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Characterization of gastric intralumenal pH and development of the proventricular deep glands during perinatal period in ostrich

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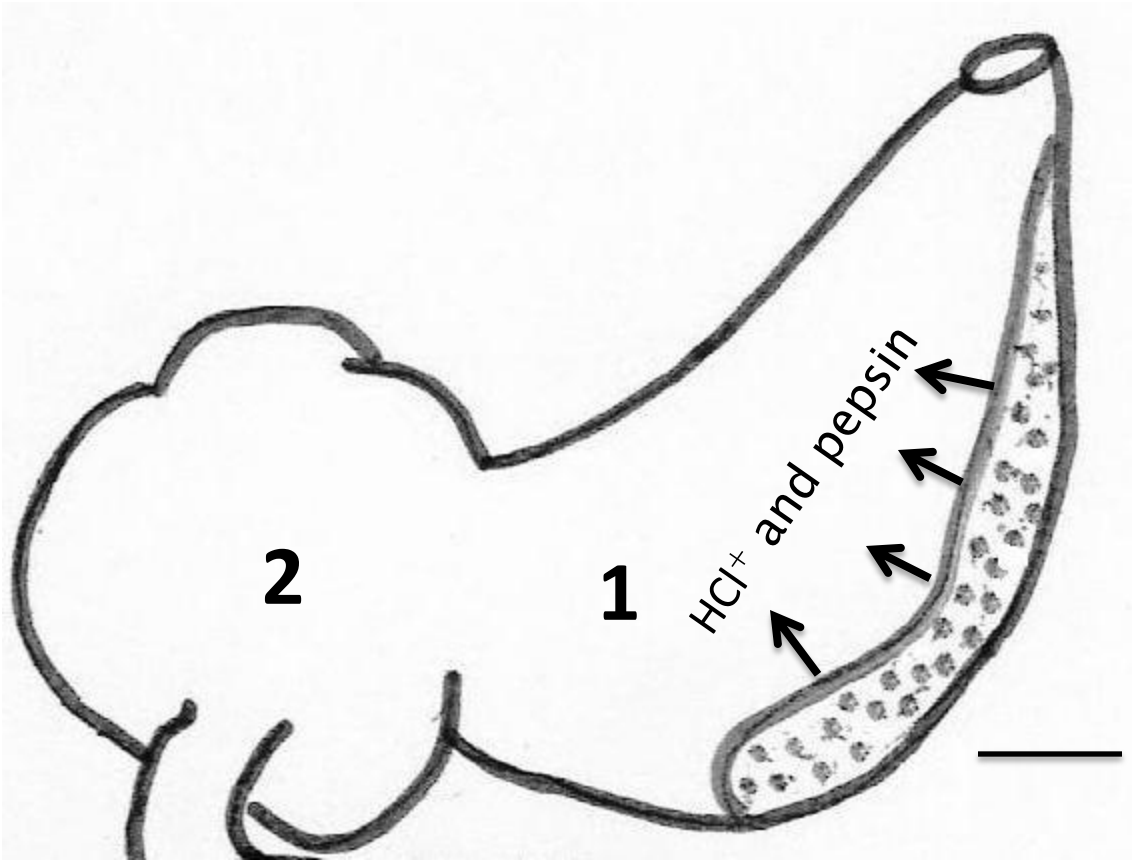
The goal of study

The goal of this study was to determine gastric intralumenal pH and development of deep proventricular glands in ostrich chicks during perinatal ontogeny.

