EPILOGUE
Sericulture is an important agro-industry in the decentralized sector, providing gainful employment to many persons. North Eastern region is the only place in the world where all four commercially known varieties of silks are produced namely eri, muga, tasar and mulberry. Eri Silkmoth Philosamia ricini belongs to the class Insects and order Lepidoptera. Britishers used to call this silk as "PALMA CHRISTI SILK". Looking like cotton, soft as silk and having the ture of wool and is a good for warm clothing for rural folk. Eri silkmoth polyphagous in nature its food plants are abundantly found in the natural forests, in plains and hilly areas of north-eastern India castor is a major food plant for eri silkworm many other options are available for eri silkworm like all other sericigenous insects, their different life activities of eri silkworm exhibit a "circadian rhythm". Hatching of eggs, development of larvae ripening of worms and moth emergence generally occurs during the day time. All life stages of eri silkworm require humidity and moderate temperature.

Several attempts were made to increase "Eriiculture" on large scale but it has not given desired impact. Eriiculture can best be taken as a secondary occupation along with castor plantation or Topioca cultivation with proper leaf harvestation schedules where the farmer gets erisilk in addition to oil seeds or the edible tubers. In Japan efforts have been made
In Japan efforts have been made to increase the silk cocoon crop yield by applying insect Juvenile hormones and their bio-analogues. Many vertebrate hormones have been found to increase the silk yield and fecundity. Studies have shown that the treatment with Cyclic AMP and prostaglandin E to the V instar larvae of *Bombyx mori*, exhibited cocoon shell weight and the pupal weight. Recent literature shown the topical application of prolactin, pituitary extract and prostaglandin F2 has accelerated the larval period and advances the moth emergence period in multivoltine *Bombyx mori*. The Juvenile hormone and their analogues have been used in practical Sericulture in Japan to improve the silk production in *Bombyx mori*. These JH and their analogues improved the various economic parameter like cocoon shell weight in *Bombyx mori*. In this contest Akai has demonstrated that repeated application of a Juvenile hormone analogue manta during the III to V instar can produced 26% increase in cocoon shell weight. He further suggested that use of this analogue at the farmers level. Krishnaswamy have shown another JH analogue hydroprene treatment to V instar larvae also exhibited the same result in various races including the pure mysore breed of *Bombyx mori*. have reported that the dietary supplementation of
thyroxine enhances the larval weight, cocoon weight, cocoon shell weight and shortens the larval duration. It also increases the silk gland weight, gonad weight and their protein, DNA and RNA content and fecundity in the topical Nistari race and also in the Bivoltines and pure mysore race of Bombyx mori.

Phytohormones are reported to control the cell division, growth and replace the old plant tissues and influence the assimilated metabolites and their transport to different parts of the plant. It has also been suggested that the plant hormones influence appetite, nutrition and absorption of plant materials in the phytophagous insects. Kamada et al. (1984) has demonstrated that the feeding of Indole-3-acetic-acid (IAA) along with the artificial diet or along with mulberry leaves or the topical application, increases the body weight and the cocoon weight in the Bombyx mori. Thakkur and Mann (1982) demonstrated that the topical application of IAA reduced the gonadal size by effecting the germinal region of gonads and reduced the number of sperm bundles and nurse cells in the fruit fly Dacus darsalis, and it was also suggested that the topical treatment of Indole-3-acetic-acid to 24 hours old flies induced sterility in both the sexes of Dacus darsalis. The Indole-acetic-acid effect on the population development and reproduction in aphids.
insects like coupling of oxidative phosphorylation, stimulates the release of diglycerides and fatty acids from the fat body and increase the dimensions of neurosecretory cells as well as the rate of neurosecretion in insects. Hence we designed an experiment so as to study the fuel reserves and metabolic changes in the life cycle of eri silkworm. Philosamia ricini treated with insect and plant growth regulators.

