

report that MPG is quite effective for protection against external γ -rays of ^{60}Co and the body weight has been maintained to a greater extent as a result of protection of various organs like gonads^{3, 8}, intestine⁹ etc. While investigating the role of MPG in preventing the HTO-induced deleterious changes in various organs, in combination, its toxicity with regard to developing brain should be understood.

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HISTOENZYMOLOGICAL STUDY ON *OESOPHAGOSTOMUM COLUMBIANUM*

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THE present communication reports the histochemical localization and distribution of dehydrogenases in *Oesophagostomum columbianum*, an important intestinal nematode parasite of sheep, goat and wild antelope.

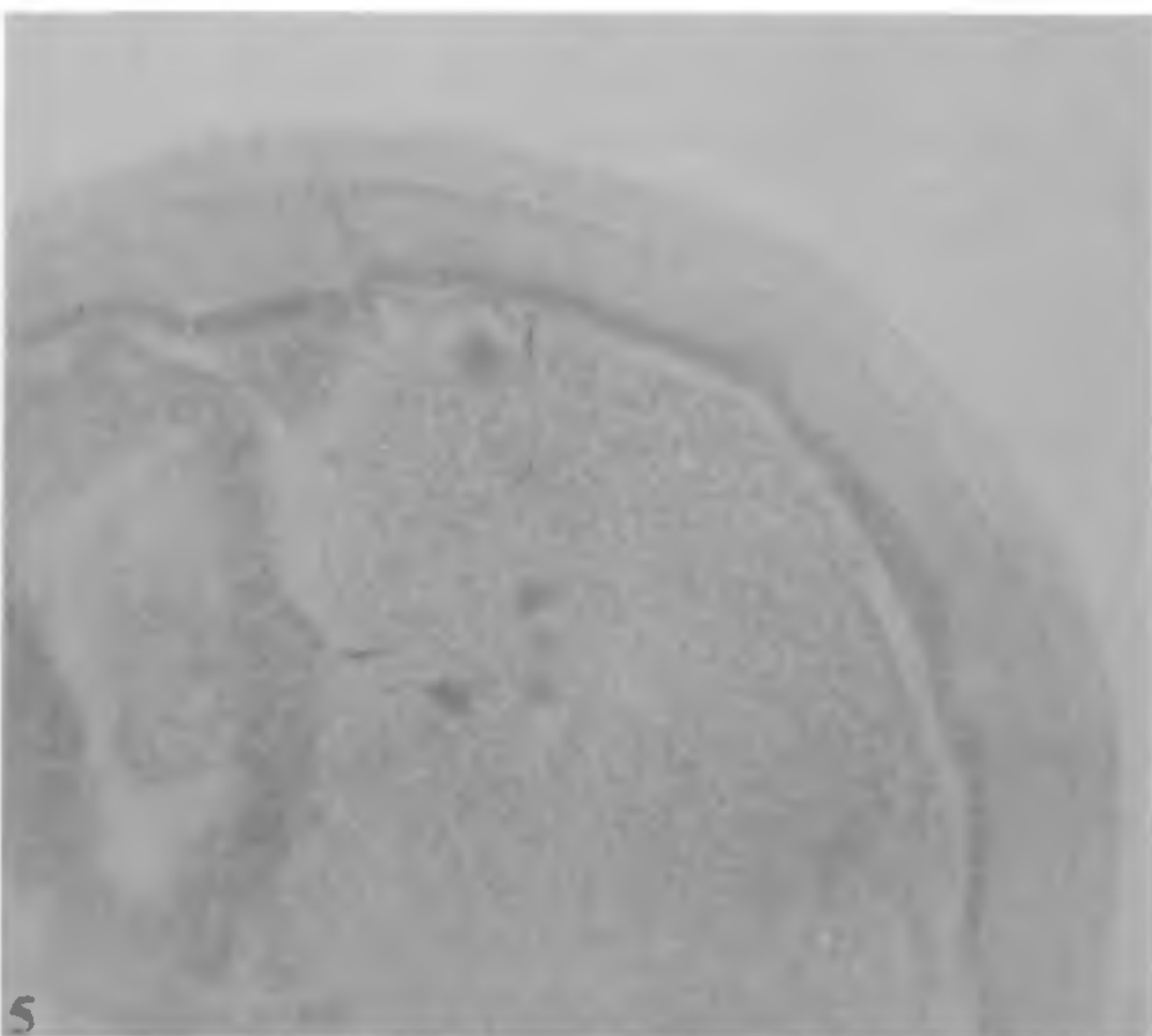
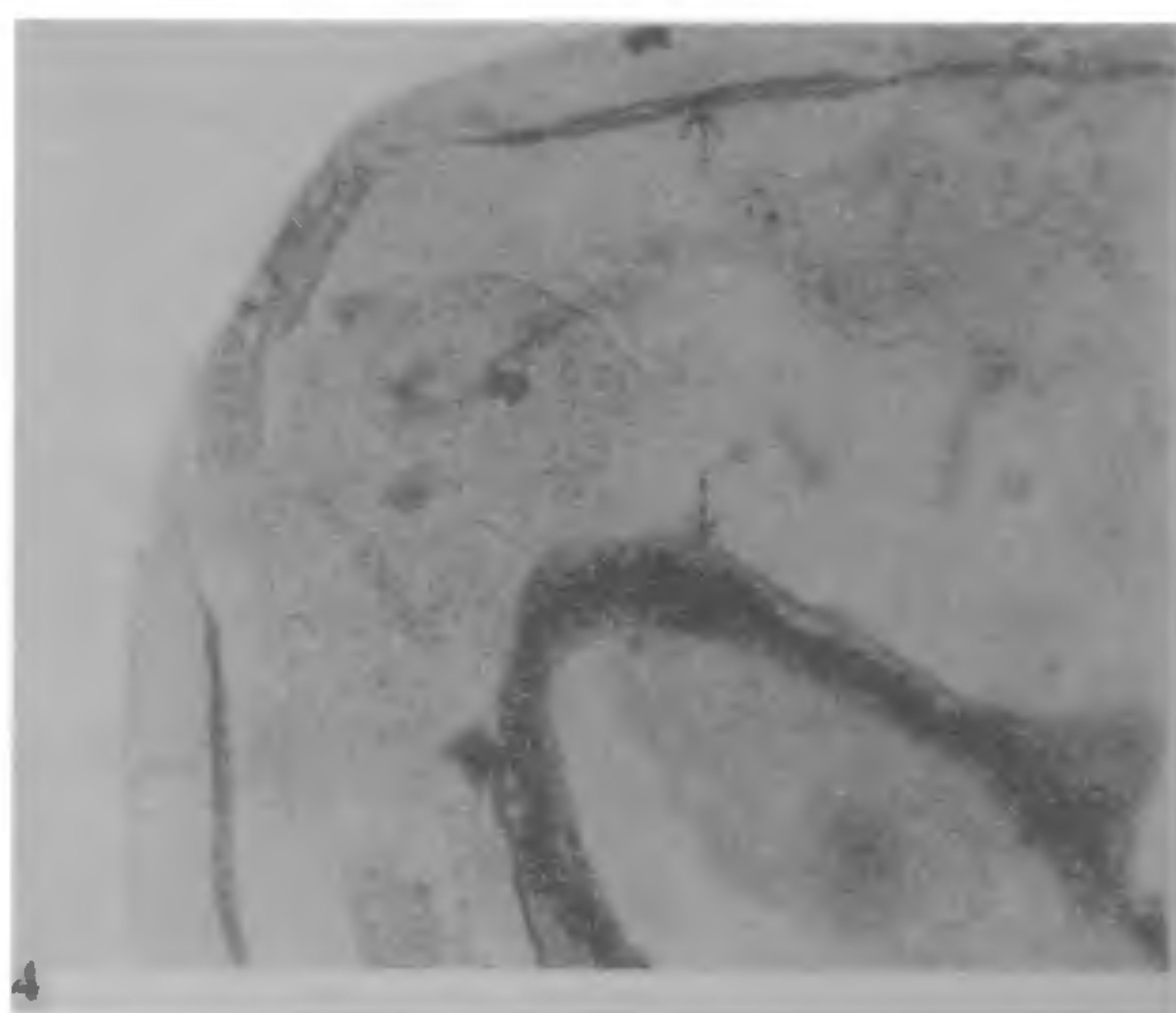
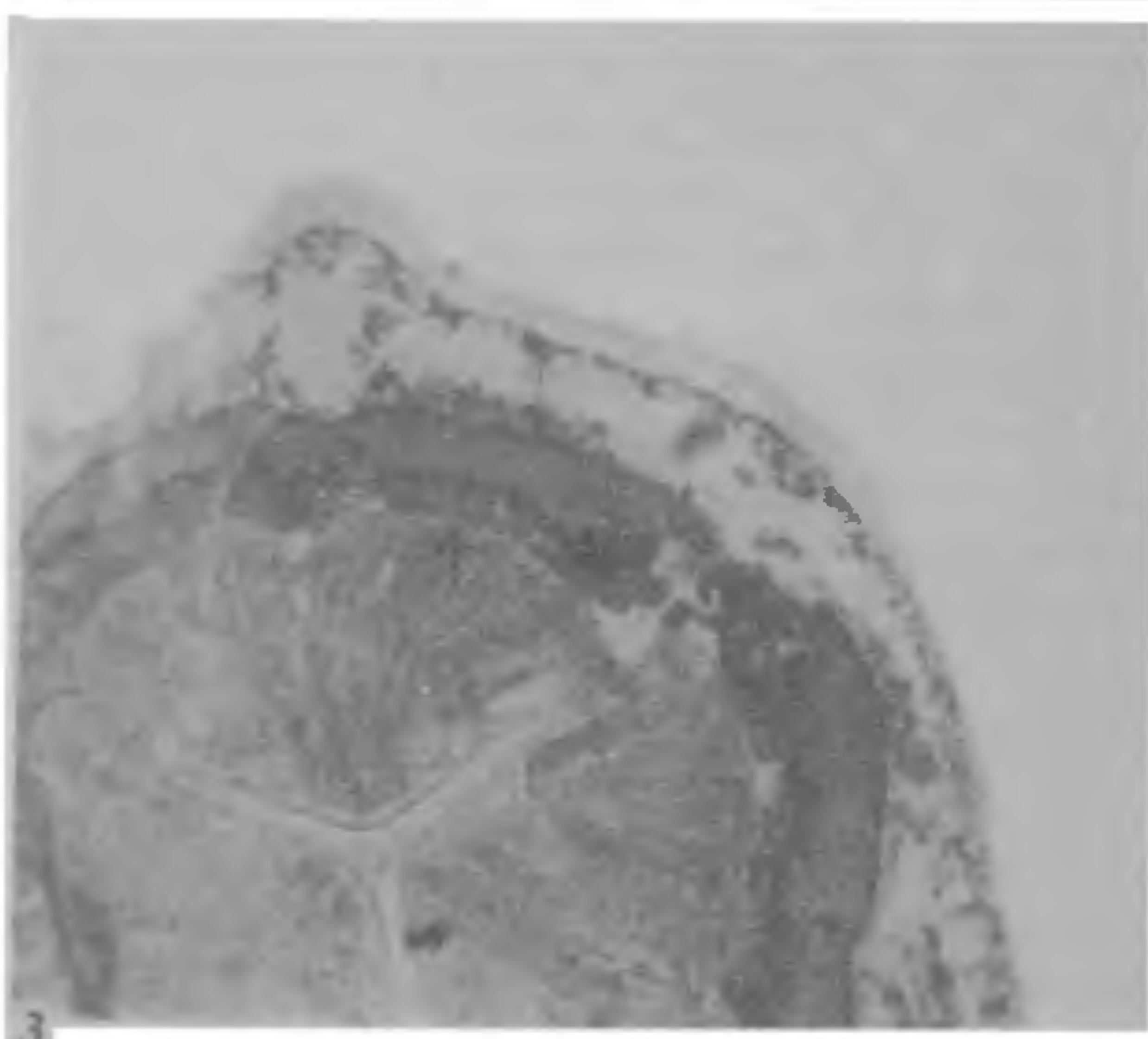
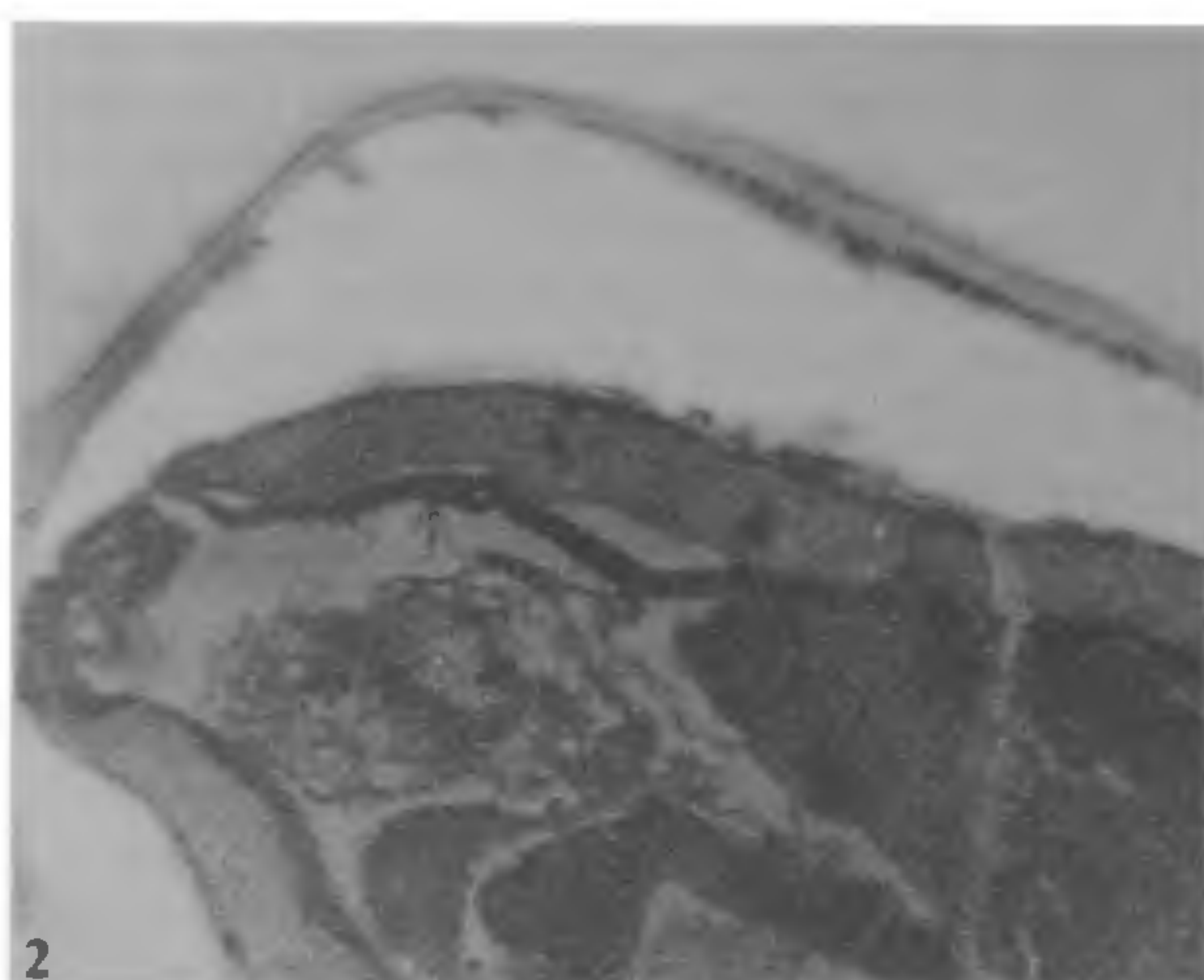
Adult *O. columbianum* worms were collected in normal saline from the intestine of freshly-slaughtered sheep at the local abattoir. The worms were washed thoroughly with distilled water. Frozen sections of the worms (both sexes) were obtained and processed histochemically as follows: Succinate dehydrogenase (SDH) was localized by nitro-BT method, cobalt-farmazan technique was employed for localization of isocitric, glutamate, malate and α -glycerophosphate dehydrogenase¹.

