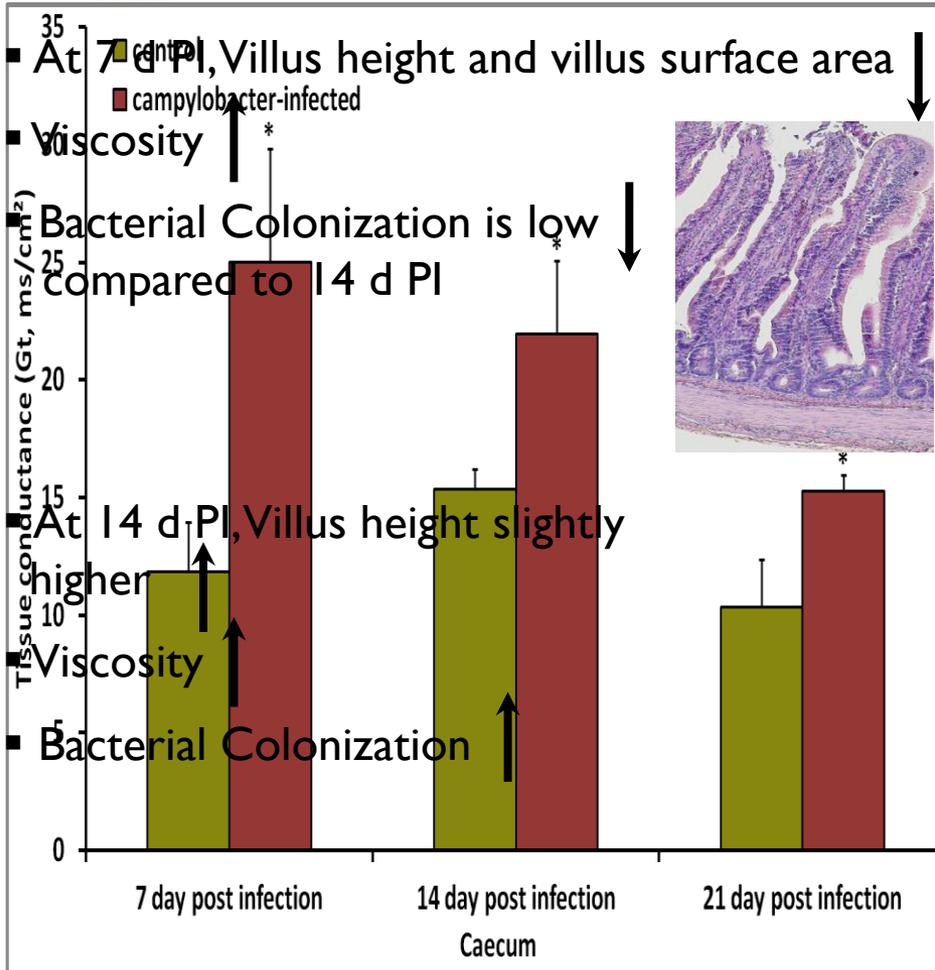
- collecting intestinal pieces of the mid-jejunum, and cecum



- **In vitro technique**
- **Epithelia incubation**
- **Investigate the changes of intestinal physiology**
- **Measurement of electrophysiological properties**
 - G_t = tissue conductance (sum of paracellular and transcellular resistance)
 - I_{sc} = ionic current (active transport of ion)
 - PD = tissue potential (unequal transport of positive and negative charges across the epithelium)
- **Changes in tissue conductance are indicating the effects on the tissue integrity and permeability**

