the junction of the shale and quartzite, just at the base of the quartzite ridge. Here the strata, whose strike is parallel to the thrust of the river water, are dipping into the river channel. Since displacement easily takes place parallel to the bedding planes, the valley-wall on which the right abutment was sitting had a tendency to slide into the river.

During floods, the pressure of water-currents near the bridge got concentrated towards the right bank, as the quartzite ridge which exists at the right bank does not allow the flood water to spread but confines it into the river channel. As a result, the river-bed is dug asymmetrically, deeper towards the right bank. This has increased the instability of the right abutment of the bridge.

In all cases the scour is intensified during flood periods. Nothing definite has yet been known about the relation between the depth of scour and the rise of flood water above the ordinary level. However, in some experiments the depth of the river bed scoured was found to be about one-third the amount of water surface rise[3]. During the flood in the Sone river which occurred on August 22, 1975, and, which is responsible for the failure of the Deolone bridge, the water surface rose to about 17 m. and therefore the bed erosion must have been quite deep.

Thus it may be concluded that the foundation of the bridge piers which was in shales, had progressivety been eroded by the running water and the foot-hold of the bridge got weaker day by day. On August 22, 1975, when the river was in flood, the bridge lost ground and collapsed into the river. This is a clear cut example, where the bridge failure has occurred as a result of its construction on a geologically defective site.

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STIMULATORY EFFECT OF THE NEUROACTIVE SUBSTANCE ON ISOLATED COCKROACH HEART

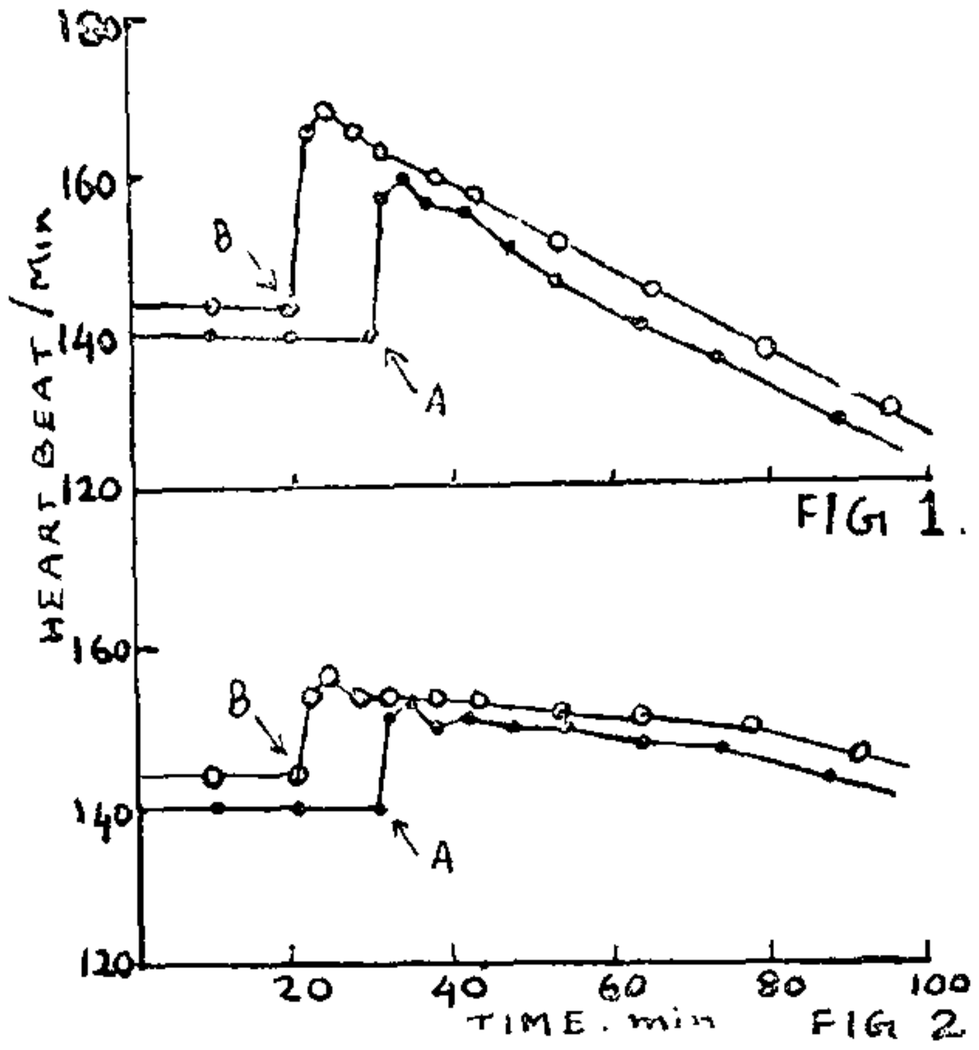
EARLIER studies indicated that certain drugs and insecticides increased the frequency of heart beat[1,2]. It has been reported that application of the insecticides is likely to release certain toxins lethal to insects from the nervous system[3,4]. Sudershan and Naidu[5] (1967) working on isolated cockroach heart found that a specific toxin released into cockroach blood by malathion and pyrethrum, increased the heart beat frequency. In the present investigation attempts have been made to isolate the neuroactive substance from endrin treated cockroach blood and to study its effect on the isolated cockroach heart.

