SUMMARY

Chapter 1 :

Changes in the levels of blood glucose and tissue glycogen during post-limb amputation (non-regenerating) and post-caudal autotomy (regenerating) in H. flaviviridis have been compared. The blood glucose level remained sub-normal in both the conditions during the entire course of the experiment. Similar pattern of changes in the form of depletion in hepatic glycogen and increase in muscle glycogen were noticed post-limb amputation and post-caudal autotomy. The in loco response was however, different with the tail regeneration depicting sub-normal levels during the first week post-autotomy and increased to the maximum peak value on the 10th day. Thereafter, while limb glycogen of the limb amputated lizard generally tended to show an increased content. Tail glycogen in the limb amputated lizards remained more or less the normal range during the first week of regeneration followed by an increase on the later half. Again limb glycogen in the tail autotomised lizards showed changes similar to those obtained post-limb amputation.

From the above observations it has been concluded that

while systemic response remains more or less similar under the two experimental conditions, the in loco responses showed a different pattern.

Chapter 2 :

Local and systemic alterations in protein content post-caudal autotomy and post-limb amputation were studied on a comparative basis in H. flaviviridis. Subsequent to tail autotomy as well as limb amputation, hepatic protein content depicted gradual depletion lasting upto 25 days, which was more pronounced in the case of post-limb amputation. Muscle protein content also got depleted under both conditions. However, in loco changes indicated a moderate increment during tail regeneration, while a hypersensitive increment were the feature post-limb amputation. It is construmed from the results that loss of a body extremity with or without regenerative ability initiates similar systemic responses in terms of protein metabolism.

Chapter 3 :

Comparative evaluation of quantitative alterations in ascorbic acid content in liver, kidney, tail regenerate and limb stump has been made post-caudal autotomy and post-limb amputation in H. flaviviridis. Results obtained indicate a

generalised depletion of hepatic and renal stores of AA under both experimental conditions. The content of AA in limb and tail after tail autotomy and limb amputation respectively, also showed a tendancy to deplete. However, the local responses of the tail and limb after autotomy and amputation respectively appeared dissimilar with the tail regenerate depicting capacity of tremendous mobilization of AA unlike the limb stump which in contrast depicted severe depletion. This would indicate that whereas the systemic modulations in AA content remain essentially same during both tail autotomy and limb amputation, the local responses are contrastingly different and might thus represent one of the reasons for the observed difference in regenerative potential of the two extremities.

Chapter 4 :

The changes in the activity levels of acid and alkaline phosphatase in liver and muscle post-limb amputation and post-caudal autotomy in H. flaviviridis. Hepatic acid phosphatase tended to be above normal under both conditions all throughout. Muscle alkaline and acid phosphatase after limb amputation showed a more or less parallel set of changes with sub-normal levels being registered by 3rd and 5th days respectively. The results

recorded herein indicate a more or less similar pattern of systemic modulations in the activity levels of acid and alkaline phosphatase in response to either limb amputation (non-regenerating extremity) or caudal autotomy (regenerating extremity).

Chapter 5 :

In loco and systemic responses to simultaneous caudal autotomy and limb amputation in *H. flaviviridis* have been assessed to determine the influence one on the other. Different parameters like blood glucose and tissue levels of glycogen, protein, ascorbic acid and phosphatases (acid and alkaline) were studied. On a morphological level tail autotomy neither could limb regeneration be induced nor did the tail regeneration get affected. At biochemical level, the changes obtained for blood glucose, tissue glycogen, tissue protein, tissue AA and phosphatases were more or less identical to those obtained during limb amputation or tail autotomy alone. It has been concluded that the double stress of simultaneous tail autotomy and limb amputation does not affect the *in loco* and systemic responses associated with tail autotomy and ensuing regeneration.

Chapter 6 :

Quantitative evaluation of the levels of vitamin A in the liver, kidney and tail regenerate during tail regeneration in H. flaviviridis was carried out. Vit. A in the liver increased on first 3 days and decreased on 5th day post-autotomy. Second increase was noted on 7th day. Thereafter a sub-normal level was noted on 10th, 15th and 25th days of regeneration followed by an increase on 40th and 60th days. Vit. A of the tail remained increased all throughout regeneration except on 7th and 60th days whence the levels were in the normal range.Kidney Vit. A content showed a steep and tremendous increase on the 10th day while at other periods it remained in the normal range. The depletion in hepatic vitamin content corresponded with the attainment of high vitamin content in the regenerate, thus indicating the mobilisation of this vitamin to the site of regeneration. The decreased level noted during dedifferentiation in the regenerate indicates the greater utilisation of this vitamin. Supra normal levels of vit.A in the regenerate during the blastemic and differentiation phases speak of an intimate association of this vitamin with many events characteristic of the phases of regeneration.

Chapter 7 :

The involvement of gonadal hormones in lizard tail regeneration has been assessed by removing gonads and determining its effect on the rate and total elongation in H. flaviviridis. Apart from an initial 48 hrs delay in the formation of blastema and a retardation between the 25th and 40th days, the growth rate remained faster in gonadectomised lizards as compared to the controls. Probable favourable influence of gonadal steroids in wound healing and better post-blastemic growth and differentiation of the regenerate in the absence of gonadal steroids have both been inferred from the present study.

Chapter 8 :

Gonadectomy induced changes in the carbohydrate metabolism as evaluated by the quantitative alterations in blood glucose and tissue glycogen in relation to tail regeneration in H. flaviviridis have been attempted. Preautotomy levels of blood glucose was low in both gonadectomised (GX) and sham operated (SGX) groups with a much lower level in SGX. An active participation of both hepatic and caudal stores of glycogen during regeneration has been noted in the controls while, the GX lizards showed

a moderate utilisation of liver, tail and muscle glycogen. GX lizards tended to exert a nullifying effect on the sham operation induced hypoglycemia and glycogen depletion. The elevation in the hepatic glycogen store between 25th and 40th days corresponded to the retardation in the growth rate noticed at that period. The modulations and spikes in the glycogen contents occurred earlier in SGX lizards compared to the other two groups of lizards.