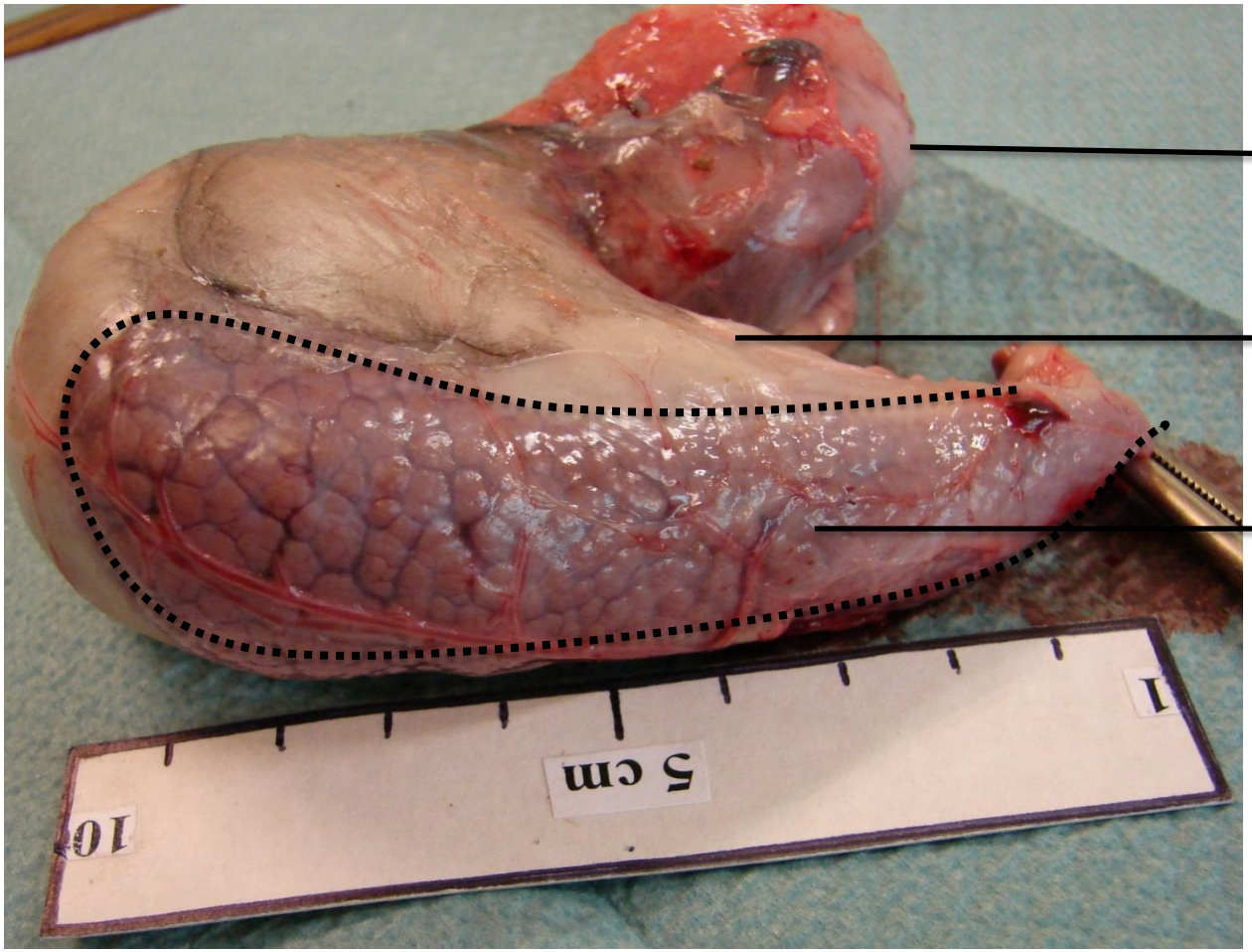
- **“The glandular area originates near the esophageal junction and extends ventrocaudally. The proventriculus of the ostrich is the largest of the ratites proportional to the gizzard and it has the smallest relative glandular region**.” (Cho P., Brown R., Anderson M. (1984) Comparative gross anatomy of ratites. *Zoo Biology 3,* pp. 133-144)

- **“The contents of the stomach was highly acid and pH tended to be lowest in the proventriculus (pH 1.6) and highest in the gizzard (pH 2.1), wich indicates incomplete mixing of digesta between the two stomach regions. Gastric proteollysis most probably commences in the proventriculus and continues in the gizzard.”** (Swart D., Mackie, R.I., Hayes J.P. (1993) Fermentative digestion in the ostrich (*Struthio camelus var. domesticus*), a large avian species that utilizes cellulose*. S.Afr.J.Anim.Sci. 23-5/6 ,* pp.127-135)