The results of the present experiment indicated that the feeding of insect growth regulators JH analogue Ro-20-3600 thyroxine and plant growth regulators Gibberellic acid and Indole-3-acetic acid exhibited considerable variations in the growth performance. Growth in animal, more or less cyclical periods of comparative rest alternating with periods of activity. But in no group this is so evident as in insects, in which development is punctuated by a series of moults or ecdysis each produced by a period of active growth followed by a period in which true growth may be absent. The study of insects lipids has received considerable attention in specific morphogenetic and physiological strategies. The use of lipid as a primary metabolic substrate permits accumulation of a large reservoir of energy, which may be used during periods of prolonged energy demand. Studies on the variation of lipids during development of insects have shown that lipid content varies according to size and age of insects.
However, Kamada and Ito (1984) had shown the increased body weight by feeding the IAA with mulberry leaves and also the topical application on second or third day of IV instar and it also increases the cocoon weight in the silkworm *Bombyx mori*. The Gibberellic acid also shows the similar effect like IAA. It is reported that dietary supplantation of Gibberellic acid (GA) induced sexual maturity in *S. gregaria*, increased larval and pupal period emergence percentage and decreased pupal weight, longevity, fecundity and hatching. In the case of *Spodoptera littoralis* similar phenomenon was noticed. In the case of the bollworm, *Heliothis virescens* found increased larval duration, larval weight and decreased fecundity and hatching. The same influenced the development and reproduction in Aphids. But on the contrary it has been adjudicated that GA is essential for the development of honey bees. Ahas observed the feeding of mulberry leaves with GA at the IV instar larva increased larval and cocoon weight in *Bombyx mori*. Apart from these studies there are a few reports showing that dietary supplimentation of various plant hormones effect the physiological processes like growth and
development in different insects. In animals comparatively a little information is available with regard to the effect of plant growth regulators. Recent studies in this area have opened new frontiers in the research field explaining the complex phytophagous insects and host plant relationship. It is evident from the above mentioned literature that plant growth regulators like other chemical stimulants and inhibitors and vertebrate hormones they might have a significant physiological effect during the larval growth, moulting and reproduction of phytophagous insects. Hence we thought, therefore that it would be rewarding to investigate the effect of insect growth regulators JH analogue Ro-20-3600, thyroxine and plant growth regulators Indole-3-acetic acid and Gibberellic acid on the life cycle of the eri silkworm *Philosamia ricini*.

Food occupies the key position in the ecology and physiology of an organism with respect to the qualitative and quantitative nutritional parameters. Lepidopterous larvae are known to as more or less continuous feeders hence a deficiency in the amount of food required to reach its full potential will be manifested in various ways and degrees. The eri silkworm is characterised by four stages in the development i.e. egg, larva, pupa and adult. The larvae are the most active feeders while pupal stage is a quiescent stage during which histogenesis and histolysis of several tissues
quiescent stage during which histogenesis and histolysis of several tissues takes place. The larval tissues are rebuilt into adult structure. The adult moths do not feed, hence the fuel reserves carried out from the pupal stage are normally utilized during adult stage. The growth in the body weight of the eri silkworm during larval stage is remarkable. Tazuma (1978) has described about *Bombyx mori* by saying that there is a progressive increase in weight throughout each larval instar and especially during the V instar. The larva attains a maximum body weight within 1 or 1.5 days before the onset of cocoon spinning in the eri silkworm, the weight has been about 12000 to 14000 times more than that of the newly hatched larvae. The eri silkworm ingest about 50 gms of castor leaves in which 70% of the nitrogen content in the leaves is used for protein synthesis. In the case of eri silkworm *Philosamia ricini* like any other silk moth experiences the energy and nutrient costs of producing a cocoon. In the case of *Bombyx mori* was reported the energy content of the silk comprises 30% of the energy content of the matured larvae. However, in general the increase in calorie content with age appears to be the main strategy. Hence the weight and size, the larvae achieves by the time it pupates is a major factor influencing its potential fitness. Hence, the V instar eri silkworm *Philosamia ricini* larvae have evolved a means to evaluate their nutritional
Philosamia ricini larvae have evolved a means to evaluate their nutritional state prior to making the neurohormonal decision. The same phenomenon has been observed in the tobacco horn worm.