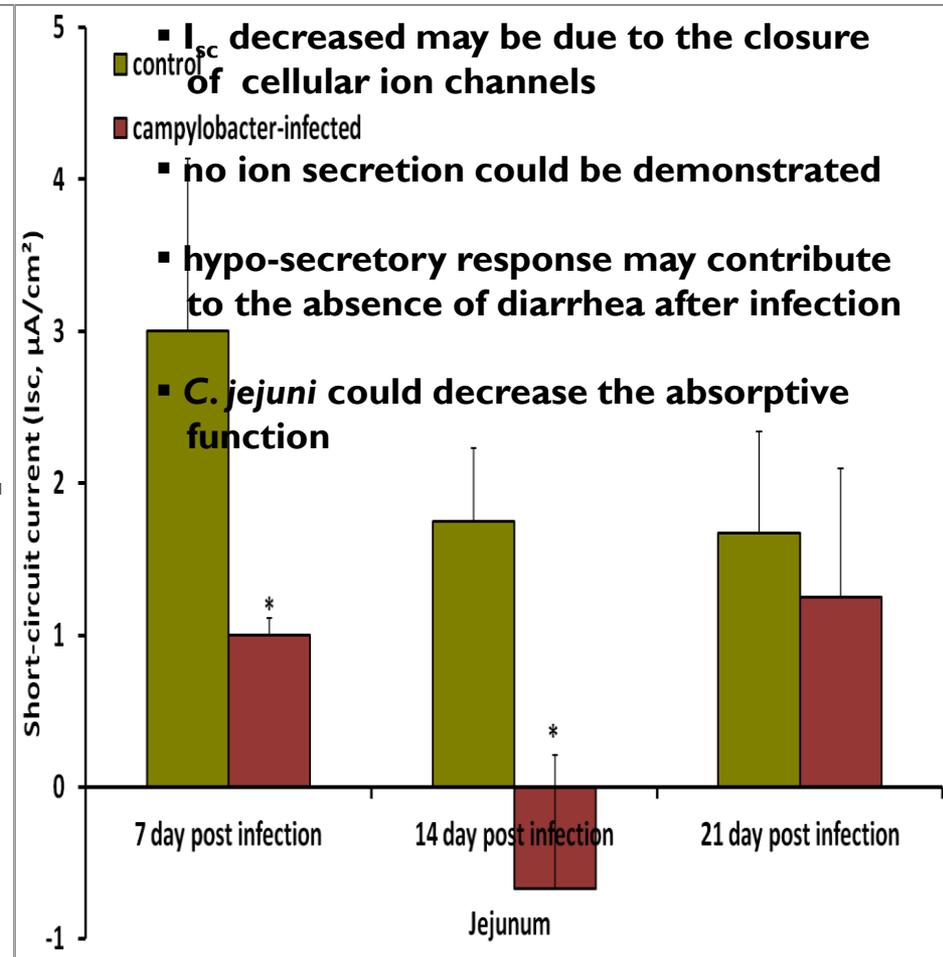
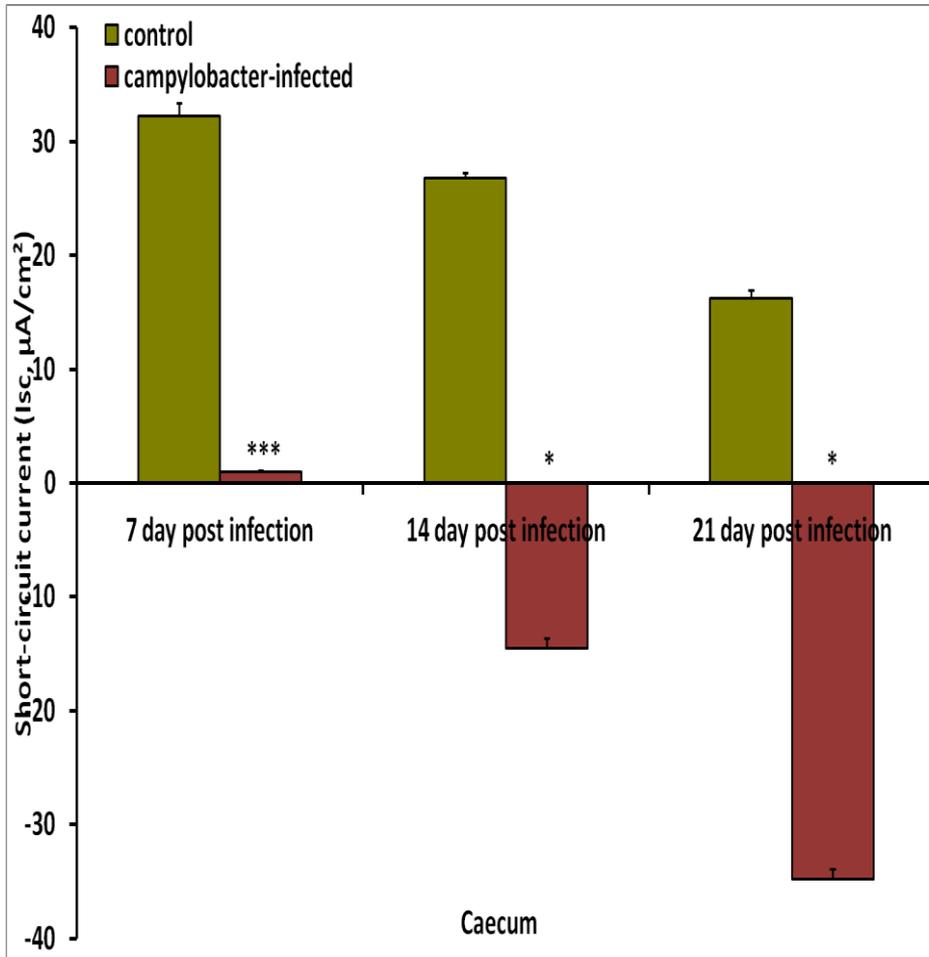


