Δ^5-3β-HYDROXYSTEROID DEHYDROGENASE ACTIVITY IN THE CAPUT, CORPUS AND CAUDA EPIDIDYMIS OF *TAPHOZOUS MELANOPOGON MELANOPOGON* TEMMNICK (MICROCHIROPTERA : MAMMALIA)

J. C. BHARDWAJ AND S. B. LALL
Department of Zoology, University of Udaipur, Udaipur, India

ABSTRACT

Histochemical studies on the distribution of Δ^5-3β-hydroxysteroid dehydrogerase (Δ^5-3β-HSDH) activity in the caput, corpus and cauda epididymis of sexually mature *Taphozous melanopogon melanopogon* Temmnick revealed the presence of cellular sites in the epididymal segments that have the ability of utilizing dehydroepiandrosterone. Spermatozoa showed an increasing order of enzyme activity from caput *via* corpus to cauda.

INTRODUCTION

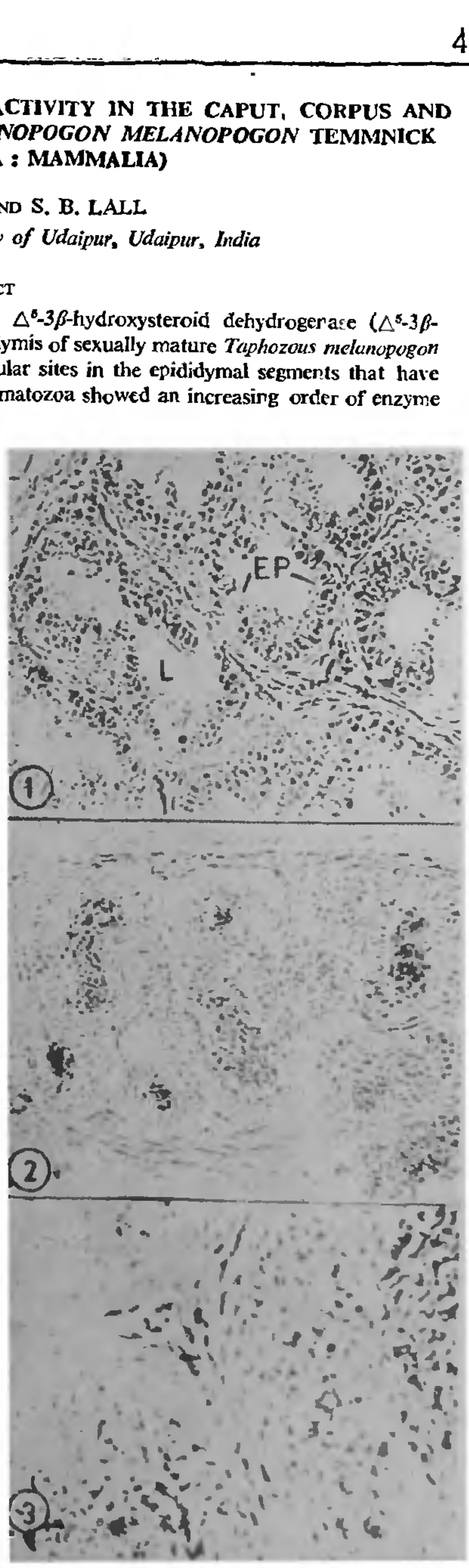
MAMMALIAN epididymis forms the longest excurrent duct system of the male genitalia, where intricate morphological, biochemical, and physiological changes take place in the spermatozoa during their transit, endowing them with fertilizing abilities. The physiological integrity of the epididymal segments is dependent on circulating titres of androgen and on the population of spermatozoa contained in the tubules[1-2].

Although there is considerable information on the occurrence of various classes of phosphatases, dehydrogenases and oxidases in the epididymis of rodents, primates, lagomorpha and ungulates, there is little tangible information on Chiroptera[3-5]. The present report concerns the histochemical site and pattern of distribution of Δ^5-3β-hydroxysteroid dehydrogeanse (Δ^5-3β-HSDH) in the caput, corpus and cauda epididymis of sexually mature *Taphozous melanopogon melanopogon* Temmnick.

