tance was observed in the presence of GT_1. No significant effect was obtained with GMO, GM_1 ganglioside and GD_{1a} ganglioside (table).

In order to determine whether the LH-GT_1 interaction was specific, experiments were carried out in the presence of an equimolar mixture (100 µg/ml) of the saccharide residues (lactose, galactose, glucose, N-acetylgalactosamine) present in the hydrophilic moeity of the gangliosides. The observed conductance ($15.2\ 10^{-8}\ \Omega^{-1} \cdot cm^{-2}$) was nearly identical with the value obtained with the GMO-GT_1 bilayer in absence of LH in the aqueous phase (table). The fact that the saccharide mixture completely reverses the GT_1-LH interaction supports the conclusion that LH interacts specifically with the carbohydrate moeity of the ganglioside.

We observed recently a change in the GMO-GT_1 membrane conductance in the presence of thyrotropin[7]. Similarly, it was demonstrated that a hyperpolarization of thyroïd cell membranes can be induced by this hormone on cultured cells via a specific interaction with the thyrotropin receptor[13]. These permeability modifications suppose the penetration of the hormone in the membrane. Fluorescence studies indicated that the LH-GT_1 interaction induces a hormone conformational change[3] which would allow the translocation of a hormone subunit in the lipid layer[3-5] inducing the observed conductance changes. These modifications in the lipid organization may be an important step in the sequence of events leading to the adenylate cyclase activation.

1 B.R. Mullin, T. Pacuszka, G. Lee, L.D. Kohn, R.O. Brady and P.H. Fishman, Science *199*, 77 (1978).
2 S.M. Aloj, L.D. Kohn, G. Lee and M.F. Meldolesi, Biochem. biophys. Res. Commun. *74*, 1053 (1977).
3 G. Lee, S.M. Aloj and L.D. Kohn, Biochem. biophys. Res. Commun. *77*, 434 (1977).
4 G. Lee, S.M. Aloj, R.O. Brady and L.D. Kohn, Biochem. biophys. Res. Commun. *73*, 370 (1976).
5 B.R. Mullin, P.H. Fishman, G. Lee, S.M. Aloj, F.D. Ledley, R.J. Winand, L.D. Kohn and R.O. Brady, Proc. natl Acad. Sci. USA *73*, 842 (1976).
6 M.F. Meldolesi, P.H. Fishman, S.M. Aloj, F.D. Fedley, G. Lee, R.M. Bradley, R.O. Brady and L.D. Kohn, Biochem. biophys. Res. Commun. *75*, 581 (1977).
7 A. Poss, M. Deleers and J.M. Ruysschaert, FEBS Lett. *86*, 160 (1978).
8 M.T. Tosteson, F. Lau and D.C. Tosteson, Nature *243*, 112 (1973).
9 A. Surolia, B.K. Bachhawat and S.K. Podder, Nature *257*, 802 (1975).
10 R.L. Juliano and D. Stamp, Nature *261*, 235 (1976).
11 J.M. Ruysschaert, A. Tenenbaum, C. Berliner and M. Delmelle, FEBS Lett. *81*, 406 (1977).
12 M. Deleers, A. Poss and J.M. Ruysschaert, Biochem. biophys. Res. Commun. *72*, 709 (1976).
13 E.F. Grollman, G. Lee, F.S. Ambesi-Impiombato, M.F. Meldolesi, S.M. Aloj, H.G. Coon, H.R. Kaback and L.D. Kohn, Proc. natl Acad. Sci. USA *74*, 2352 (1977).

Phosphomonoesterases in the 2 sexes of the root-knot nematode, *Meloidogyne lucknowica* Singh, 1969

R.S. Tandon and Praveen Kumar[1]

Department of Zoology, Lucknow University, Lucknow (India), 13 June 1978

Summary. The 2 phosphomonoesterases of the root-knot nematode were colorimetrically determined. Alkaline phosphatase activity was observed to be lower than the acid phosphatase activity. Sex related trends were clearly seen in the enzyme levels of the 2 sexes of thenematode. Alkaline phosphatase level differed 28.76%, while acid phosphatase level differed 60.36% in the 2 sexes.