The consumption and utilization of food constitute a sine qua non for growth development and reproduction. The amount rate and quantity of food consumed by larvae influences their performance on growth rate, development time, final body weight and the most is the probability of survival, this influence might also effect the adult performance. For example if the larval suffers reduced growth, it automatically produce a small sized adult with reduced fecundity.

In recent years attempts have been made to study the effect of many vertebrate hormones on the economic parameters of the silkworm Bombyx mori. The cyclic AMP and prosta glandin E sprayed on the larvae of V instar resulted enhanced pupal and cocoon weight. The vertebrate hormones acts immunochemically similar to invertebrate hormones, application of prolactin also resulted in the accelerated growth, increased weight shortened the larval period significantly so also the fecundity. Similarly pituitary extract also exhibited the same results.

In reviewing all literature we thought of studying the insect growth regulators and the plant growth regulators by feeding them in minute.
In reviewing all literature we thought of studying the insect growth regulators and the plant growth regulators by feeding them in minute quantities to the eri silkworm *Bombyx mori* by comparing them with respect to their physiological changes with these above findings the present investigation was carried out to test the two insect regulators JH analogue Ro-26-3600, thyroxine and to compare with the plant growth regulators Gibberellic acid and Indole-3- acetic acid by feeding them along with the chopped castor leaves to study the effect on the growth, development, fecundity and other physiological changes.

The oral feeding of this insect growth regulators and plant growth regulators have not affected any mortality in the eri silk worm larvae during development. The growth in terms of the weight was much more pronounced with the treatment of JH analogue in contrast to thyroxine control. Among the plant growth regulators Gibberellic acid produced better growth than Indole-3-acetic acid. The pupal weight also exhibited the same pattern. The moth exhibited sexual dimorphism in the JH treatment. In the case of thyroxine treatment the reverse was observed i.e. female moth showed less weight compared to male moth. In the case of Gibberellic acid, the female moths exhibited more weight than the male moths. So also the Indole-3-acetic acid. Hence these treatment resulted in
moths. So also the indole-3-acetic acid. Hence these treatment resulted in the sexual dimorphism in the moths. The cocoon percentage also followed the same pattern. The percentage of hatching the JH treatment has resulted in about 74% hatching. Next is thyroxine and Gibberellic the least hatchibility was observed in the Indole-3-acetic acid. The cocoon weight as well as the cocoon shell weight were fairly well over the controls. Hence, we can say the treatment certainly gave same physiological changes which were evident in treated over the control.

It is well known that JH hormones and their analogues play an important role in molting, metamorphosis and reproduction in insects. Juvenile hormones and their analogues have been used as successful pest control agents, as third generation pesticides to control insect population. On the other hand Juvenile hormones and their analogues have been utilized for the production of more silk in Sericulture industry in Japan. Akai and Kobayasi were the first to show the application of Juvenile hormones in the induction of prolonged larval duration with a consequent increase in cocoon weight. Further Akai et al. (1971) reported their injection of a single dose of JH hormone during the first half of the V instar resulted in the increase in the duration of feeding period, RNA synthesis, and fibrion synthesis and recommended the topical application of the
and fibrion synthesis and recommended the topical application of the
Juvenile hormones in the sericulture to increase the silk production. Since
then onwards several JH analogues were tried in the *Bombyx mori*. In the
present study the two insect growth regulators, The analogue Ro-20-3600
thyroxine and the plant growth regulators, Gibberelic acid and Indole-3-
acetic acid have exerted certain influences on theeri silkworm physiology
over the natural controls.