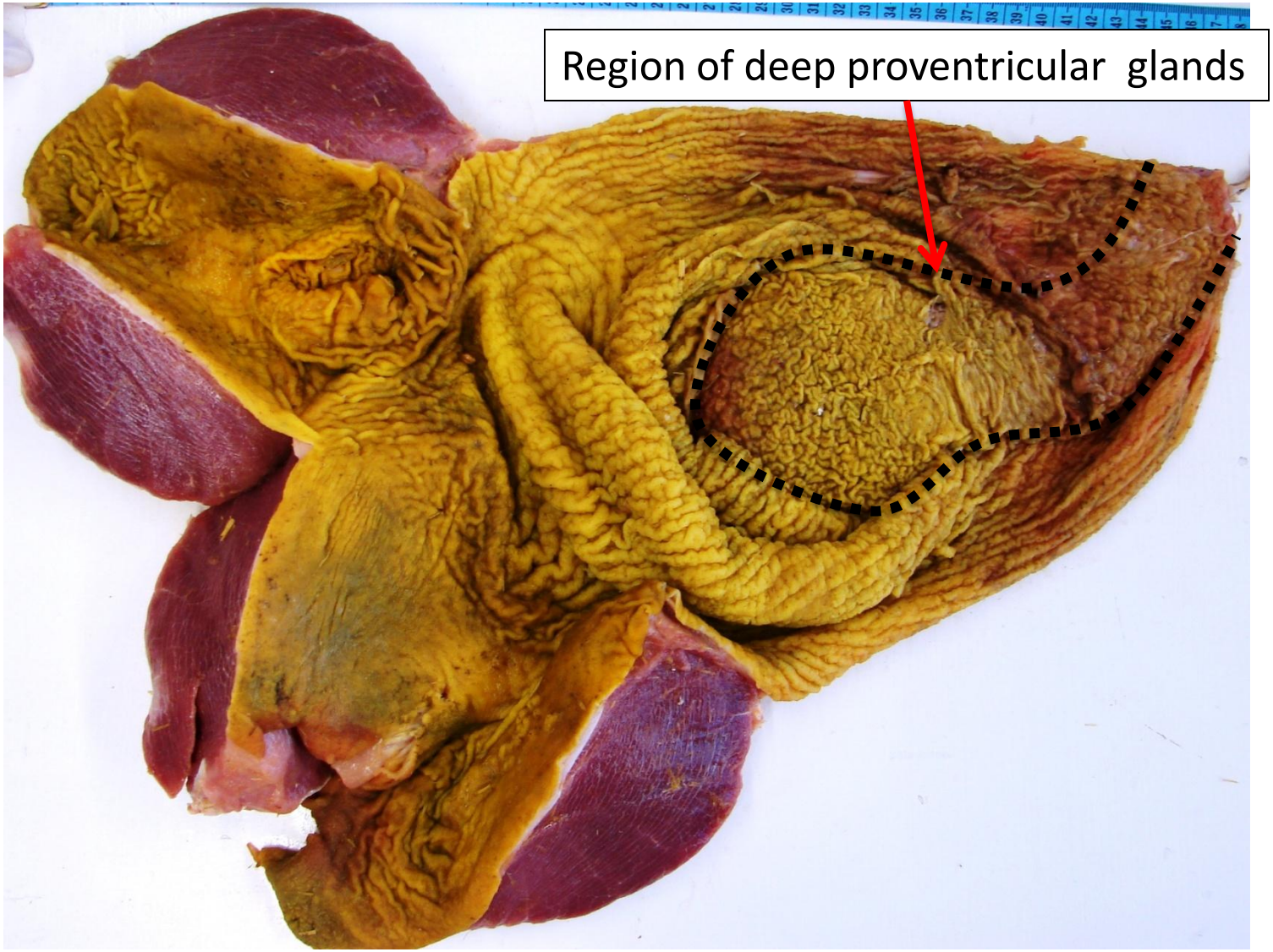


1- proventriculus *(s.pars glandularis)*

2- ventriculus *(s.pars muscularis)*



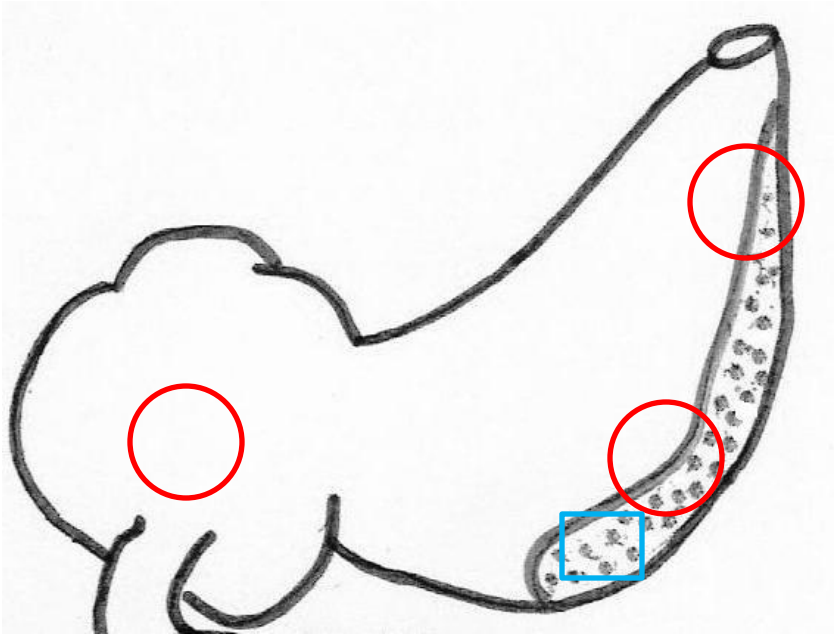
Stomach of 30 days old ostrich chicks


Region of deep proventricular glands

Materials and methods

- Six African ostrich embryos (38th day of development) and 36 chickens (1; 3; 7; 14; 30; and 60 days post hatching; 6 in each age group) representing both sexes were used.
- pH was measured in the proventriculus above deep glandular region and within ventriculus
- Tissue samples for histological assessment were collected from the deep glandular regions of proventriculus.
- For histological characterization sections were stained with hematoxilin and eosin (H&E) and Alcian blue/ period acid - Shiff (PAS)