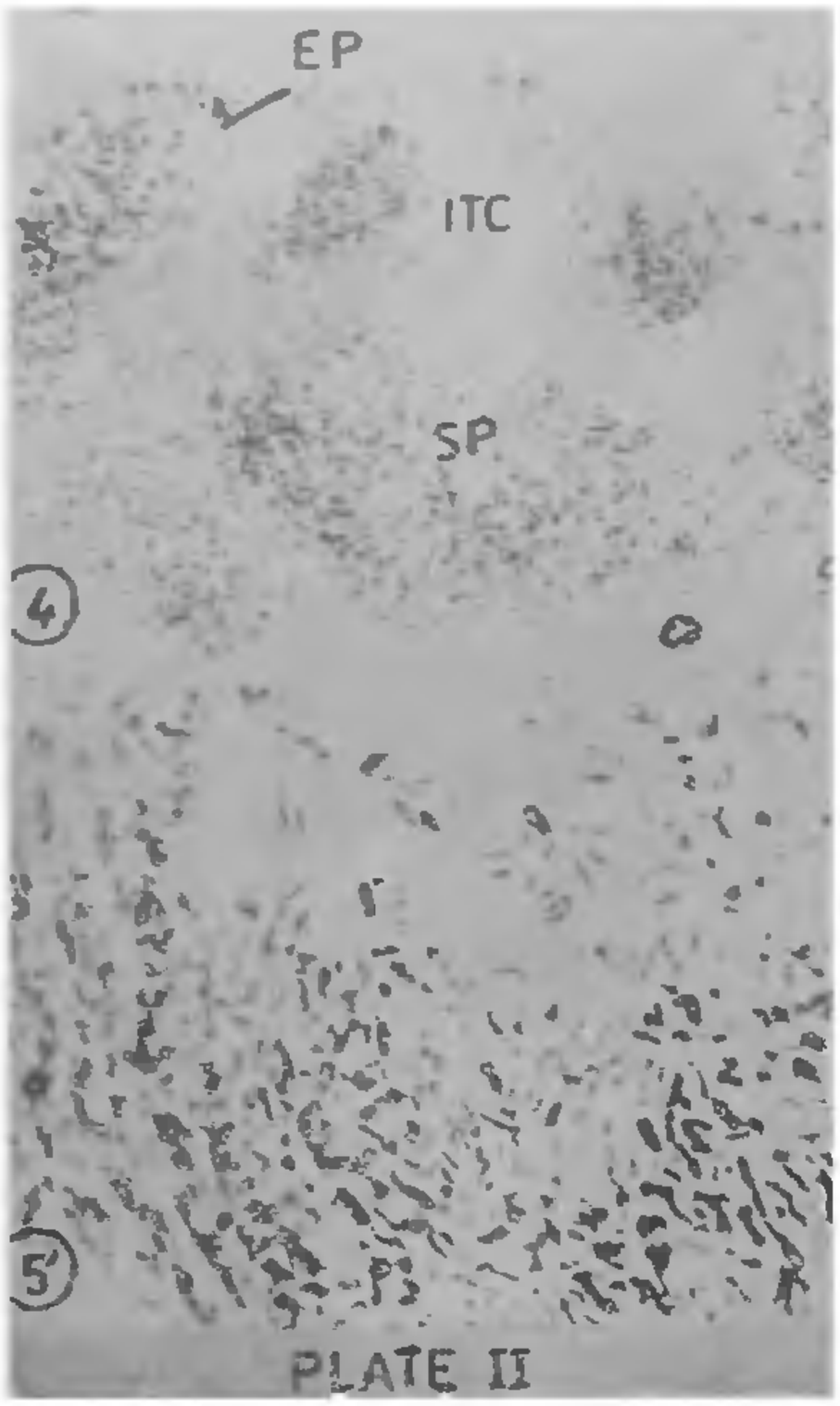
MATERIALS AND METHODS

Males of *T. m. melanopogon* were netted locally at dusk during October–December. Animals weighing *ca.* 25·0 g were used. Surgical procedures for recovering epididymis were as described earlier[6].

