

## S U M M A R Y

## CHAPTER 1:

Histomorphological studies on the normal and various phases of the regenerating tail of the Scincid lizard, Mabuya carinata are carried out. Salient points of similarities and or dissimilarities in the morphological and anatomical features of the normal and regenerating tails of Mabuya carinata and a Gekkonid lizard, Hemidactylus flaviviridis are noted. The caudal scales in Mabuya carinata are large, greatly superimposed and highly keratinized compared to those in Hemidactylus flaviviridis. In the regenerated tail of Mabuya carinata, the number of scales gets reduced and has a broad dorsal one like the ventral scale; while there is no such difference in the scales of the tail regenerate in Hemidactylus flaviviridis. There is no external indication of the segmental arrangement for autotomy in tail regenerate of either Mabuya or Hemidactylus. The absence of external demarcation of the autotomy segmentation, a well defined subcutaneous adipose tissue, and intervertebral cartilage and the presence of dermal scutes are peculiar to Mabuya carinata. The telescopic arrangement of caudal muscles, that

present 'W' shaped myotomes, are seen clearly in Mabuya carinata. The submuscular adipose tissue present in the fully regenerated tail is less than that noticed in the normal tail. In both the lizards, the plane of autotomy is intravertebral. In the fully regenerated tail of both the lizards, neither ossification nor segmentation of the cartilagenous neural canal occurs. The ependyma formed of glial cells and Schwann cells is a common feature of the tail regenerates.

## CHAPTER 2:

A quantitative estimation of total lipids and a histochemical distribution of neutral and acidic lipids and lipolytic enzymes such as lipase and esterase were studied using appropriate techniques. Negligible lipid content in almost all the tissues of the normal tail, excepting the adipose tissues and a concomitant low level of the lipolytic enzymes have prompted the suggestion that the tissues of the normal tail are not dependent on lipids as the energy source. The possible role of the adipose tissue in giving a structural integrity to the tail, and its hitherto unknown important functions in hibernation and aestivation are discussed. Accumulation of lipids is noticed from preblastemic to differentiation phase and is correlated with the increased activities of

malic enzyme, ICDH and G6PDH, as these enzymes are the chief source of  $\text{NADPH}_2$ , an important cofactor for lipogenesis. Differentiating tissues seem to utilize lipid as the chief energy source, as it yields more ATP molecules as is evident from the increased activities of lipolytic enzymes and other dehydrogenases such as SDH, BDH and ICDH. There was a marked decrease in lipid content in these tissues together with the enzymes concerned through the growth phase, to the fully regenerated condition of the tail, finally attaining a level corresponding to that in the normal tail.

#### CHAPTER 3:

Significant fluctuations in the total glycogen content and phosphorylase activity were evidenced in the normal and regenerating tail of the Scincid lizard, Mabuya carinata. The reported presence of glycogen, phosphorylase and aldolase in almost all the tissues of the normal tail, especially in the stratum germinativum and muscles lead to the conclusion that normal tail is adapted for the anaerobic utilization of glycogen. The glycogen which was observed in the wound epithelium is correlated with the phagocytic activity of these cells. Blastemic phase is characterized by a minimum quantity of glycogen and phosphorylase activity. A gradual

glycogenesis is hinted at from early to late differentiation phase by the revealed five fold increase of the metabolite in comparison to the normal level. During the early phase of tail regeneration, the metabolic pattern is anaerobic and later a gradual shift from anaerobic to aerobic one during the differentiation phase is evidenced. Glycogen is the chief energy source for the growing tissues, as is evident from the reduced glycogen contents and a corresponding high activity of the enzymes concerned with glycolysis during this phase. The content of glycogen seems to <sup>be</sup> slightly more in fully regenerated tail than in the corresponding normal tail.

#### CHAPTER 4:

A histochemical study of the acid phosphatase distribution pattern in the normal and regenerating tail of the Scincid lizard, Mabuya carinata was carried out. Muscles were negative for the enzyme activity. Presence of acid phosphatase in the epidermal region is correlated with keratin synthesis during the process of moulting.