We observed the larval duration was prolonged only with the JH
analogue treatment. However the other-three treatments have not effected
the larval duration. The larval growth was enhanced over the control
suggesting the higher synthesis of metabolites like fats, proteins and
carbohydrates. The cocoon weight was also increased in Juvenile hormone
treatment. Next thyroxine gibberelic and Indole-3-acetic acid, suggesting
these treatments played an important role in the protein synthesis. The
moth emergence also followed the same pattern. It was also reported the
thyroxine hormone has shown various physiological changes in insects like
coupling of oxidative phosphorylation (Karlson and Schultz, 1963),
stimulates the release of diglycerides and free fatty acids from fat body and
increase the dimensions of neurosecretory cells as well as the rate of
neurosecretion in insects. Mathias and Lucile (1954) demonstrated that the
neurosecretion in insects. Mathias and Lucile (1954) demonstrated that the dietary supplementation of thyroxine in moderate amounts accelerates the growth and metamorphosis in Callophora erythrocephala. Smaller doses promoted growth as well as the oxygen consumption; higher dose inhibited growth rate in the rice moth. Injection of thyroxine to Bombyx mori resulted in increased weight of gonads, cocoon as well as silk production.

The result of the present experiment exhibited a prominent growth with Insect growth regulators of the plant growth regulators. We conclude all the four treatments seem to be having stimulating growth factor.

Growth represents an integration of a wide range of physiological processes. This parameter in terms of the weight gain may therefore be used as an indicator of tolerance, utilization of an organism to the various plant and insect growth regulators. The growth in the body weight of the silkworm during larval stages is remarkable, the larvae attain a maximum body weight within 1 or 1.5 days before the onset of cocoon spinning. In the case of eri silkworm Philosamnia ricini, the rate of growth, resistance to diseases and the amount of silk produced are greatly influenced by nutritional and environmental factors. The larval stages will end up with the onset of pupation. The pupa represents a unique stage in the development of holometabolous insects because from the time of pupation
Development of holometabolous insects because from the time of pupation until adult ecdysis, the pupa is essentially a cleidoic system. In this situation they exchange gases and water vapour with its environment. In the eri silkworm *Philosamia ricini* the adult moth does not feed and they are short lived. The nutritional state is generally optimized by enhanced feeding and substrate storage before larvae enter into pupal stage. During the processes of metamorphosis that is from pupa to adult some of the tissues undergo histolysis, while some adult structures develop from embryonic nests of the cells. This is a remarkable phenomenon where there is a complete reorganization within the animal, with no exogenous substrates entering the organism. Two main features of an adult insect that influence its reproductive competitiveness its size and weight. In biochemical studies as the eri silkworm gains the body weight and undergoes metamorphosis during the period the deposition and utilization of nutrient reserves are important components. Interconversions of metabolic fuel reserves from one another occurs, and is controlled by neurohormones in general. The increase in the lipid content occurs. The moulting process itself energetically is very costly. According to Hiratsuka (1920), 19 to 34 percent of lipid and 65 to 70% of glycogen is utilized by *Bombyx mori*
during its four larval instars. The chief organic fuel reserves carbohydrates, proteins and fats mainly stored in the fat body are released according to the metabolic demand. The storage function of the fat body is thought to be an important mechanism in insects. Glucose is a major nutrient or an energy source and multifunctional precursor for trehalose synthesis, glycogen, lipids, amino acids and proteins. The protein from the leaves is converted to amino acids by the enzymes in the gut. These amino acids are transported and accumulated in the fat body via haemolymph and are synthesized again into protein. Proteins are indispensable for growth. Proteins are stored in the fat body as well as in the integument. During development, the glycogen stored in the fat body is released into the haemolymph in the form of trehalose.