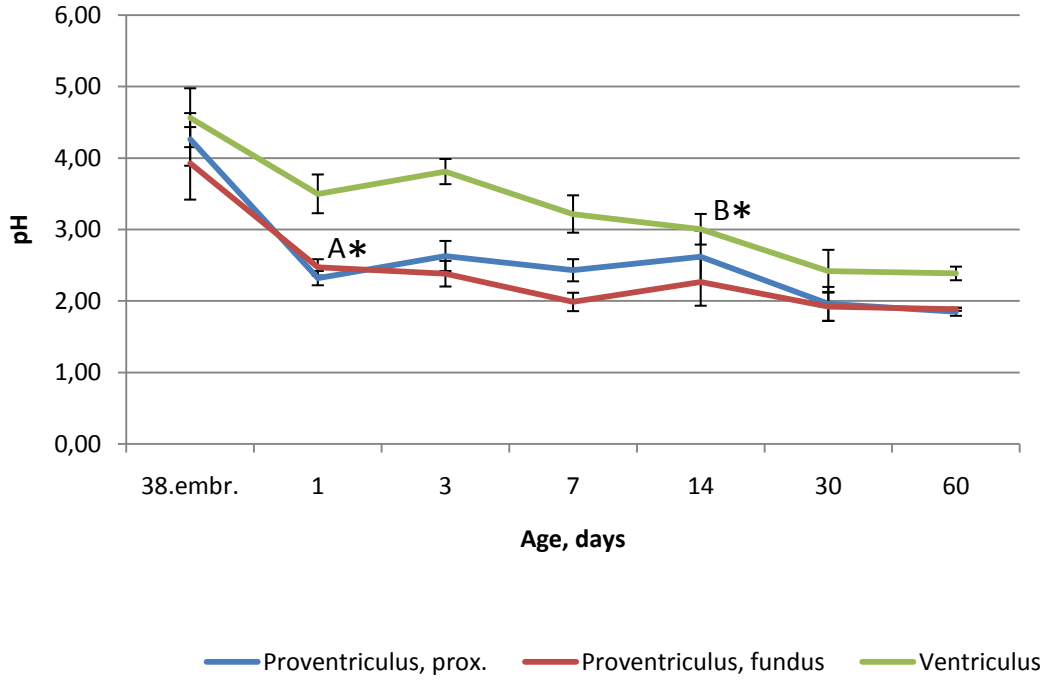
pH measuring



— place of pH measuring

— tissue samples for histological assessment

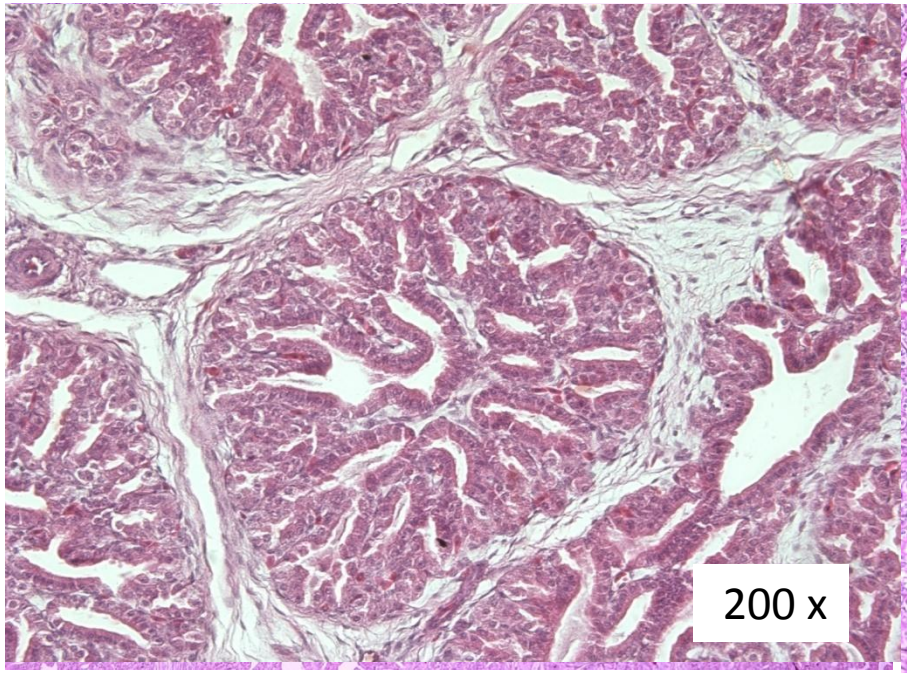
Intralumenal pH (±SE) in the proventriculus and ventriculus during perinatal period in ostrich



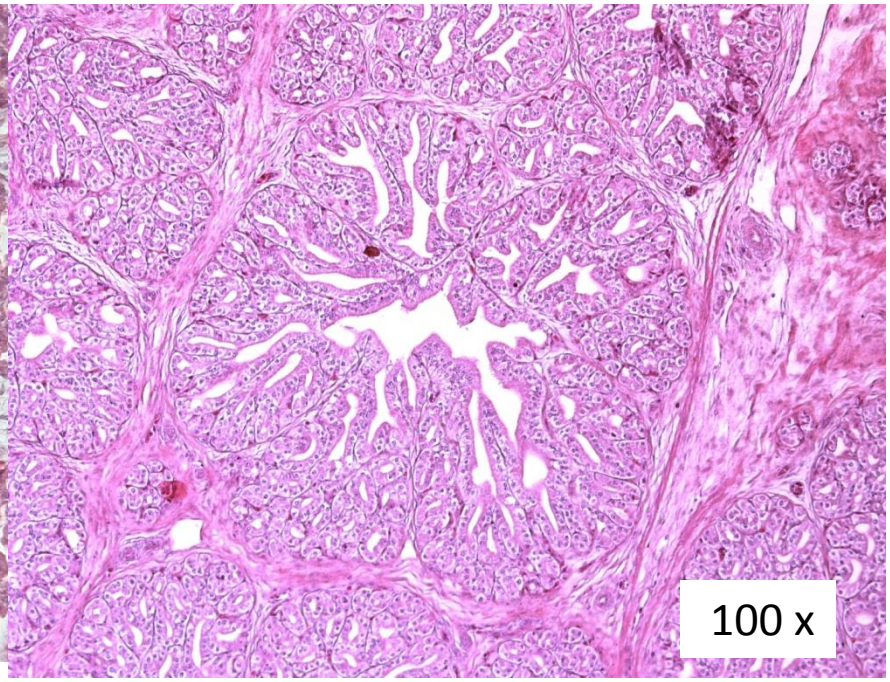
[A] statistically significant difference between 38. embr. and 1 day age
[B] statistically significant difference between 38. embr. and 14 days age
Statistically significant difference ($p<0,01$) was detected between pH level in proventriculus and ventriculus in all age groups.