C. jejuni-induced intestinal epithelial barrier disruption



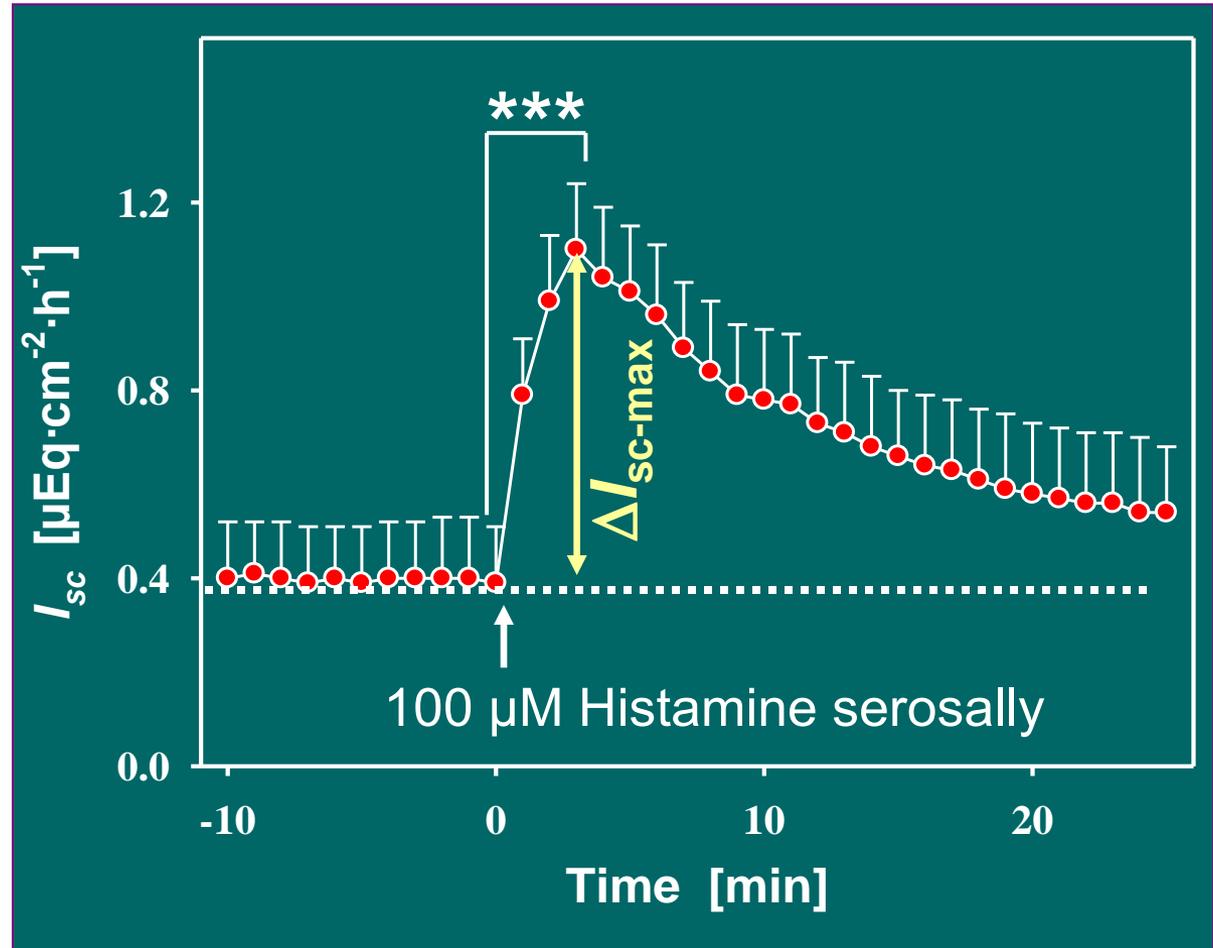
Data are means + SEM. ***Asterisks mark significant differences ($P < 0.001$), **Asterisks mark significant differences ($P < 0.01$), *Asterisks mark significant differences ($P \leq 0.05$).