In the early stages the carbohydrates are incorporated into the egg and lipids in the latter into the cocoon proteins. This we can call as a stage dependent metabolism of glucose and could provide an ideal system for explaining the relationship between the function of storage in the larval life and utilization of reserves which are stored for the development of an adult insect. It has also been reported that there is a metabolic shift from lipogenesis to glycogenesis at the end of the feeding period for the beginning of metamorphosis. The glycogen produced and accumulated at the last
of metamorphosis. The glycogen produced and accumulated at the last instar is used during the transformation of larvae into pupa. The remaining glycogen is carried into the pupa. The glycogen stored in the late pupa is partially utilized for the development of the gonads and accessory reproductive structures. In the adults the glycogen might act as energy for mating and also for ovulation. The larval lipids in the fat body were transferred into the pupa without any modification. The lipids seem to increase up to 7 to 8 days of pupal development afterwards the storage is depleted. During the development of the pupa several changes take place, the phospholipids must be transported. In insects the phospholipids are synthesized in the fat body and then transported to the site of utilization through haemolymph bound proteins. Most of the potential energy is available from the triglycerides in the fatty acid molecule. The fatty acids along with the non esterified fatty acids form a major metabolic reserve. Lipid metabolism in insects is effected by neuroendocrine, physiological and environmental influences. In view of this literature we presume that hormones certainly influence various physiological changes in insects like coupling of oxidative phosphorylation, stimulates the release of diglycerides and fatty acids from the fat body and
increase the dimensions of neurosecretory cells as well as the rate of neurosecretion in insects. Hence we designed an experiment so as to study the fuel reserves and metabolic changes in the life cycle of eri silkworm, *Philosamia ricini* treated with insect and plant growth regulators.

The results of the present experiment indicated that the feeding of insect growth regulators JH analogue Ro-20-3600, thyroxine and plant growth regulators, Gibberellic acid and Indole-3- acetic acid exhibited considerable variations in the growth performance. Growth in animal more or less cyclical periods of comparative rest alternating with periods of activity. But in no group this is so evident as in insects, in which development is punctuated by a series of molts or ecdysis each produced by a period of active growth followed by a period in which true growth may be absent. The study of insects' lipids has received considerable attention in specific morphogenetic and physiological strategies. The use of lipid as a primary metabolic substrate permits accumulation of a large reservoir of energy, which may be used during periods of prolonged energy demand. Studies on the variation of lipids during development of insects have shown that lipid content varies according to size and age of insects. Lipidopterans have been observed to utilize lipids both for muscular activity and development. That the change in lipid content during
activity and development. That the change in lipid content during development is a key point to the various regulatory systems responsible for histogenesis and histolyses has been reported in several insects. During development total carbohydrates declined just prior to each larval moult of *Philosamia ricini* by 50 to 60% and total lipid increases by 20%. However, during feeding periods of larval development especially during II to IV instars total soluble carbohydrates and glycogen increased significantly with a simultaneous decrease of total lipid. This suggests that the utilization of lipids for locomotor activities and suggests that conversion of ingested food to glycogen, which is turn stored as a reserved nutrient. Stephen and Gillbert (1970) suggested that the lipid metabolism insects is regulated by the juvenile hormone (JH). Low concentration of JH stimulating the lipid synthesis giving rise to an adipokinetic effect. This indicates that during the feeding period of the larva, the gradual depletion in the lipids was due to the corresponding increase in the JH. The synthesis of lipids at ecdysis may be associated with the low concentration of JH hormone that occurs at that time immediately after moult.