* $p<0,05$; ** $p<0,01$; *** $p<0,001$

Deep proventricular glands in 38th embryonal day and one day old ostrich chicks

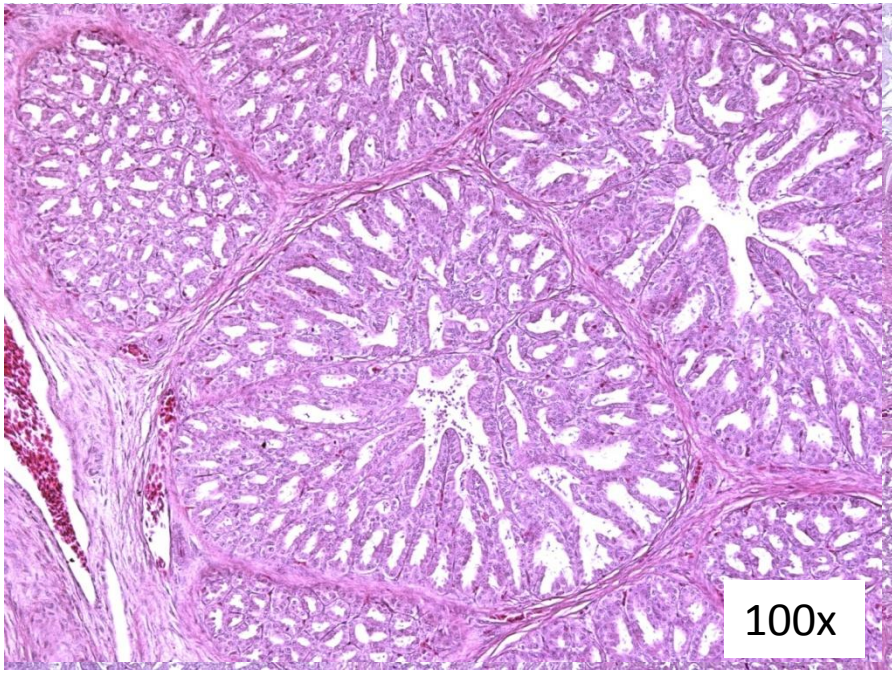


38 day of incubation, H&E

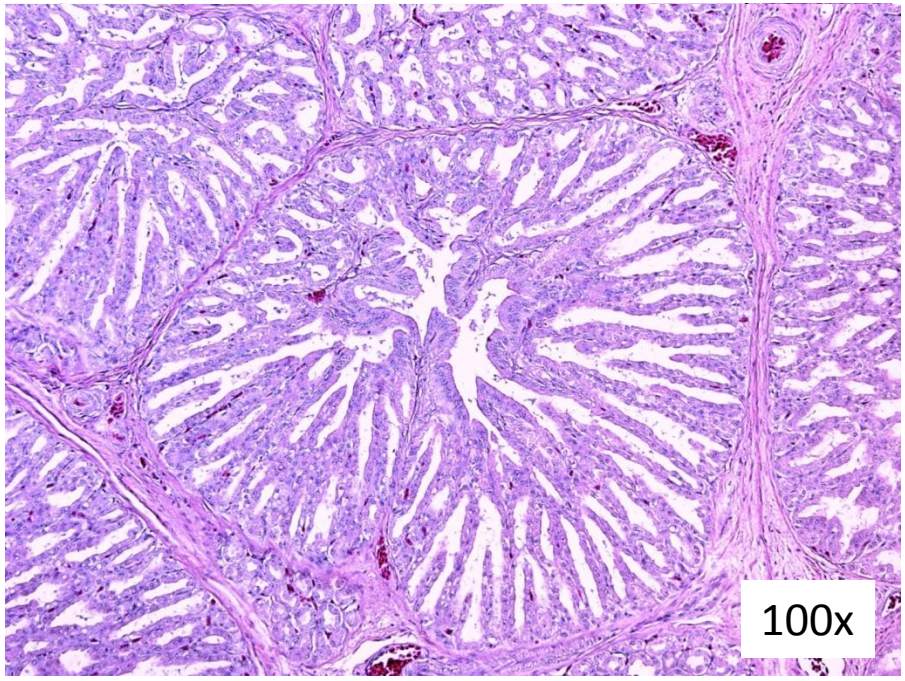


One day old, H&E

