The ammount of reducing sugars produced due to invertase activity increased linearly with the incubation period and enzyme concentration up to a certain limit; thereafter the activity of the enzyme was retarded. HORIE[12], KHAN and FORD[13] and SRIVASTAVA and AUCLAIR[14] also noted similar decrease in the rate of reaction of the gut invertase of *Bombyx mori*, *Dysdercus fasciatus* and *Acyrthosiphon pisum* respectively. This drop was due to the inhibiting effect of the end products of sucrose hydrolysis. Usually this does not happen in vivo, since the monosaccharides produced in the system are simultaneously absorbed. But under abnormal conditions, when the flies are forced to feed on sucrose alone, the phenomenon may be an important measure to check hyperglycaemia.

Invertase activity was maximum in the femal flies and minimum in the larvae (Figures 1 and 2). The ability to digest sucrose is very low in the larvae, since they do not need carbohydrates for growth and development[15,16].

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Inhibition and Enhancement of Photically Evoked Responses by Different Doses of L-DOPA

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Summary. Administration of small doses of L-DOPA (10 and 20 mg/kg) resulted in reduction in amplitude of photically evoked responses in the primary visual, association, and cerebellar vermal cortices, while large doses (40 and 80 mg/kg) produced enhancement.

In our previous study, modification of visual, auditory, and somatosensory evoked responses by electrical stimulation of the substantia nigra was demonstrated[3]. Since recent histochemical experiments[4] revealed dopaminergic pathways from the substantia nigra to the neostriatum (caudate nucleus and putamen), in this study we investigated effects of several doses of L-DOPA (L-3,4-dihydroxyphenylalanine), precurser of dopamine, on photically evoked responses in the primary visual, association, and cerebellar vermal cortices.

Methods. The experiments were carried out on 20 adult cats. A tracheotomy was performed on each cat under ether anesthesia. The animal was then placed in a stereotaxic frame under artificial respiration and immobilized with gallamine triethiodide. All pressure points and wound edges were infiltrated with 2% procaine. The left pupil was dilated with atropine, and the right eye was shaded with a thick black vinyl wrapper. The cat remained in a semi-dark room, and recording was begun several hours later. Silver ball electrodes were placed on the right primary visual area (lateral gyrus), right association area (middle suprasylvian gyrus) and midline vermis. The indifferent electrode was placed on the frontal sinus. 60 flashes at 0.5 Hz were presented by a xenon flash lamp facing the eye at a distance of 80 cm. Responses of the brain were amplified by an EEG-machine or an oscilloscope, and recorded onto FM tape. For each cat, 5 selected good responses and either 30 or 50 of 60 – excluding those in which basic waves were extremely variable or artifacts appeared – were averaged with a computer. These were virtually the same in waveform. Averaged responses were photographed and read out on an X-Y plotter.

At first 3 control records were obtained before administration of L-DOPA. Injection of the drug was followed by recordings every 5 min for the first 40m in, and then every 10 min for the following 80 min. The 20 cats were divided into 4 groups. To each group of 5 cats

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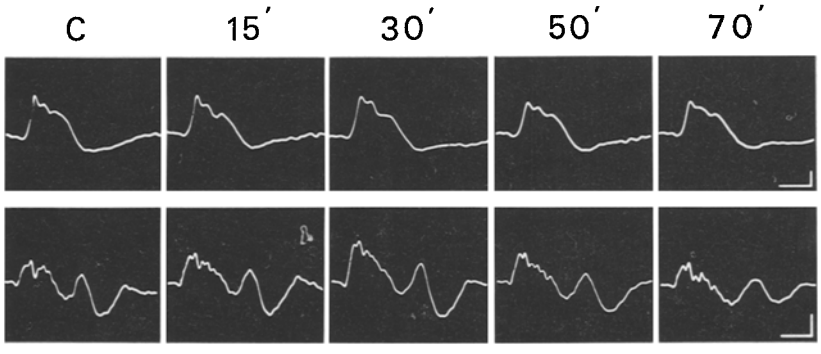

Fig. 1. A) Photically evoked responses in the primary visual cortex. C presents the control record prior to L-DOPA injection. The numbers indicate time in min after i.p. administration of the drug. The upper row shows effects of 20 mg/kg L-DOPA on the average response to 5 flashes, and the lower row effects of 40 mg/kg L-DOPA on the average response to 30 flashes. Flashes were given at the beginning of the sweep. Negativity recorded upwards. Calibrations: 100 μV, 100 msec.

L-DOPA (Sankyo; Dopaston) was given i.p. in aqueous solution of 10, 20, 40 and 80 mg/kg, respectively.