Chapter 9 :

Alterations in the levels of tissue protein content were studied during tail regeneration in the gonadectomised (GX), sham operated (SGX) and intact lizards. Protein content of the liver in GX, SGX and intact normals showed a more or less similar pattern. From the 5th day onwards the hepatic protein content in GX lizards remained higher till the 40th day. SGX animals followed a pattern intermediate between those of the normal and GX. GX lizards showed a greater increase in muscle protein content in the initial stages. Tail protein showed a similar pattern in SGX and control. GX showed an initial low level and from 10th day onwards the caudal protein content continued to increase till the 40th day. Kidney protein content showed maximum fluctuation in SGX as compared to the intact normals. The SGX and GX showed a more

or less similar pattern with an initial set of changes during the 1st week being exactly opposite to that of controls. Regeneration induced modulations in the systemic and *in loco* protein contents seem to be affected by the absence of gonadal steroids. Protein turnover value was maximal in SGX lizards and may be responsible for the better growth noticed in these lizards.

Chapter 10 :

Variation in the levels of hepatic renal and caudal ascorbic acid content were estimated during tail regeneration in the normal, sham operated (SGX) and gonadectomised (GX) lizards, *H. flaviviridis*. The GX lizards showed lowest caudal AA content prior to autotomy and remained unchanged till the 5th day but its level increased by 7th day. Slight decrease on the 10th day followed by a sharp increase resulted in the attainment of maximum peak level on the 15th day. Afterwards, the AA content decreased gradually to the pre autotomy level on 60th day. The SGX and intact controls showed the highest level on the 25th day. Hepatic AA showed a more or less similar pattern in all the three groups. Renal AA content in the GX showed an increase in between 10th and 25th days and a decrease on 40th day. Gonadectomy had no effect on hepatic AA content while in the case of renal AA,

gonadectomy appeared to have a nullifying influence on the surgery induced elevation. The better growth rates recorded for GX lizards during 2nd and 3rd week have been construed to bear some relation with the increased caudal AA content.

Chapter 11 :

Alterations in the levels of different lipid fractions were estimated during tail regeneration in normal, sham operated (SGX) and gonadectomised (GX) lizards, H. flaviviridis. The total lipid content of the liver in all the three groups of lizards showed a similar pattern, with GX showing an elevated level, normal ones an intermediate and sham operated the minimum level. The total lipid content of the tail of normal and SGX lizards depicted a similar pattern with very little difference. GX animals, however, showed maximum fluctuations. Phospholipids showed an elevated level on 25th day in the tail regenerate and a decrease to normal range on 60th day; whereas the liver phospholipid content in the GX animals showed a decrease on 25th day. Pre autotomy levels of hepatic cholesterol was minimal in SGX lizards and intermediate in GX ones as compared to the normal controls. The GX lizards though depicting similar fluctuations as the SGX, however, showed an increase on the

3rd day post-autotomy. Thereafter, though showing fluctuations, caudal cholesterol content was however, elevated during the 15th day. In general, the pattern of alterations of triglyceride content in tail and liver of all the three groups of lizards during regeneration was more or less identical except for minor deviations in GX lizards. The important fact noted was the tremendous depletion of caudal cholesterol content in GX lizards between 25th and 40th days of regeneration which corresponds to the retardation in the regenerative growth. Another point is the tendancy of the GX lizards to maintain higher levels of all lipid fractions in the regenerate as well as in the liver.

Chapter 12 :

The levels of inorganic phosphorus in the liver and tail were measured during tail regeneration in the normal, sham operated (SGX) and gonadectomised (GX) lizards, H. flaviviridis. The SGX and intact controls showed a parallel pattern of changes in the hepatic phosphorus content. The gonadectomised animals showed a decreased level prior to autotomy. From the 7th day onwards, there was a steady increase till the 25th day to reach the maximal level with a small drop in between 10th and 15th days. The tail phosphorus content in all the three groups showed a

more or less similar pattern. An increase was the feature in SGX on 15th, 25th and 40th days with a drop to normal intact control levels. The GX lizards showed an increase on 7th, 25th and 40th days with a fall on the 15th day. The present observations suggest the relative insensitivity of regeneration associated phosphorus metabolism to gonadal steroids. Elevated levels of inorganic phosphorus noted in between 25th and 40th days also seem to have some relation with the earlier reported retardation in the rate of regenerative growth during this period in GX lizards. 7th day increase in the caudal phosphorus content in GX roughly corresponded to the blastema formation thus denoting the build up of phosphate for the dividing and differentiating cells.

Chapter 13 :

Unilateral adrenalectomy induced alteration on tail regeneration and the *in loco* and systemic alterations in various parameters like blood glucose, tissue glycogen, tissue ascorbic acid, acid and alkaline phosphatase and Na^+ K^+ ATPase were estimated along with the rate of growth of the regenerate in the normal, sham operated (SGX) and unilaterally adrenalectomised (UAX) lizards, *H. flaviviridis*. Although there was a 24 hrs delay in the formation of

blastema in UAX lizard, the regenerate was well formed in size as compared to the normal intact ones. There was also an initial alteration in the various parameters studied. These alterations may be due to the induced adrenal insufficiency which resulted in the slight delay in the formation of blastema. The attainment of normal growth rate and similar pattern of modulations in the various parameters in the later stages indicated the compensatory overproduction of adrenal principles by the remaining intact adrenal.