Deep proventricular glands in 3rd and 7th day post hatching

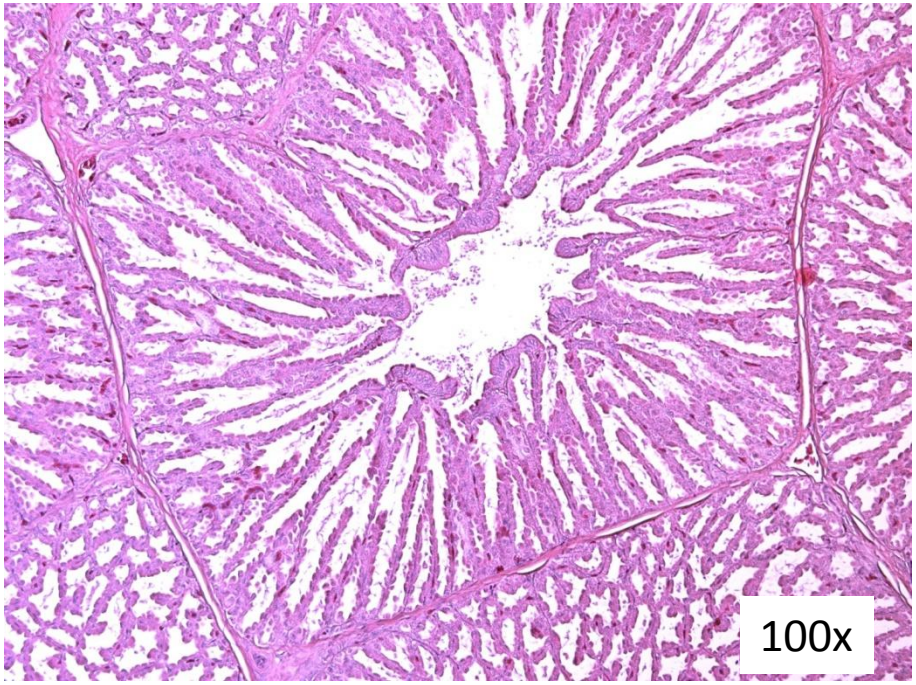


3 days old, H&E

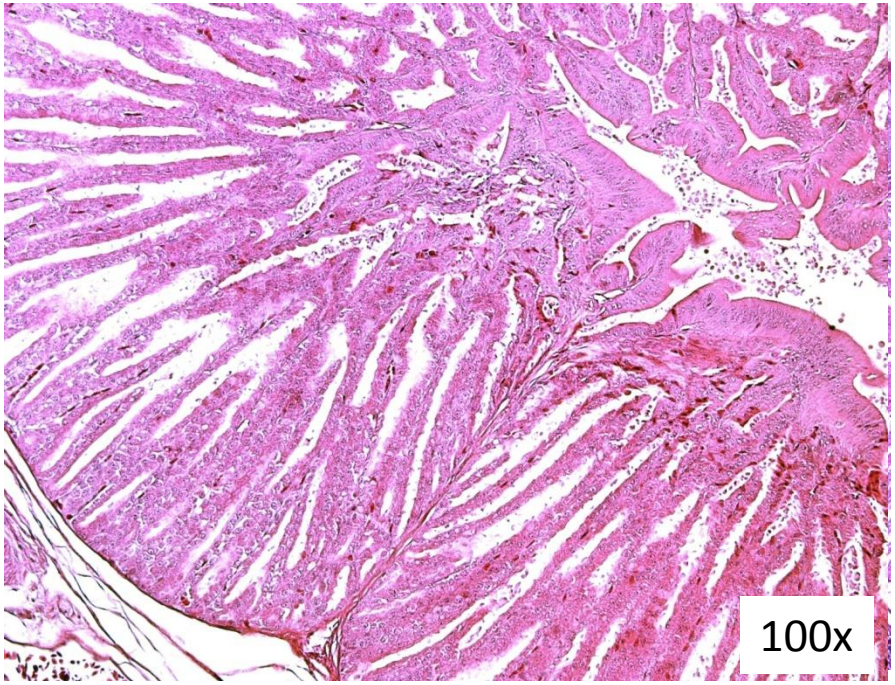


7 day old, H&E

Deep proventricular glands in14th and 30th day post hatching day

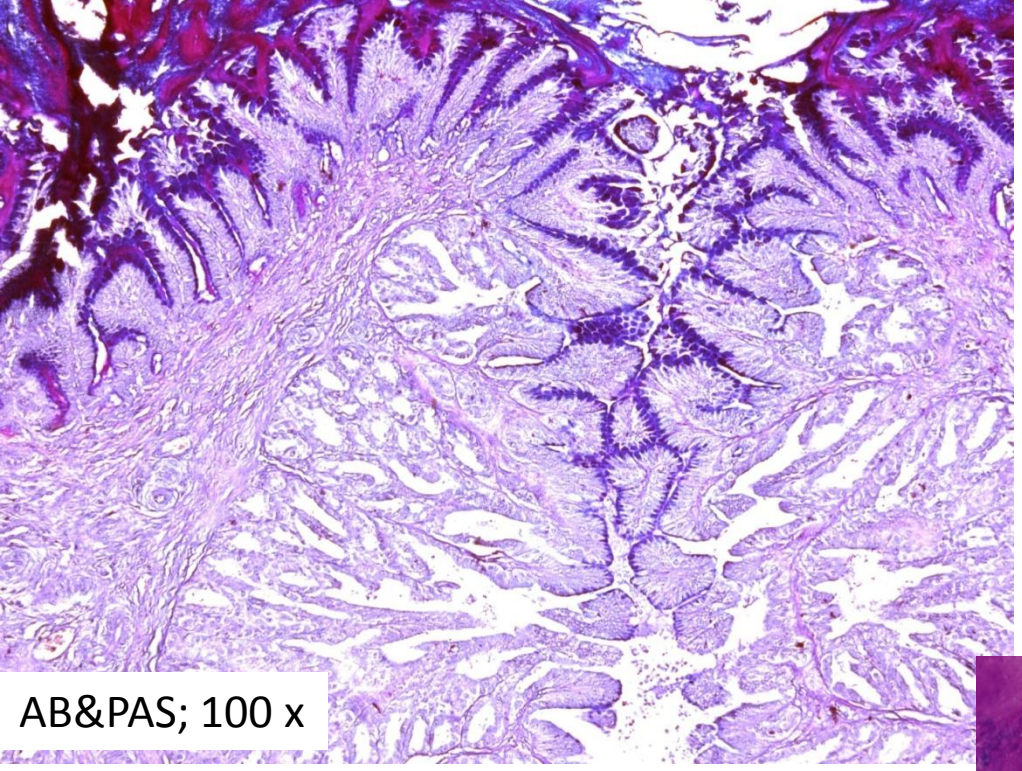