C. jejuni alter epithelial ion function



Data are means + SEM. ***Asterisks mark significant differences ($P < 0.001$), **Asterisks mark significant differences ($P < 0.01$), *Asterisks mark significant differences ($P \leq 0.05$).

- Infection induced sensitivity to histamine only in jejunum at 7 d PI
- Histamine was ineffective in the control tissues



*** $P < 0.001$

Summary

- ***Campylobacter* infection decreased growth performance in clinically healthy appearing birds.**
- ***Campylobacter* infection altered the electro-physiological functions along the intestinal tract of chickens.**
 - **At 7 days PI *C. jejuni* decreased the trans-epithelial ion conductance (G_t) in the jejunum but increased the G_t in cecum.**
 - **At 14 and 21 days PI, the *C. jejuni* infection increased the G_t in all segments**
 - **Affecting the specific tight junction proteins expression or by activating signaling pathways**
 - **At 7, 14 and 21 days PI, the ion transport across the epithelium decreased in all segments.**
- ***C. jejuni* infection induced sensitivity to the secretagogue histamine in the jejunum at 7 d PI.**
- **Secretory pathways can be activated by *C. jejuni* but do not affect all segments and are limited to certain time points after infection.**

Conclusion

- ***Campylobacter* modulates gut health by disrupting the intestinal epithelial barrier function.**
- **A compromised barrier function could potentially increase permeability for other bacteria.**
- ***C. jejuni* may influence the severity of mild bowel diseases.**
- **The absence of diarrhea in infected chickens may be seen as a result of differently regulated local electro-physiological and immunological gut reactions.**
- ***Campylobacter*-host interaction can be used as a model for understanding infections with related pathogens in chickens and other bird species.**
- **Characterization of modulation of intestinal physiology by inapparent infection could enforce effective tools for controlling infection.**



**Clinic for Avian, Reptile and Fish Medicine
Department for Farm Animals and
Veterinary Public Health**

**Thank you for
your attention!**

