figures appear to be convincing evidence of lens regeneration.

Positive cases of lens regeneration were found only in eyes taken from embryos of about 3 days of age. An analysis of the results obtained by earlier authors shows that in their experiments also lens regeneration occurred when the eyes belonged to embryos of less than 3 days of age. Although VAN DETH[5] has reported a few cases of lens regeneration in 4-day-old embryos, his figures are not convincing at all. A similar case was found in the present series of experiments also; but, as mentioned earlier, it cannot be considered more than a very doubtful case. It is suggested that perhaps the lens regeneration capacity in the pupillary margin is present in the chick embryos up to about the end of the third day of incubation and it is lost thereafter. This would also explain the completely negative results obtained by MCKEEHAN[11]. The 72 h stage may be a critical one with respect to lens regeneration capacity. The loss, however, may not be irrevocable and the capacity can perhaps be restored under experimental conditions[13].

It has been stated[5] that in chick embryos the lens is regenerated as a solid plate from the iris border. This plate later becomes folded and encloses some of the outside space to form its own cavity secondarily. The present observations also support this interpretation. The present author, however, is unable to confirm whether it is the dorsal or the ventral iris border which is involved in lens regeneration in these embryos. According to a previous report it is the ventral border[5].

Extremely low frequency of lens regeneration in even young chick embryos still remains to be explained. It is stated[13] that even in *Triturus*, where frequency is high and lens regeneration predictable, it often fails if fibroblasts fill up the vitreous chamber of the lenectomized eye, thus preventing the retinal influences from reaching the iris. Probably a similar reason may operate in the case of chick embryos also[14].

*Zusammenfassung*. Die Linsenregeneration beim Hühnchen tritt nur auf, wenn die Embryonen am 3. oder 4. Bebrütungstage operiert worden sind. Wenn die Operation später stattfindet, tritt keine Regeneration auf.

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[13] L. S. STONE, in *Regeneration in Vertebrates* (Ed. C. S. THORNTON, University of Chicago Press 1956), Chapter I.

[14] The author gratefully acknowledges the support received from Dr. D. J. MCCALLION and Dr. R. A. LIVERSAGE of the Department of Zoology of the University of Toronto (Canada) where the experiments were conducted. The remaining part of the work was done at the University of Rajasthan, Jaipur, India.

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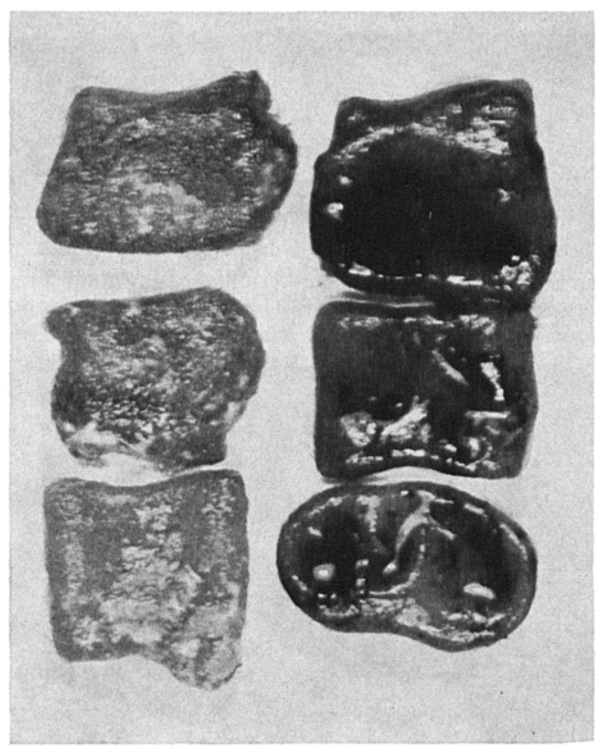
## Changes in Permeability of the Mucosa during Intestinal Coccidiosis Infections in the Fowl

During the fourth and fifth days of a severe infection of *Eimeria acervulina*, the mucosa appears inflamed and haemorrhagic, although actual loss of blood does not often occur (MOREHOUSE and MCGUIRE[1], PRESTON-MAFHAM[2]). It was decided to investigate the possibility that a change of permeability of the mucosa and a consequential loss of serum protein into the lumen of the gut might be associated with this inflammatory reaction.

An experiment was performed to follow the distribution of a dye, Pontamine sky blue, over the period of the infection. The use of this dye as a marker for serum proteins, has been described by HALPERN, LIACOPOULOS and LIACOPOULOS-BRIOT[3]. Eight- to ten-week-old cockerels were used for the experiment and the disease was initiated with a dose of 10 million sporulated oocysts. A 2% solution of Pontamine sky blue in Krebs-Ringer bicarbonate saline was injected into the brachial vein of both infected and control birds at a dose of 2 ml/kg body weight. A period of 20 min was allowed for the dye to circulate and the birds were then killed by an overdose of sodium pentobarbitone and the intestine removed for examination. Observations were made upon a total of 31 infected birds over the period of infection from 1–170 h.