The study of the 2 phosphatases is important, due to their role in transport processes of the nematode[2]. High enzymatic activity has been shown at the luminal and vascular borders of tubular cells of both plants and animals. Both the phosphatases have been studied in several plant parasites, such as *Meloidogyne*[3], *Ditylenchus* and *Panagrellus*[4] and *Meloidogyne* and *Tylenchus*[5]. But the effect of sex has rarely been observed on the enzyme levels of plant nemas.

Materials and methods. 650 brinjal plants *(Solanum melongena)* were collected from Government garden Aliganj and other localities of Lucknow, from which 85% were infected with *Meloidogyne lucknowica.* The infected roots were placed in water in 2 petridish and shredded carefully with fine needles. The parasites were kept in 0.7% saline in small cavity blocks. 20% homogenate was prepared in normal saline and kept at 4 °C, well-protected from light. The nematodes of 2 sexes were separately collected from the same host plant and processed simultaneously. The females were carefully and completely freed from the gelatinous matrix of the egg capsules. Method of King and Wootton[6] was followed for the determination of the 2 phosphatases. OD was determined with Bausch and Lomb Spectronic-20 Colorimeter, at 650 µm against blank.

Results and discussion. The normal values of the 2 phosphatases in the 2 sexes of *M. lucknowica* have been given in the table. The males had higher phosphatase activity than their females. Both the phosphatases have been observed to be present in traces in the cuticle and hypodermis of gelatinous matrix of eggs of *M. javanica,* when examined histochemically[5]. No alkaline phosphatase activity was found in zymograms of *Ditylenchus triformis* and *Panagrellus redivivus*[6]. Veech and Endo[7] observed histochemically greater phosphatase activity at the sites of infection, even in the host soya bean infected with *M. incognita acrita;* thus the

Phosphomonoesterases in the 2 sexes of root-knot nematode, *Meloidogyne lucknowica*

Enzymes	No. of experiments	Sex*	Enzyme activity kA units/g**
Acid phosphatase	12	M	7.14 ± 2.21 (5.00 – 9.06)
	24	F	2.83 ± 1.40 (1.02 – 4.50)
Alkaline phosphatase	12	M	0.73 ± 0.46 (0.12 – 1.02)
	24	F	0.52 ± 0.11 (0.12 – 1.20)

* M: male, F: female. ** Mean ± SD (range in parentheses).

parasite affected the activity of the host also. No specific enzyme was found in the free living forms of *M. hapla,* but negative results for amylase, pepsin and cellulase were obtained[8]. Acid phosphatase was observed in 10-day-old larvae of *M. javanica* and fresh larvae of *Tylenchulus semipenetrans;* and the activity increased in the older larvae, thus showing the role of enzymes in ageing of the parasites[5]. Erlanger and Gershon[9] observed acid phosphatase activity in soil nematodes, and the activity varied at different stages of nematodes. Sex ratio of plant nematodes has been found to vary under different physiological and ecological conditions. Sex ratio of *Ditylenchus dipsaci* changed when cultured on callous tissues of different hosts[10]. Tyler[11] noted that percentage of males of *Meloidogyne* in tomato increased during malnutrition and other stresses on the host plant, more fertilized eggs are produced. In these observations, the males showed greater activity of both the phosphomonoesterases than the females. There were differences of 28.76% in the alkaline phosphatase and 60.36% in acid phosphatase activity of the 2 sexes of *M. lucknowica.* Thus sexual variations are related to the physiology of sex in the plant nematodes.

1 The authors are grateful to the Council of Science and Technology U.P. for the grant of a Research Scheme for these studies.

2 W. Abraham, P. Handler and E.L. Smith, in: Principles of Biochemistry. 1968.
3 A.F. Bird and G.E. Rogers, Nematologica *11,* 231 (1965).
4 A.W. Benton and R.F. Myers, Nematologica *12,* 495 (1966).
5 S.D. Van Gundy, A.F. Bird and H.R. Wallace, Phytopathology *559* (1967).
6 E.J. King and I.D. Wootton, in: Microanalysis and Medicinal Biochemistry, p.101. 1959.
7 J.A. Veech and B.Y. Endo, J. Nematol. *1,* 265 (1969).
8 A.F. Bird, Nematologica *12,* 471 (1966b).
9 M. Erlanger and D. Gershorn, Exp. Geront. *5,* 13 (1970).
10 D.R. Viglierchio and N.A. Croll, Science *161,* 271 (1963).
11 J. Tyler, Hilgardia *7,* 373 (1933).

