The preliminary reports of Devi[6] and Maraini *et al.*[7] show considerably lower incorporation of amino acids into the proteins of mature cataracts as compared with the lenses having posterior and nuclear opacities. However, their results have not been obtained from the incorporation of labelled amino acid into the proteins of different types of cataracts because of the insufficient number of early cataractous and normal lenses. In the present investigation, the incorporation of labelled amino acid into the proteins of different types of cataracts reveals a considerable change in the incorporation of labelled amino acid into the proteins of the senile cataracts, this change being higher in the hyper mature cataracts. The lower incorporation of amino acid into the proteins of mature and hyper mature cataracts may be due to a lower turnover of protein synthesis in the severely diseased lenses. Small changes in the incorporation of amino acid into the lens proteins of earlier cataracts could be due to an unaltered protein synthesizing mechanism in these lenses.

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SUCCINIC DEHYDROGENASE ACTIVITY IN *CRYPTOZONA LIGULATA* (FERUSSAC) DURING AESTIVATION

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ABSTRACT

The levels of activity of succinic dehydrogenase in hepatopancreas, mantle and foot tissues of normal, aestivated and naturally aestivating *Cryptozona ligulata* (Ferussac) were studied. Natural aestivating snails and snails induced to aestivation in the laboratory showed decreased enzyme activity over the normal snails. Addition of body fluid and cerebral ganglia extracts of aestivated snails to the homogenates of normal snail tissues effected a significant decrease in the enzyme activity. Possible regulation of enzyme activity by hormonal factors and amino acids has been suggested.

SHELLED pulmonates have been known to pass into a quiescent state of aestivation during dry periods in summer and remain viable for years in the aestivated state[1]. Most of the physiological processes slow down during aestivation. The oxygen uptake falls rapidly and the stored glycogen reserves decline gradually in *Pila virens*, a pulmonate gastropod[2–4]. The levels of activity of ATPase, Succinic dehydrogenase (SDH), Glutamate dehydrogenase and Cytochrome oxidase decrease during aestivation[5,6] in *Pila globosa*. No such studies on aestivation have been reported in the case of *Cryptozoma ligulata* (Ferussac), a terrestrial pulmonate. Since the metabolic and respiratory activity seem to be altered during aestivation it is likely that the body fluids and the nervous system of the

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snail under aestivation contain metabolic regulators. This aspect has been studied selecting Succinic dehydrogenase (SDH) as a representative of oxidative enzymes in the normal and aestivating snail *Cryptozona ligulata* and the effect of the body fluids and other factors was investigated.

Materials and Methods

Active snails were collected locally and used for present study. A set of snails was wrapped in filter papers and was buried in dry sand in wooden boxes and thus induced them to aestivate for a period of more than six months before they were used for the experiments. The tissues of midgut gland (hepatopancreas), mantle and foot were isolated in the cold, and SDH was assayed from cell free extracts of the above mentioned tissues. A set of naturally aestivating snails was also collected and used for experiments on similar lines. The cerebral ganglia were removed from aestivating snails and homogenised in 0·5 ml of ice-cold potassium phosphate buffer (pH 7·4; 0·1 M). The body fluids of aestivated snails were also collected and used for the experiment.

Succinate dehydrogenase activity was estimated in (i) active snail tissue extracts (controls), (ii) aestivated snail tissue extracts, (iii) naturally aestivating snail tissue extracts, (iv) active snail tissues, after adding body fluids (0·02 ml) of aestivated snails and (v) active snail tissues *plus* extracts of cerebral ganglia (0·04 ml) of aestivated snails by a modified method of Nachlas *et al.*[7]. The protein measurement was done by the method of Lowry *et al.*[9].

Results and Discussion

It was observed that the level of SDH activity was higher in mantle tissue than in midgut gland and foot muscle during active life (Table I), and it may be correlated with the greater involvment of mantle folds in the respiratory process. Hepatopancreas showed relatively higher activity during aestivation. The percentage decrease was more in foot muscle (67·53%) and mantle (64·0%) and less in hepatopancreas (45·5%), which suggests that the metabolism is more evenly regulated in midgut gland during the changed physiological state.