The juvenile hormone content might start increasing, resulting the low content of lipid after the moult. The neutral lipids in general constitute major components during development. The occurrence of higher amount
The occurrence of higher amounts of neutral lipids suggests their role as a main source of energy. Due to the dynamic state of lipids and lipases in a living system, the preparation of lipids, especially neutral lipids, may vary under experimental conditions as well as in the physiological changes. It is understood that phospholipids participate in almost all aspects of normal metabolism. The percentage of phospholipids in the total fat varies from 0 to 40% (Shridhara and Bhatt, 1962). The vast differences found in the distribution of phospholipids in various organs of the silkworm was taken to mean that the distribution was according to the metabolic status of each tissue (Gupta and Commoja, 1962). These scientists suggest the relationship between lipids and the ability of the silk glands for protein synthesis and secretion. Similar distribution of neutral and phospholipids was reported by Fast and Brown (1962). In general, phospholipid content depicts an overall increase although larval, pupal, and adult development. The relative fall and rise of phospholipids is suggestive of the role of phospholipids in transport of lipids. Our present findings suggest that insect growth regulators, especially the JH analogue, have exerted the maximum influence over the lipid synthesis among the plant growth regulators, Gibberellic acid exerted
higher synthesis of lipid content than Indole 3 acetic acid. The same pattern was observed in the neutral as well as phospholipids. We assume the phospholipids play a dual role in the eri silkworm *Philosamia ricini* as a medium of lipid transport and also as a structural unit in histogenesis during metamorphosis.

The protein synthesis was much enhanced with JH analogue and Gibberellic acid comparatively than thyroxine and Indole acetic acid. The use of Gibberellic acid to improve the commercial characteristics of silkworms was in practice. Proteins are known to participate in the energy yielding processes under the exceptional conditions. In the silkworm *Bombyx mori*, the synthesis of protein has been extensively investigated in respect of the production of vitellogenin, the precursor of egg yolk proteins. It is found that the active production of vitellogenin in the silkworm begins in the II instar and continues till the completion of the maturation of oocytes. Protein granules appear and disappear in the fat body trophocytes in correspondence with the stages of growth and the metamorphosis. From our present experiments the result indicated that the insect growth regulators as well as plant growth regulators serve as stimulators for the protein synthesis.
It is well expected that glycogen serves as chief source of energy during growth development reproduction and flight. The major glycogen reserves of insects are located in the fat body and muscles. The stored glycogen content varies in its concentration and can be mobilized into haemolymph as trehalose. The circulating levels of trehalose is subjected to regulation dependent on the developmental stages and the activity of insects. In insects two major pathways of carbohydrate metabolism - Embden meyerhof Glycolysis followed by the rib cycle and pentosephosphate pathway. The relative importance of pathways of glucose metabolism is variable according to the insect species and developmental stages of insects. It was known that glycogen content during development decreased gradually during the early phase of embryogenesis. This suggests the utilization of glycogen for various metabolic as well as for physiological functions, such as energy source and substrate for Chitin formation. The present experiment suggests the use of these four regulators both insect as well as plant growth regulators exerted influence on the glycogen synthesis. The insect growth regulators exerted more stimuli than the plant growth regulators.

The trehalose principal haemolymph sugar which is present in the insect is maintained at study levels through homeostatic regulation at all the
The trehalose principal haemolymph sugar which is present in the insect is mentioned at study levels through homeostatic regulation at all the stages of life cycle. Trehalose content of the haemolymph is closely related to moulting metamorphosis and diapause. The concentration of trehalose in the haemolymph declined to half or less at the transformation from larva to pupa. Our present results indicate the higher amount of synthesis of trehalose observed with treatment over the control.

Cholesterol plays an important role in insects many vital activities during development, moulting, oogenesis, and hatching. In general, insects are considered incapable of converting simple precursors into cholesterol, but phytophagous insects are known to convert dietary sterols into cholesterol. Hence they possess necessary enzymes. Many other reports indicate the change. It was shown in vitro that cholesterol is converted into ecdysone in the ovaries of Locusta migratoria in the concentration of cholesterol in the ovary of Dysdercus singulatus during development in Bombyx mori. The treatment employed in the present investigation have pronounced more synthesis of cholesterol than control groups. The synthesis of cholesterol in different moths have a sexual dimorphism. Hence we can conclude the use of insect growth regulators induces the higher metabolism than plant growth regulators.
The post embryonic growth and development in insects is punctuated by periodic moults. In the case of *Bombyx mori*, certain experimental evidence has provided and furnished the cellular events, which occur in larval moults. During the moults the epidermis undergoes cell division and differentiated into hair bristles or hairs, scales, dermal glands or oenocytes. In *Bombyx mori* the post embryonic developmental events like moulting and metamorphosis are known to be controlled by at least four major hormones, namely prothoracic hormone (PH), prothoracicotropic hormone (PTTH), moulting hormone (MH) and juvenile hormone (JH). To understand the physiological and developmental significance of these hormones it is essential to understand biological events and processes, which contribute to and are reflected by hormone synthesis, release, transport, storage, degeneration and excretion as well as the factors, which regulate each of these processes.