Innervation by W-type retinal ganglion cells of superior colliculus neurons projecting to pulvinar nuclei in cats

T. Nagata[1] and Y. Hayashi[1,2]

Department of Neurophysiology, Institute of Higher Nervous Activity, Osaka University Medical School, Joancho, Kita-ku, Osaka (Japan), 26 June 1978

Summary. Neurons of the cat superior colliculus (SC) sending their axons to the pulvinar nuclei were identified electrophysiologically as the ones responding antidromically to electrical stimulation of the pulvinar nuclei. They were located in the superficial layers of SC and found to be innervated by axons of W-type ganglion cells of the retina.

Anatomical studies have shown that there is an ascending projection from the superior colliculus (SC) to the thalamic pulvinar nuclei (Pul), which in turn projects largely to the visual association cortex[3–5]. The experiments reported here were made in cats for the purpose of knowing what types of retinal ganglion cells are responsible for visual impulses which are relayed by SC to Pul.

Material and methods. All the experiments were conducted in cats anesthetized with nitrous oxide (70% O_2:30% N_2O), paralyzed with continuous i.v. infusion of Flaxedil (20 mg/h) and artificially respirated.

Bipolar electrodes with exposed tips about 1.5 mm apart were introduced stereotaxically into the optic chiasm (OC), the optic tract (OT), 3 portions of the medial pulvinar nucleus[6] (Pul_m) and 2 portions of the lateral pulvinar nucleus[6] (Pul_l). Electrical stimuli were single pulses of 0.01–0.5 msec in duration with variable intensities. Extracellular spike discharges were recorded from SC with glass-coated tungsten microelectrodes.

During experiments the animal was fixed in a stereotaxic apparatus facing a tangent screen (99° × 99°) that was placed 1 m in front of his eyes. The pupils were dilated by topical application of phenylephrine chloride (Midrin-P, Santen Chemical). The cornea was protected with a contact lens having such a power as to give a clear projection of retinal landmarks onto the screen.

The visual stimuli were spots and slits of light (60 lux) projected onto the dimly lit screen (14 lux) from the mirror of a moving coil galvanometer which was driven by a function generator. Hand-held black rectangles and light spots from an ophthalmoscope (Pantoscope, Keeler) also provided stationary and moving stimuli.

Results and discussion. A total of 152 SC units responded to both OC and OT stimulation. The latencies to OT stimulation were distributed from 0.7 to 12.9 msec, with a pattern similar to that reported by Hoffmann[7] (figure 2, E). From these response latencies and the measured value of the distance from OC to OT (average 13.1 mm) conduction velocities of the OT fibres were calculated. They ranged from 0.9 to 67.4 m/sec and found to cover all the retinocollicular pathways so far reported[7,8].

Among 136 SC units activated by stimulation of OC and OT, 132 were also activated by stimulation of Pul_m and Pul_l. Of these, 120 showed transsynaptic responses which were characterized by a sign of EPSP and variable latencies of spike discharges. In other 12 units, responses to stimulation of Pul_m were found antidromic, although those to stimulation of Pul_l were transsynaptic. The antidromic response is exemplified in figure 1, A and B; the spike had a short and fixed latency with a clear step midway to the positive peak (an arrow in figure 1, A). When paired stimuli were applied with short intervals, the response to the 2nd shock was reduced in size, sometimes the A spike only. These SC cells followed repetitive stimulation of Pul_m up to 100 Hz. In one unit with spontaneous discharges, the collision test[9] successfully proved that its Pul_m-induced response was of antidromic origin; in other units no such test could be made because of paucity of spontaneous discharges.

The SC cells driven antidromically by Pul_m stimulation were found in the layer from which the OC-induced field response was recorded as a positive wave of intermediate amplitude. Referring to previous works[10–12] which studied the configuration of the SC field response to electrical