The results are summarized in table 1 and illustrated in figures 1–5. SDH and isocitric dehydrogenase activities were manifested in the form of granules, being more intense in the musculature, oesophagus and intestine (figures 1, 2). Moderate activity was observed in the cuticle, subcuticle, germinal zone of the ovary and testis, while the growth zone of the ovary exhibited feeble reaction. Glutamate dehydrogenase (GDH) activity was observed in the subcuticle, oesophagus, being more intense in the musculature and intestine (figure 3). Moderate to intense malate dehydrogenase activity was observed in the musculature and intestine,

Table 1 Distribution and localization of various enzymes in *Oesophagostomum columbianum*

Anatomical features of the worm	Enzymes				
	Succinate dehydrogenase	Isocitric dehydrogenase	Glutamate dehydrogenase	Malate dehydrogenase	α -glycerophosphate dehydrogenase
Cuticle	—	++	—	—	—
Subcuticle	++	++	++	+	+
Musculature	+++	+++	+++	+++	++
Oesophagus	+++	+++	++	++	++
Intestine	+++	+++	+++	+++	++
Ovary:					
Germinal zone	++	++	+	—	+
Growth zone	+	+	—	—	+
Testis	++	++	—	—	+

+ Feeble reaction; ++ Moderate reaction; +++ Intense reaction.



Figures 1–5. T. S. of *Oesophagostomum columbianum*
1. Showing SDH activity in the subcuticle and musculature. 2. Female showing intense isocitric dehydrogenase activity in the distal part of the musculature and intestine. 3. Showing GDH activity in the subcuticle, musculature and oesophagus. 4. Female showing intense malate dehydrogenase activity in the distal part of the musculature and intestine. 5. Male showing α -glycerophosphate dehydrogenase activity in the distal part of the musculature and intestine, (1–5 \times 400).

while germinal zones of the testis and ovary were completely devoid of this enzyme (figure 4). Manifesting diffuse reaction in different parts of the body including reproductive organs, α -glycerophosphate dehydrogenase activity was relatively more intense in the distal part of the musculature and digestive tract (figure 5).

The localization of TCA cycle enzymes and hydrolytic enzymes in various organs have been reported in *Litomosoides carinii*, *Setaria cervi*, *Diplotrinaena tricuspis*, *Ascaris lumbricoides*, *Trichuris muris*²⁻⁶. Biological significance and apparent involvement of these constituents in the energy metabolism of the parasite have already been demonstrated by histochemical and biochemical procedures by various investigators⁷⁻⁹. According to Bell and Manners¹⁰ the enzymatic synthesis by helminth tissues follows the same pattern as demonstrated for vertebrate tissues.

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MITOSIS AND MEIOSIS IN TWO SPECIES OF MOSQUITOES

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ALTHOUGH chromosomes of several dipteran species are known for a long time, their studies in mosquitoes are of recent origin. The general cytogenetic interest, however, has centred on species-specific chromosome number and their behaviour during cell division with a view to understanding the karyotypic evolution among this group¹⁻³. *Aedes aegypti*, a vector for both Dengu and Yellow fever and *Armigeres obtrubans*, a vector for Malaria, belong to the tribe Aedini, under subfamily Culicinae of the family Culicidae⁴. It was considered worthwhile to study the chromosomes of these two species from the point of view of medical entomology as vectors, and their behaviour during cell division.

The strains of *A. aegypti* and *A. obtrubans* were collected from local populations. Mitosis was studied from the neuroblast cells of late third instar larvae and meiosis from the testes of early pupae. The tissues were dissected in Shen's physiological saline and fixed in 1 : 3 acetic acid : methanol. They were then stained and squashed in lacto-aceto-orcein¹. The somatic metaphases contained 6 metacentric chromosomes in both the species studied (figures 1, 2). During prophase, the chromosomes begin to condense, appearing as a network of coiled threads. During metaphase the chromosomes are maximally condensed with smooth surfaces arranged on the equator by their centromeres. The homologous chromosomes, during this stage, lie so close that the chromatids of each chromosome were not distinguishable. During the onset of anaphase the chromosomes repel each other and progress synchronously towards the poles (figures 3, 4). The repulsion seems to be initiated at the centromeric region so that the chromosomes appear 'V'-shaped.

Unlike as reported for most mosquito species⁵⁻⁷, the first recognisable stage during the meiosis of these species was the zygotene stage (figures 5, 6). Pairing is clearly evident and the chromosomes show gradual condensation. The formation of chiasma is well observed as the cells enter pachytene (figures 7, 8). The homologues contract further as they enter into diplotene. With centromeric repulsion, the two homologues separate from each other except at the points where crossing over has probably occurred. During