The endocrine function of the insect brain was first suggested by Kopeck (1922). Latter on in the year 1940 Wigglesworth demonstrated that moulting of *Rhodnius prolixus* was initiated by a hormonal factor originating from the dorsal region of protocerebrum containing the
originating from the dorsal region of protocerebrum containing the neurosecretory cells. Since then onwards a number of investigators unravelled the exact nature of the endocrine regulation of insect metamorphosis particularly the function of the brain. Classical parabiotic experiments of Sir Vincent Wigglesworth using blood sucking bug Rodnius prollexus have provided evidence to Kopec's hypothesis, that the insect brain acts as an endocrine gland and plays an important role in insect growth and development. In classical hypothesis the brain is activated when exposed to low temperature and secretes a hormone affecting the prothoracic gland. With this stimulation the prothoracic gland secretes a hormone which induces metamorphosis. At the same time the existence of moulting hormone from the brain was proved therefore several studies indicating that another center from the thoracic region was necessary for moulting to occur. These centers was identified as ring gland in blow fly (Burtt 1938; Hachlow 1931; Fukuda 1940ab; 1941) identified the prothoracic gland as the source of hormonal factor in the thorax of Bombyx mori. Williams (1947, 1948) was able to demonstrate that prothoracic gland in the American silkmoth Hylophora cecropia was the endocrine factor which initiated the moulting. With this demonstration it is well
accomplished that an isolated abdomen of a diapausing pupa, when implanted with chilled brain + two pairs of prothoracic gland, developed into an adult abdomen. From these studies Willims concluded that the termination of pupal diapause and subsequent adult development required both brain and prothoracic gland and that the brain factor exerted a controlling action on the prothoracic gland. Then he proposed that the only function of the brain factor was to affect the prothoracic gland and their secretory factor. These investigations established the endocrine importance of brain and prothoracic gland in moulting and metamorphosis and opened a channel for the identification of brain hormone prothoracicotropic hormone (PH) and moulting hormone (MH). Since then the findings of comparable studies on Juvenile hormone gave rise to the so called "Classical" scheme for the endocrine control of post embryonic development.

The corpus allatum is a gland tissue which has a function, in cooperation with the prothoracic gland to induce larval moulting and is thought to be a terminal organ, releasing the neurosecretory material from the brain in the silkworm. Wigglesworth (1936) concluded that the corpus allatum was the secretory center for an inhibiting hormone or anti metamorphosis hormone which is named as Juvenile hormone. It was
matamorphosis hormone which is named as juvenile hormone. It was evidenced by the experiment conducted on the silkworm by ligating between head and thorax around 2/3 i.e brought the IV instar. Most of the larvae became precocious pupa skipping the IV larval moult. Hence from these results it is clear that the carpus allatum has an important role in the induction of larval moult.

Considerable amount of work has been carried out on the active factors isolated from corpora cardiaca of the insects. These neurosecretory organs act as releasing sites, not only for secretion from the intrinsic neurosecretory cells they contain, but also for neurosecretory products synthesized by the cells of the par intercerebralis and transported to the corpus cardiaca for release. Examples of the active principles from this source include those that affect the lipid metabolism, carbohydrate metabolism, cuticle tanning, water balance, muscle contraction and cardio acceleration.