14 days old, H&E



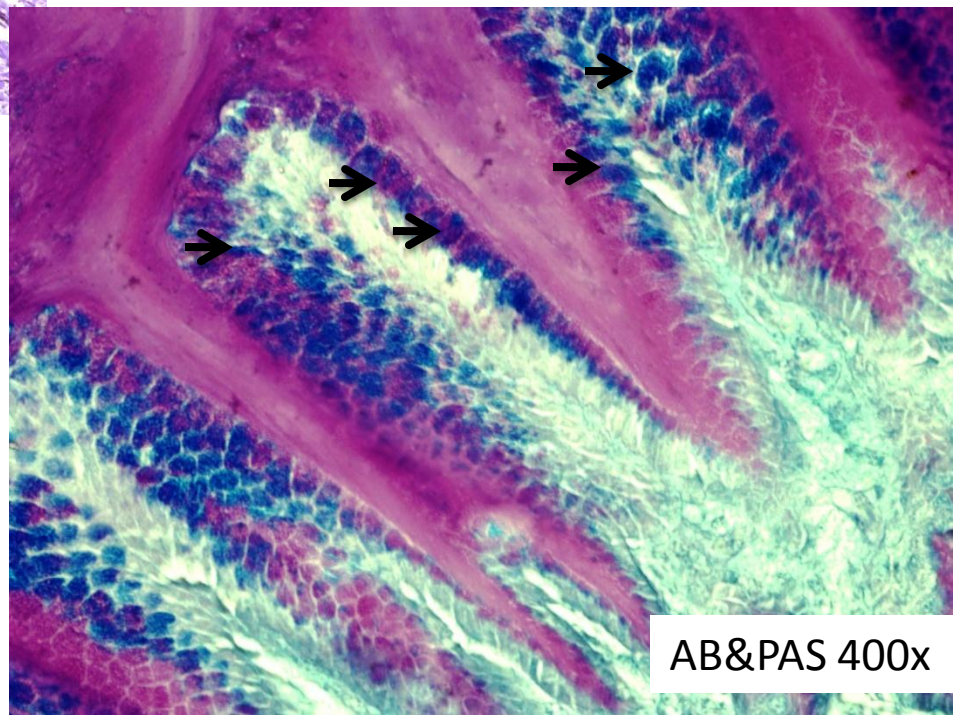
30 days old H&E

Deep proventricular glands in 60^{th}day



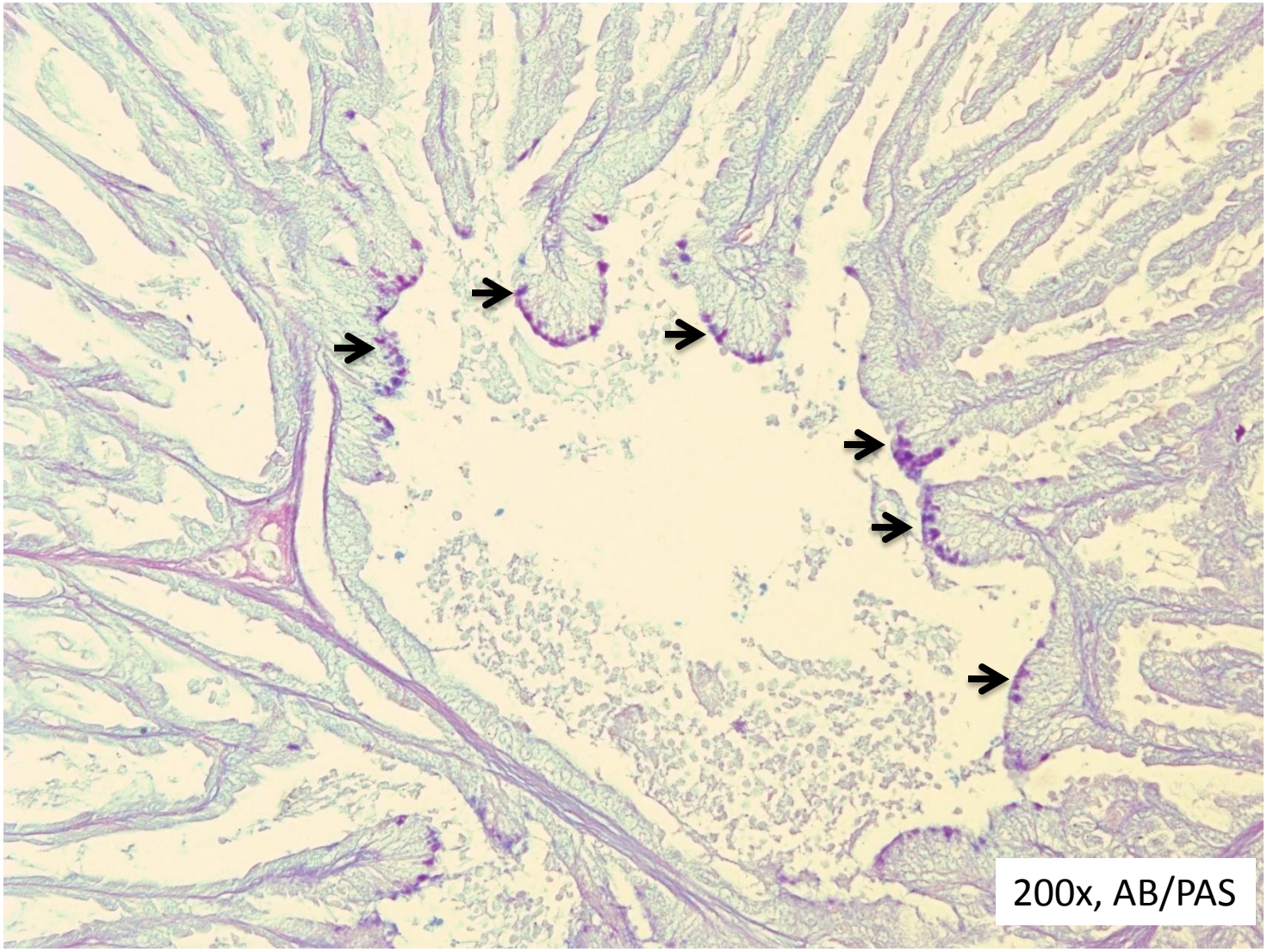
AB&PAS; 100 x

Deep proventricular glands and superficial epithelium in 3 days old ostrich chick



