lates produced all the above three extracellular enzymes, showing their identity as *Beneckea harveyi*.

B. harveyi has both luminous and non-luminous strains with phenotypic and genotypic similarities that justify their inclusion in one species[13]. Nealson and Hastings[14] are of the view that the bacteria are luminous under certain conditions and non-luminous under others *i.e.* the luminescent system is autoinducible and repressible. However, in the present study, only luminescing bacterial colonies were selected and identified. Occurrence of *B. harveyi* in the gut of leiognathids shows that the species exists not only as free-living forms but also occurs in an enteric habitat.

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SEX STIMULI RECEPTORS OF *PARHYALE HAWAIENSIS* DANA (CRUSTACEA: AMPHIPODA)

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FEMALE crustaceans produce a 'pheromone' during the breeding period and this is promptly received by adult males. It is generally believed that the chemoreceptor organs are the aesthetes usually found on the antennules or antennae of the male. In some cases both sexes possess aesthetes.

In order to study the location of sex stimuli receptors the following experiments were conducted.

The antennules and antennae of nature males were amputated in the following ways. 1. Both the antennae were amputated at the base of the third peduncular segment. 2. Both the antennules were amputated at the base of the first peduncular segment. 3. Both the antennules and the left antenna were amputated at the base of the peduncle. 4. Both the antennae and the left antennule were amputated at the base of the peduncle. 5. Both the antennules and the antennae were removed at the base of the peduncle.

Fifty individuals were used in each set of experiments. In two days after amputation, the animals resumed normal activity. Every day, females that had performed precopulatory ride were made available to these males to make sure that the sex stimuli were actually present; the pheromone is believed to be produced only by females having developed eggs in the ovary and the males perform precopulatory riding only with such females.

Between the 4th and 10th day after amputation all the males except those in the 5th group mentioned above (without both antennules and antennae) took up precopulatory riding. None of the males in the 5th group did this till the next moult. During this moult both the appendages were regenerated.

The following deduction is possible from the above experiments. According to the present observation, it is not clear whether the aesthetes have any role in sex stimuli reception. But it is established that even in the absence of aesthetes, male *P. hawaiensis* can receive sex stimuli, and the sex stimuli receptors are located both in the antennules and antennae. This is contrary to the belief of the previous workers that aesthetes are the sex stimuli receptors in Crustacea. Further, it is evident that *P. hawaiensis* can receive sex stimuli either with the antennule or with the antenna.

By the study of tritium labelled isotope Dahl *et al*[1] found that in *Gammarus duebeni* aesthetes are the pheromone receptor organs. It may be true in cases where males alone possess aesthetes. As in *P. hawaien-*

sis. G. chevreuxi[2] also possesses aesthetes on the flagellar segments of antennules of both sexes.

In *Lepidomysis*[3] males, the number of aesthetes increases as the animals become sexually mature. A mature *Lepidomysis* male possesses up to 33 aesthetes while the female of the corresponding size has only 12. No such sexual dimorphism is observed in *P. hawaiensis.*

In *Hyalella dentata*, the male becomes aware of the presence of the female only when the two sexes collide in their apparently random movements[4]. Kinne[5] has suggested the probability of 'smelling' in *G. duebeni* for sex recognition.

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SCANNING ELECTRON MICROSCOPIC OBSERVATIONS OF PENIAL SETAE OF THE EARTHWORM, *LAMPITO MAURITII* (ANNELIDA: OLIGOCHAETA)

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PENIAL setae of *Lampito mauritii* have been described by Stephenson[1] as 1.5 to 2 mm long with a single curve; tip horseshoe shaped with semicircular concavity flattened; numerous rings of large slender spines standing off somewhat from the shaft. "The present report is an observation of these penial setae in the scanning electron microscope and the probable role of these structures in sperm transfer.

L. mauritii has two pairs of penial setae, a pair in each of the two openings of the vasa deferentia in segment XVIII. These setae were fixed in Karnovski's fixative for 14 hr followed by five 10 min washes with 0.1 M phosphate buffer (pH 7.4). Post fixation in 1% aqueous osmium tetraoxide was followed by three 10 min alternative treatments in 1% aq. osmium tetraoxide and 5% tannic acid in phosphate buffer. Setae were then dehydrated in graded series of alcohol (one 10 min wash in 30%, 50%, 70%, 90%, 95% ethanol respectively and two 10 min washes in 100% ethanol) followed by two 15 min washes in propylene oxide, air dried, and scanned in a Jeol 100 S transmission-cum-scanning electron microscope, of the Tata Institute of Fundamental Research, Bombay.