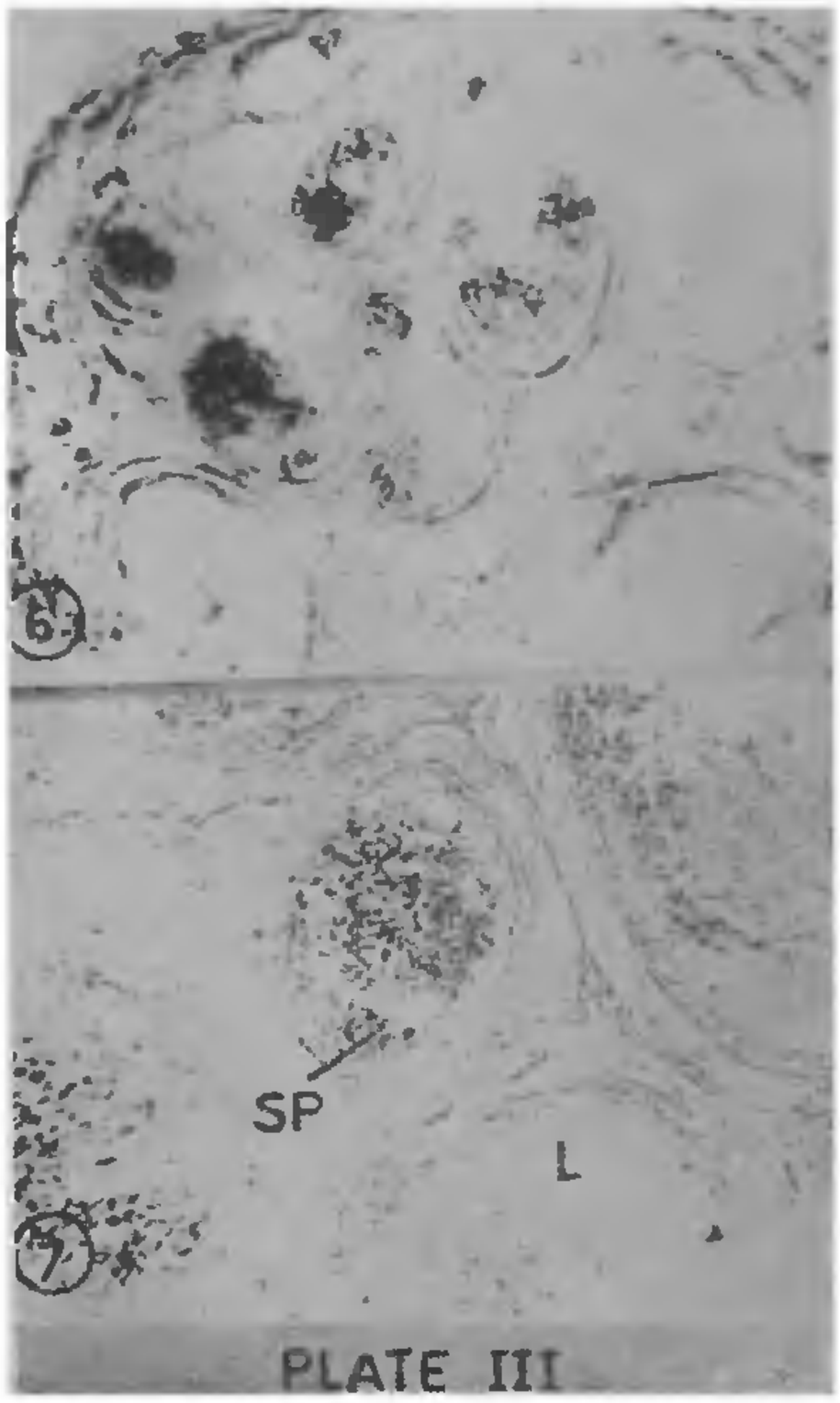
Fresh frozen sections of caput, corpus and cauda epididymis were cut at 10 μM. Δ^5-3β-HSDH activity was histochemically localised according to the technique of Wattenberg[14] by incubating sections in a medium containing NAD, tetrazolium salt and dehydroepiandrosterone (3β-hydroxy-5-androstan-17-one, Sigma sample). The period of incubation was 30 min at



FIGS. 1–3. Fresh frozen sections of a caput epididymis showing profile of the enzyme activity. Note the intense enzyme activity in the luminal spermatozoa. The tubular epithelium also shows positive enzyme activity localised towards the basal region.
(Fig. 1 × 100, Fig. 2 × 100, Fig. 3 × 400).



FIGS. 4–5. Corpus epididymis tubules and the contained spermatozoa manifesting Δ^5-3β-HSDH activity. Note the characteristic orientation of the luminal spermatozoa. (Fig. 4 × 100, Fig. 5 × 400).



FIGS. 6–7. Cauda epididymis tubule and the spermatozoa showing the Δ^5-3β-HSDH paradigm. The mass of spermatozoa shows intense enzyme activity. Differential spermatozoal population can be seen in the tubules. (Fig. 6 × 40, Fig. 7 × 100).