The high response of the wound epithelial cells towards acid phosphatase is correlated with phagocytosis and autolysis at the wound surface. A high acid phosphatase activity in the blastema cells <sup>is</sup> ~~are~~ correlated with the

increased nucleic acids levels, especially that of RNA during this phase. Even during myogenesis, the enzyme remained unrepresented. The chondrocytes during the differentiation phase revealed maximum response towards the enzyme and is correlated with chondrogenesis. A possibility of more than one acid phosphatase(s) taking part in the metabolism of nucleic acids, proteins, carbohydrates and also in the synthetic and phagocytic activities during regeneration process is suggested.

#### CHAPTER 5:

The activity of alkaline phosphatase in the various tissues of the normal and regenerating tail of Mabuya carinata was studied using suitable histochemical techniques. As compared to acid phosphatase, alkaline phosphatase has a wide distribution in almost all tissues of the normal as well as regenerating tail of Mabuya carinata. The possible role of this enzyme in the transport of phosphorylated metabolites such as glycogen and monosaccharides is discussed. Distribution of alkaline phosphatase and glycogen at identical loci at the cut end of muscles are correlated with the transport of glycogen from the cut end of the muscles towards the wound surfaces during the wound healing to preblastemic phases. The functional

significance of alkaline phosphatase in the dermal region is discussed with respect to the role of this enzyme in the synthesis of collagen and other fibrous proteins.

#### CHAPTER 6:

Both DNA as well as RNA were studied histochemically in the adult normal and regenerating tail of the Scincid lizard, Mabuya carinata. The epidermal RNA is correlated with acid phosphatase in keratin synthesis, a feature met with in moulting skin. Increased levels of both RNA as well as DNA from wound healing to differentiation phase and then a fall in the nucleic acid contents during growth phase, finally reaching the normal level in the fully regenerate were noticed. The increased levels of nucleic acid during the wound healing phase is correlated with the need for an increased protein turn over for the actively dividing epithelial cells. The high levels of nucleic acids in blastema phase are correlated with a concomitant increased activities of G6PDH and acid phosphatase. The elevated nucleic acid levels during the differentiation phase reflect the high rate of protein turn over by the actively dividing and differentiating cells during this process. A direct

correlation between the increased nucleic acid contents and alkaline phosphatase is discussed during the differentiation phase. A gradual fall in nucleic acid contents is registered during the growth phase, denoting the reduced metabolic activity and protein turn over in the said phase.

#### CHAPTER 7:

Localisation of both Acetylcholinesterase (AChE) and Butyrylcholinesterase (BuChE) were studied histochemically in the normal and regenerating tail of Mabuya carinata. In the normal tail muscles and nerve\$ cord are the only tissues which show<sup>e</sup>d pronounced cholinesterases activity. The localization was in the myoneural junctions (endplates) of the muscles and were of 'en plaque' type. AChE was found to be more than BuChE eventhough the muscles are of tetanic type. During the early phases of regeneration i.e., wound healing and blastema, the enzymes were negligible; it is presumed in this connection that no trophic influence of nervous origin is needed for the initiation and formation of the early regenerate. The reappearance of both the cholinesterases during the differentiation phase is correlated with their possible role in histodifferentiation of various tissues.

## CHAPTER 8:

Histochemical and quantitative studies on the total ascorbic acid (AA) content in the normal and various phases of the regenerating tail revealed significant fluctuations. A two-fold increase of AA was registered in the wound healing phase followed by a drop in the blastemic phase. In none of the phases of tail regeneration ascorbic acid (AA) level fell below that of the normal one. The role of AA in the wound healing process in providing the matrix material is discussed. The role of AA as an alternative to cytochrome oxidase in the respiratory chain, in the oxidation-reduction reactions in connection with the reported less activity of cytochrome oxidase is also discussed. For the proper functioning of the TCA cycle enzymes AA does play an important role. The presence of AA in the dermis, and in the cartilage cells <sup>is</sup> ~~are~~ discussed in the light of its known role in collagen and matrix formation.

There was a fall in AA level from the five fold increase noticed during the differentiation phase to three fold in growth phase before finally reverting in the fully regenerate tail to almost the same level as in the normal tail, denoting the completion of the regenerative process.