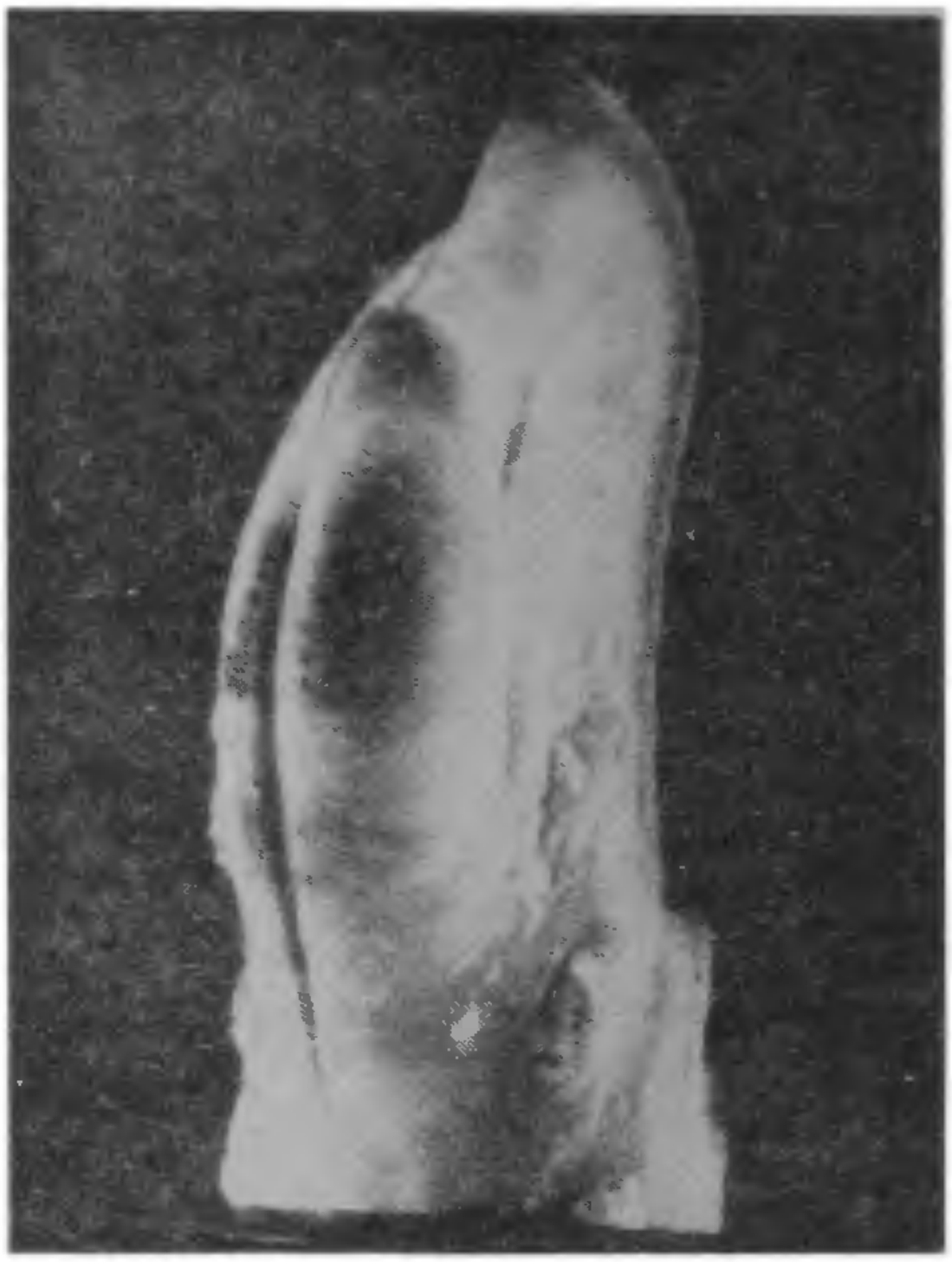

Figure 1. The trident in the distal end of the penial seta of the earthworm, *L. mauritii.* (× 4000)

The tip of the setae under the scanning electron microscope is a clearly distinguishable trident (figure 1) with three distinct units. The groove in the concavity of the setae, shows the presence of "ciliated" processes (figure 2). This groove with "ciliated" processes extends from the basal end of the shaft to the base of the trident (figure 3). Figure 4 shows the presence of a pore within the trident, which is the opening of the groove into the trident "closet" and can be termed the ejaculatory pore.

These structural complexities assign a more important role in sperm transfer to the penial setae than just to provide physical stimuli to the partner as described by Feldkamp (c.f. Edwards and Lofty)[2]. The best