(SP—Spermatozoa; L—lumen; EP—epithelium of epididymal tubules; ITC—intertubular connective tissues.

37° C. Blue formazon deposits indicated the site of enzyme activity. Controls were incubated in substrate deficient medium. Enzyme activity in the various histological constituents of the epididymal segments was visually appraised and graded as described earlier[6].

OBSERVATIONS AND DISCUSSION

The paired epididymis of *T. m. melanopogon* are distinctly divisible into three well defined regions of caput, corpus and cauda epididymis. Several histological variations were noticed in the epididymal segments pertaining to shape, size of the tubules and the population of spermatozoa oriented in a characteristic manner.

Δ^5-3β-HSDH activity was uniformly present in the caput and corpus epididymis, while the cauda displayed a relatively intense enzyme reaction. Some lack of uniformity was also discerned in the enzyme profile of tubules constituting the epididymal regions. The tubules were engorged with varying populations of spermatozoa. Spermatozoa exhibited gradually stronger enzyme activity as they pass down the epididymal duct and reach the cauda. Luminal fluid manifested negative enzyme reaction (Figs. 1–7).

The results clearly show the varying abilities of the epididymal epithelium to serve as the cellular sites for steroid biosynthesis and conversion, thus generating a characteristic hormonal milieu promoting maturational changes to occur in the male gamete. Further, the positive enzyme reaction also distinctly establishes the capacity of spermatozoa to utilize dihydroepiandrosterone. This observation is also in consonance with the suggestion that androgens present within the epididymis are apparently essential for the acquisition of fertility by spermatozoa, and also that spermatozoa have the capacity to synthesize and convert steroid hormones[11–13]. Thus, it seems that the activity of

tubule epithelium and the population of spermatozoa may be one of the key factors determining the androgen environment within the epididymis. Our studies are at variance with the epididymal Δ^5-3β-HSDH of monkey[5], rabbit, ram, rat, bull, and mouse[4,14,16]. These findings reinforce the concept of species-specific characteristic of epididymal steroid dehydrogenases in mammals.

ACKNOWLEDGEMENTS

The authors thank UGC for supporting the chiropteran research project and the University of Udaipur for the grant of Senior Research Fellowship to J. C. B.

1. Hamilton, D. W. "Mammalian epididymis," In *Reproductive Biology*, eds. H. Balin and S. Glaser, Excerpta Medica, Amsterdam, 1972, p. 268.
2. Moniem, K. A., *J. Reprod. Fert.*, 1972, **28**, 461.
3. McGadey, J., Baillie, A. H. and Ferguson, M. M., *Histochemie*, 1966, **7**, 211.
4. Inano, H., Machino, A. and Tamocki, B. J., *Endocrinology*, 1969, **84**, 997.
5. Dinakar, N., Arora-Dinakar, R., Kumar, P., Talesra, C. L. and Prasad, M. R. N., *Indian J., Exp. Biol.*, 1977, **15**, 865.
6. Bhardwaj, J. C., Jaroli, D. P. and Lall, S. B., *Ibid.*, 1977.
7. — and Lall, S. B., *Ibid.*, 1979.
8. — and —, *Ibid.*, 1979.
9. Swami, D. R. and Lall, S. B., *Curr. Sci.*, 1979.
10. Wattenberg, L. W., *J. Histochem. Cytochem.*, 1958, **6**, 225.
11. Blaquier, J. A., Ferguson, M. M. and Hart, D. M., *Developments in Steroid Histochemistry*, A.P. Lond., N.Y., 1966, p. 8.
12. Orgebin-Crist, M. C., Dyson, A. L. M. and Davies, J., *Fendite et Sterilite du Male, Acquisitions Recentes*, ed. C. Thiabautt, Masson, Paris, 1972, p. 22.
13. Frankel, A. I. and Eik-Nes, K. B., *Endocrinol.*, 1970, **87**, 646.
14. Vreeberg, J. T. H. and Aafjes, J. H., "Dehydrotestosterone (5- -13β-ol-3-one) in the epididymis of rats," In *Current Problems in Fertility*, eds. A. Ignleman-Sundberg, and N. O. Lunell, Plenum Press, N.Y., 1972, p. 203.
15. Galena, H. J., Pillai, A. K. and Turner, C. J., *Endocrinology*, 1974, **63**, 223.
16. Veglmayr, J. K., *Acta Endocr.*, 1971, **68**, 793.