Laboratory reared male adult *Periplaneta americana*, L. was used for the experiments. The isolated cockroach heart technique described by Krijgsman *et al.*[1] (1950) was employed. LC_{90} of endrin dissolved in ethanol was injected intraperitoneally to cockroaches. Four hours after the treatment, blood was collected by centrifugation and the neuroactive substance was isolated from blood as described by Sternburg *et al.*[4] (1959). Test solutions were prepared in ethanol (wt/vol) and incorporated into the physiological solution. Neuroactive substance and synergist combinations were made at the ratio of 1 : 1. The concentration of ethanol used was not detrimental to the isolated cockroach heart.

Addition of neuroactive substance ($1{\cdot}6 \times 10^{-6}$ and $3{\cdot}3 \times 10^{-6}$) induced an immediate increase in the heart beat frequency followed by rapid decline (Fig. 1). When it is mixed with piperonyl butoxide ($1{\cdot}4 \times 10^{-6}$ M) and sesamin ($1{\cdot}4 \times 10^{-6}$ M) slight initial stimulation was seen which sustained for some time (Fig. 2).

A detailed study of endrin on isolated cockroach heart[6] reveals that it acts at the cardiac ganglia by paralysing them and acetylcholine is not involved. In combination with the synergists, the effect of endrin is considerably increased thus suggesting synergism. The fact that no apparent change was noticed in the original action of neuroactive substance when mixed with piperonyl butoxide and sesamin, indicates that synergism is absent. The sustained action (Fig. 2) may be due to the effect of synergists on the heart. In the present communication it is difficult to assess whether degradation of neuroactive compound is taking place in the insect body as in the case of endrin. However, an enzyme which destroys biologically active substance has been reported from the blood of cockroach[4]. If it is true, the factor responsible for the degradation of neuroactive

substance is probably not interfered with by the synergist.



FIGS. 1–2. Fig. 1. Effect of neuroactive substance (A = $1 \cdot 6 \times 10^{-6}$, B = $3 \cdot 3 \times 10^{-6}$) on isolated heart of Cockroach. Fig. 2. Effect of neuroactive substance in combination with A : Piperonyl butoxide ($1 \cdot 4 \times 10^{-6}$ M). B : Sesamin ($1 \cdot 4 \times 10^{-6}$ M). Arrows indicate addition of the test solution.

A detailed account on the nature and biological activity of neuroactive substance will be reported elsewhere.

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SOLUBILITY OF PROTEINS OF MUSCLE IN FATIGUE

IN isolated muscle fatigue is associated with the accumulation of lactic acid[1] and other metabolic byproducts and metabolism by acidification or otherwise[2,3] which contribute to disturbances of internal equilibria. Local accumulation of lactate might be expected to induce water and electrolyte shift due to osmotic acid-base changes in muscle cells[4-6]. To reduce the acidity and other side effects, the buffering capacities of sarcoplasmic preteins are utilized to safegaurd other structural components[7]. This paper is aimed at analysing the ionization and soluble properties of proteins of muscle in fatigue by salting out processes of various fractions of proteins.

Rana hexadactyla were double pithed and the gastrocnemius muscle of both the legs were Isolated with least injury. They were washed in amphibian ringer[8], several times to recover from shock effects. One of the muscles was immersed in ringer and made to fatigue by giving electrical stimulations of 120 shocks per minute of 10 volts D.C. strength (INCO/CSIO student stimulator, AMBALA) continuously until there was no response. The fatigued muscle was rapidly cooled to 0° C to prevent residual metabolism. The contralateral control muscles were treated in the same way except that they were not stimulated. Total, soluble and insoluble proteins were estimated in the aqueous homogenates of muscle by the method of Knights *et al.*[9] (1962). Alpha, beta and gamma globulin and albumin type of proteins were sedimented from the supernatant fraction of the muscle homogenate, following the procedure of Cohn *et al.* (1940) for serum[10].

The decrease in the levels of soluble proteins is nearly proportional to the increase of insoluble proteins (Table. I). Practically there is no change

TABLE I

Levels of total, insoluble and soluble proteins in muscle expressed as mg/gram wet weight. The values are means of ten individual observations

Muscle	Total	Insoluble	Soluble
Control	164·1 ± 14·83	120·2 ± 15·29	43·9 ± 2·62
Fatigued	163·4 ± 15·74	122·3 ± 17·45	41·1 ± 2·38
% Deviation	− 0·43	+ 1·75	6·37
* 't' test	NS	NS	NS

* NS - Not Significant.