Results. After administration of L-DOPA, changes in photically evoked responses were observed, but they depended upon doses of the drug. Namely, small doses of L-DOPA (10 and 20 mg/kg) produced reduction in amplitude of the responses, but large doses (40 and 80 mg/kg) produced enhancement at first and slight reduction later. Examples recorded in the primary visual area are shown in Figure 1, A. Recovery curves of the response after administration of L-DOPA are as Figure 1, B. Measurements were made of amplitude from peak of the primary positive component to that of the succeeding primary negative component. Ordinate shows amplitude of the response after administration of L-DOPA as percentage of amplitude of the control response. Abscissa indicates time in min after injection of L-DOPA. The numerals 10, 20, 40 and 80 represent doses of mg/kg, respectively.

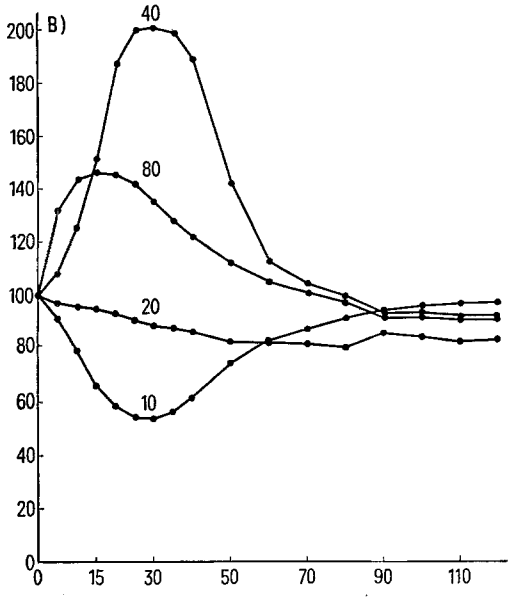

Fig. 1. B) Recovery curves of photically evoked responses in the primary visual cortex following administration of L-DOPA. The numbers indicate doses of the drug: namely, 10, 20, 40 and 80 mg/kg, respectively. Ordinate: Amplitude of the response after injection of L-DOPA as percentage of that of the control response. Abscissa: Time in min after injection of the drug. The same graph is used in Figure 2, A and B.

As seen in Figure 1, after administration of L-DOPA 10 mg/kg the response was reduced in amplitude gradually, reached a minimum after 30 min, and then recovered slowly. Soon after injection of 20 mg/kg, reduction in amplitude was less than that after injection of 10 mg/kg, but continued for a longer time. In contrast, after injection of 40 mg/kg, a marked increase of the response was visible. Amplitude reached a maximum 30 min after, and then decreased gradually. Finally, a slight reduction in amplitude could be seen from about 90 min after. When the dose applied was 80 mg/kg, the increase of the response appeared sooner than when it was 40 mg/kg, reached a maximum 15 min later, which was then slowly reduced.

The time course of the recovery curve for the association area was similar to that for the primary visual area, but changes were less – approximately half of those in the primary visual area (Figure 2, A). Measurements were made of amplitude from peak of the primary positive component to that of the following primary negative component.

The time course of the recovery curve for the cerebellar vermis was similar to those for the primary visual and association areas, but changes were much less – about a third of those in the primary visual area (Figure 2, B). Measurements were made from the baseline to peak of the secondary negative component, which was constantly visible.

Discussion. L-DOPA has been known to increase dopamine of the brain[5,6]. Microiontophoretic application of dopamine onto caudate neurons resulted in predominant inhibition[7–10], and onto lateral geniculate neu-

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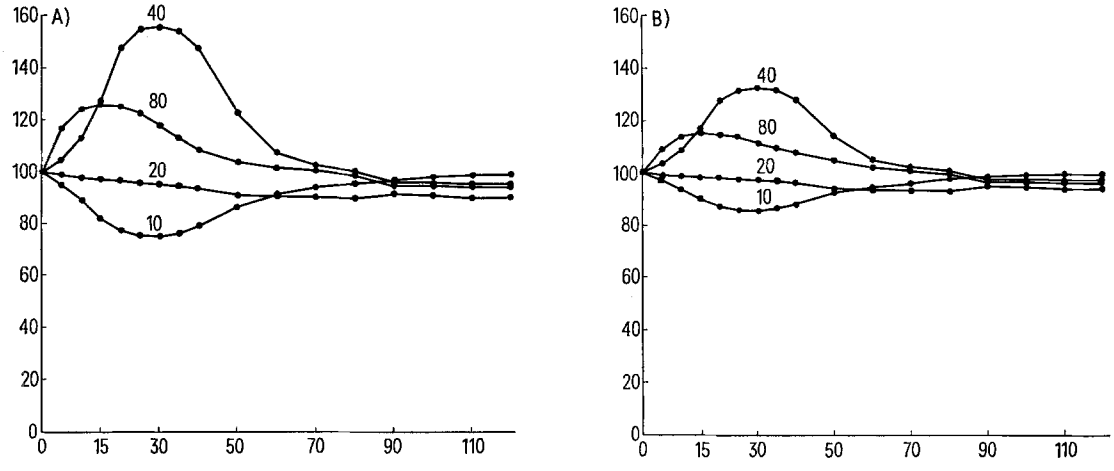