The first appearance of the dye in the lumen of the gut was in a bird examined 48 h after infection. All of the birds examined after this time, with one exception at 52 h, showed some degree of dye loss. The amount of dye loss, as judged visually, was small up to 72 h but increased from this time to a maximum over the period from 90–120 h. Dye losses diminished gradually after this time and beyond 144 h was slight and mainly from the small




A comparison of the mucosal surfaces of the intestine of a norma control and an infected fowl, both injected with Pontamine sky blue. C, control; IN, infected bird; UD, upper duodenum; LD, lower duodenum; SI, small intestine from above the yolk stalk.

intestine, rather than the duodenum. It was noticeable that dye loss occurred first in the duodenum and not until about 10 h later did it occur in the small intestine. The appearance of the infected intestine compared with that of a normal control can be seen in the Figure. This shows the state of the intestine 90 h after infection. The dark areas on the infected tissue correspond to sites of dye loss. Microscopically, a marked difference in the colouration of the mucosa was found between the controls and the infected birds, during the period of dye loss. Both the mucosa and the submucosa of the infected birds always took on a blue colouration, whereas with the controls, the colour was restricted to the submucosa, leaving the mucosa quite clear.

The leakage of Pontamine sky blue, presumably attached to serum proteins, into the lumen of the gut of infected birds and the alteration in its distribution within the gut wall, indicates that there has been some change in the permeability of both the mucosal capillaries and the epithelium. The reasons for this change in permeability are not clear but the phenomenon is associated with the rapid growth of the parasite within the epithelial cells and the sloughing of the epithelium. Concurrent with the period of maximum dye loss, a depression in the absorption of L-histidine, D-glucose and fluid has been found by PRESTON-MAFHAM[4], indicating that there are considerable physiological changes in the gut during infection.

*Résumé*. La perméabilité de l'intestin grêle infecté d'*Eimeria acervulina* est modifiée. Des poules normales et des poules infectées ont reçu des injections i.v. de pontamine colorant bleu-ciel en solution saline. La présence de teinte bleu seulement chez les poules infectées a indiqué un changement de perméabilité. Ce changement est produit par les coccidioses entre 48 et 144 h à partir de l'infection dans la plupart des cas.

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[2] R. A. PRESTON-MAFHAM, *The Effects of Intestinal Coccidiosis upon Amino Acid Absorption in the Fowl* (M.Sc. Dissertation University of London 1965).
[3] B. N. HALPERN, P. LIACOPOULOS and M. LIACOPOULOS-BRIOT, Archs int. Pharmacodyn. Thér. *119*, 56 (1959).
[4] R. A. PRESTON-MAFHAM, unpublished experiments (1967).

## Architectonical and Volumetrical Investigations on the Thalamus of the Cetacea in Comparison with the Human Brain[1]

The thalamus has a key position in the cerebrum. Many afferent pathways from the cerebellum, the mesencephalon, the hypothalamus and particularly the afferent somatic sensory fibre system end here and undergo reorganization. On the other hand, the cortex has a two-way contact with the thalamus and is constantly controlled and influenced by it.

More research should be carried out on one of the main nuclei of the thalamus, the Nucleus anterior thalami. The fact that it plays a leading role as link in the limbic system concerning the study of behaviour problems is important. PILLERI[2–5] has published several papers on the morphology of the cetacean brain. KRUGER[6] made an important contribution to the information on the thalamus of *Tursiops truncatus* with his paper on comparative anatomical and volumetrical investigations. The following observations were made on the brains of 2 *Odontoceti* (*Delphinapterus leucas*, *Delphinus delphis*) and on the brain of 1 *Mysticeti* (*Balaenoptera physalus*).

The relative portion of the thalamus averages 2.8% in the Cetacea, which is twice that of the human brain.

The Nucleus anterior thalami can, as is the case in the human brain, be divided into a main nucleus, which consists of the Nucleus anterior principalis (Apr) and medialis (Am), and into a Nucleus anterodorsalis (Ad).

The Nucleus anterior thalami is very small in the cetacean brains we examined. The relative volume of *Balaenoptera* is 0.66%, of Delphinapterus 0.49% and of Delphinus 0.20%, which gives an average of approxi-

Table I. Absolute and relative voluminal values of the thalamus and the nucleus anterior thalami

| Species | | Thalamus total | Nucleus anterior thalami total |
|---|---|---|---|
| Homo | Fresh volume mm³ | 18,810.00 | 404.50 |
| | % | 100 | 2.15 |
| *Delphinus delphis* | Fresh volume mm³ | 18,531.94 | 37.43 |
| | % | 100 | 0.20 |
| *Delphinapterus leucas* | Fresh volume mm³ | 78,100.00 | 383.17 |
| | % | 100 | 0.49 |
| *Balaenoptera physalus* | Fresh volume mm³ | 79,910.00 | 530.44 |
| | % | 100 | 0.66 |

[1] With the assistance of the Schweizerische Nationalfonds zur Förderung der wissenschaftlichen Forschung (Grant No. 3883).
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Table II. Volume of the neurons of the anterior nuclei as a percentage

| Nucleus | Species | Neuron volume % |
|---|---|---|
| Apr | Homo | 4.2 |
| | *Delphinapterus leucas* | 2.4 |
| | *Balaenoptera physalus* | 3.7 |
| Ad | Homo | 3.3 |
| | *Delphinapterus leucas* | 4.4 |
| | *Balaenoptera physalus* | 4.8 |