The enzyme activity in naturally aestivating snails and snails induced to aestivation was more or less the same (Table I) indicating that the naturally aestivating snails may be of the same aestivation period as those of the induced ones. The body fluids of aestivating snails showed an inhibitory effect on the respiratory enzyme of active snail (Table II). It was reported that the acidic amino acids increase in the body fluid of aestivated *Pila globosa* due to proteolysis and these were found to have an inhibitory effect on the metabolism of the snail[10,11]. In *Cryptozona* the lowered enzyme activity of active snail tissues on account of the addition of body fluids from aestivating ones may be due to similar factor since preliminary investigation showed an increase in glutamate and aspartate during aestivation in *Cryptozona*[12].

A variety of steroids inhibit SDH activity and mitochondrial respiration[13]. Meenakshi[14] showed that the respiratory metabolism is under the control of a steroid hormone elaborated in the cerebral ganglia in the case of *Pila virens*, a gastropod. She found a ten.fold increase of sterol content in the cerebral ganglia of aestivating snail and the injection of extracts from the brain of aestivating snail into the active snail registered a lowered respiration. In the present experiment, the depression of SDH activity (Table II), brought about by the addition of cerebral ganglia extracts of aestivating *Cryptozona* to the active animal

Table I

Succinic dehydrogenase activity in Cryptozona ligulata *during active life and aestivation.*

Enzyme activity is expressed in μ moles of formazan per milligram protein per hour† **

Tissue	Active snail	Aestivated snail	% reduction in activity	*Naturally aestivating snail	% reduction in activity
Hepatopancreas	0·518±0·025	0·284±0·026	45·67	0·272±0·045	47·49
Mantle	0·665±0·053	0·247±0·063	64·00	0·237±0·059	64·36
Foot muscle	0·462±0·051	0·150±0·024	67·53	0·148±0·05	67·90

* Period of aestivation not known.

† Each value is Mean ± S.D. of 6 individual observations.

** The differences between active snails and aestivated ones and between active snails and naturally aestivating ones were all significant ($P < 0·01$).

TABLE II

Succinic dehydrogenase activity in Cryptozona ligulata: *Effect of body fluid and cerebral ganglia extract of aestivated snail on the SDH activity of active snail tissues*

*Enzyme activity is expressed in μ moles of formazan per milligram protein per hour**†*

Tissue	Active snail	Active snail ± body fluid of aestivated snail	% reduction in activity	Active snail + ganglia extract of aestivated snail	% reduction in activity
Hepatopancreas	0·518±0·025	0·315±0·036	39·1	0·362±0·040	30·00
Mantle	0·665±0·053	0·353±0·036	47·9	0·496±0·044	25·50

* Each value is Mean ± S.D. of 6 individual observations.

† The differences between the controls (active snails) and the experimentals were significant ($P < 0·01$).

tissues, may be due to the increased presence of a hormonal factor produced in the cerebral ganglia of the aestivating *Cryptozona ligulata*.

The present experiment indicates that the metabolic changes in *Cryptozona* are pronounced during aestivation. It may be suggested that the lowered respiratory enzyme activity during aestivation may be due to the elaboration of hormonal factors in the cerebral ganglia or due to the increased amounts of amino acids by way of proteolysis in the tissues.

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SEMICONDUCTOR INJECTION LASERS AND THEIR APPLICATIONS

The Quantum Electronics Group of the Institute of Physics (London) is arranging a meeting on Semiconductor injection lasers and their applications to be held at UWIST, Cardiff, on 28 and 29 March 1979. The meeting is co-sponscred by the Solid State Physics Sub-Committee, The Institution of Electrical Engineers, The Institute of Electronic and Radio Engineers and UWIST. Outlines of contribution (200-300 words) should be submitted before the 1st February 1979 to Dr. Ben Thomas, Department of Physics, Electronics and Electrical Engineering, UWIST, Cardiff. CF1 NU, Wales, U.K. Further details and application forms may be obtained from the Meetings Office, the Institute of Physics, 47 Belgrave Square, London SW1X 8QX.