Fig. 2. A) Recovery curves of photically evoked responses in the association area following administration of L-DOPA. B) Recovery curves o photically evoked responses in the cerebellar vermis following administration of L-DOPA.

rons it caused inhibition[11]. But recently, DAFNY and GILMAN[12] reported enhancement of acoustic evoked responses in the caudate nucleus following administration of L-DOPA 100 mg/kg in rats. SABELLI et al.[13] reported that L-DOPA doses of 20 and 50 mg/kg decreased the amplitude of the fast positive components of the photically evoked potentials in rabbits, but 50 mg/kg of L-DOPA pretreated 24 h before with tetraethylthiuram disulfide (dopamine-β-hydroxylase inhibitor) increased the amplitude.

In this study, we observed reduction in amplitude of visual evoked responses after administration of 10 and 20 mg/kg of L-DOPA, but enhancement soon after the injection of 40 and 80 mg/kg. This conversion seems very interesting. WACHTEL and KANDEL[14] demonstrated a dual chemical synapse of *Aplysia*: an excitatory receptor with a low threshold to acetylcholine and an inhibitory receptor with a higher threshold to acetylcholine. CORRODI et al.[15] reported interaction between cholinergic and catecholaminergic neurons: amine turnover is slightly reduced in the telencephalic dopaminergic terminals and increased in the noradrenergic terminals by the anticholinergic drugs. Thus, the synaptic transmitter can, on the one hand, produce a dual effect, and on the other hand, may interact with other transmitters.

Differences in effect of L-DOPA in recording sites are also worth attention. Namely, the most prominent effect was seen in the primary visual area, moderate one in the association area, and slight one in the cerebellar vermis. This may depend on different pathways from the retina to the recording site and on the chemical transmitters between them.

In any case, the evidence obtained in this study seems to suggest complicated brain mechanisms, and further studies are necessary to explain them.

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Central Course of Photic Input in the Ventral Nerve Cord of Scorpion (*Heterometrus fulvipes*)

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Summary. The course of the photic input from the metasoma in the ventral nerve cord of scorpion was studied. The input was found to influence the activity in a large number of neurons in the nerve cord. The phenomenon of contralateral stimulation of units at various levels of the nerve cord has been demonstrated.

Simple neural photoreceptors have been reported in a wide variety of animals, and there has been a growing interest in the comparative physiology of these photoreceptor systems. During our studies on the central nervous system of the scorpion *Heterometrus fulvipes*, it was observed that the abdominal ganglia in the metasoma and the telsonic nerves of the animal are directly sensitive to light. The various aspects of the physiology of these metasomatic photoreceptors (MPR) in scorpion are being studied in our laboratory, and some of our findings have been reported earlier[2,3]. The present study was an attempt to follow the central course of the photic input from the MPR and to examine the phenomenon of contralateral stimulation of units in the ventral nerve cord of scorpion.

Methods. The tergal plates of the metasoma and mesosoma were removed and the ventral nerve cord was exposed. The electrical activity was recorded in air from the ventral nerve cord connectives using platinum hook electrodes. A narrow beam of light from a tungsten filament microscope lamp fitted with a heat-filter was used for photic stimulation. The conventional electronic set up used for the study consisted of a Tektronix 502A dual beam Oscilloscope, Grass P9 preamplifiers and Grass AM3 audiomonitor. A Grass C4 kymograph camera was used for photographing the electrical activity.

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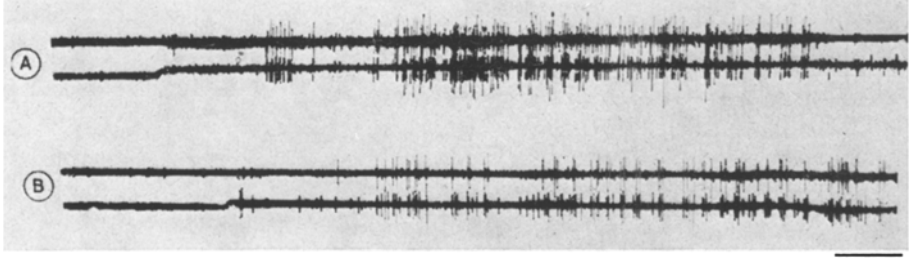

Fig. 1. A) Responses from the left (lower trace) and the right (upper trace) 2–3 connectives to photic stimulation of the fifth abdominal ganglion.
B) Responses from the left (lower trace) and the right (upper trace) 1–2 connectives to photic stimulation of the sixth ganglion. The activity was recorded from the whole connectives. Note the phase relationship between the activity in the 2 halves of the cord in both A and B. Activity is superimposed on the light signal in the lower traces of A and B in this figure and in Figure 3. Calibration: 0.5 sec.