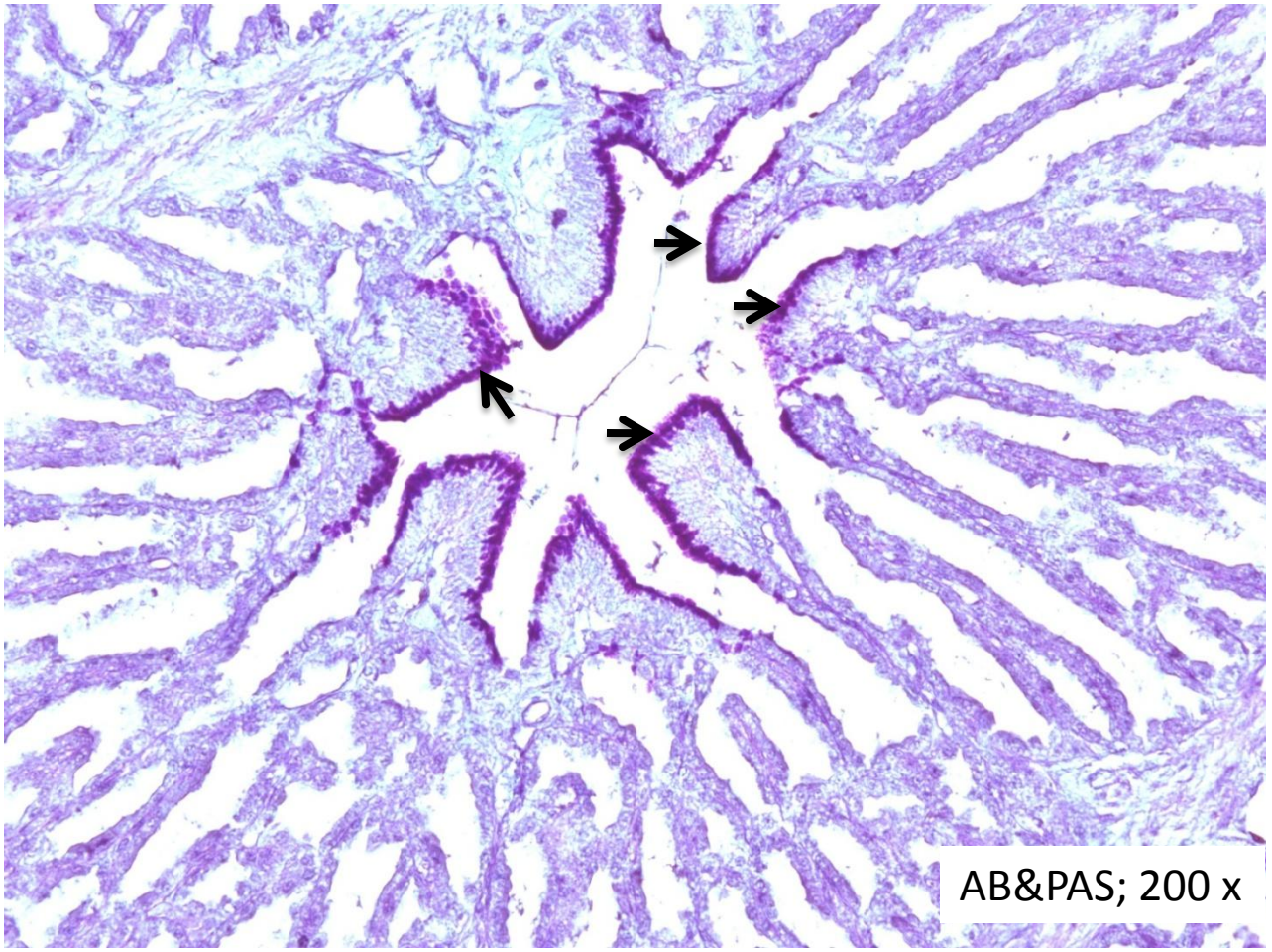
AB&PAS 400x

Dark blue (AB +) – acidic;
Magenta (PAS+) – neutral ;
Violet (AB/PAS+) – mixed mucopolysaccharides



Central cavity of deep proventricular glands lobule in 14 days old ostrich chick

➔ - mucopolysaccharide granules



Central cavity of deep proventricular glands in 30 days old ostrich chick

➔ - mucopolysaccharide granules

Conclusions

- Gastric lumenal acidity indicates that hidrochloric acid is secreted in the deep glands of proventriculus as early as 38th day of embryonal development and intensity of secretion increases beginning from hatching day as evidenced by decreased pH.
- With increase in age, intraluminal pH in both gastric compartments tends to decrease.
- The development of deep glandular epithelium occurs at accelerated rate between 3rd and 7th day of age coinciding with onset of chicken feeding, and it continues to develop with age. In 30 day old chickens glandular histology resembled that of adult ostrich.