Indirect affects brain hormones are also known. The injection of the hormone in Samia cynthia promoted oxygen consumption of the brainless pupa. If C-Glucose was injected, it was incorporated into glycogen in the fat body. In case of hormone treated brainless pupa if C-glucose was injected it was incorporated into trehalose in the blood. These results
suggested that the hormone promotes biosynthesis of trehalose. Similarly, the ecdysone was also tested. In view of these findings, we thought of studying the effect of insect growth regulators and plant growth regulators if they exert any effect on the endocrine glands and their secretions. If the secretions are altered, whether it has any effect on the lipid release.

It is now understood that the active agent in the lipid metabolism is the neurosecretory cells from the brain which are stored and released by the corpora cardiaca. It is known that the corpora cardiaca is responsible for the stimulation of lipid mobilization from locust fat body by in vivo studies and in vitro experiments.

It is understood that the juvenile hormone stimulates succinate oxidation and that the site of stimulation is a part of the respiratory change between succinate and cytochrome c. On the other hand, Gilbert and Schneiderman (1960) showed that the administration of the juvenile hormone resulted in the enlargement of pupal epidermal cells. It was shown that the injection of juvenile hormone from the *Ceropia* moth silkworm if injected into American cockroaches gonadotrophic action was observed. But the injection of farnesol had no effect. The topical application of farnesol to American cockroaches resulted in the growth of gonads, they
farnesol to American cockroaches resulted in the growth of gonads, they
concluded the gonadotrophic hormone may be same as "Yolk-forming
hormone" we conclude the treatment of JH analogue Ro-20-3600 over a
prolonged period in the eri silkworm Philosamia ricini is clearly exhibited
that hormone analogue is indeed responsible for lipid release from the fat
body in in vitro experiments. Chino and Gillbert (1965) Tietz (1967) have
already described the the importance of haemolymph proteins in loading
and transporting of diacylglycerides in the haemolymph. Hence we
conclude that the JH analogue treatment in the eri silkworm larva has
induced a similar effect during our in vitro studies.

The thyroxine treatment also exhibited the influence. Among the
plant growth regulators Gibberellic acid influenced corpora allata extract. It
was known that the release of glycerides usually found to specifically
require the haemolymph, suggesting haemolymph lipoprotein to be
responsible for diacylglyceride uptake as well as transport from the storage
site-1 to the site of energy demand. Another instance is adipokinetic
hormone released from corpora cardiaca after initiation of flight
(Rademakes and Beenekker's, 1977) was shown to be responsible for the
stimulation of lipid mobilization form locust fat body in vivo and in vitro.
This adipokinetic hormone also have an influence on the diacylglycerol
This adipokinetic hormone also have an influence on the diacylglycerol transporting lipoprotein in haemolymph on the lipolytic processes in the flight muscles or both.

In general the neuroendocrine controlled the protein synthesis in the locusts (Hill 1962). This has been proved by the experiments of Osbourne et al., (1968). He reported the ejection of Carpora cardiaca extract stimulates the protein synthesis in the adult female locusts.

The present short term in vitro experiments conducted on the oral treatments of Insect growth regulators and plant growth regulators, the larvae exhibited, that the oral treatment has certainly influenced and effected the neurosecretory cells. It is understood that the Juvenile hormone secreted from the carpora allata and the moulting hormone secreted from the prothoracic gland activated from the Brain hormone. Morohoshi proposed from a Physiogenetic viewpoint that the carpora allata and Suboesophysial ganglian hormone act antagonistically in the processes of development. According to him the Secretory activity of the Carpus allatum varies with moulting type. The secretary activity of carpora allata gradually decreases with age, the brain controls the function of these organs. Hence these factors influence the neuroendocrine organs as well as
their secretion. The secretion in terms act differently on the reserves of like metabolites lipids, from the fat body of eri silkworm *Philosamia ricini*.

In insects the fat body like mammalian liver plays a remarkable role in the intermediary metabolism of fat, carbohydrate, protein and nucleic acids as well as storing there constituents. Wigglesworth showed glycogen is present in bulk quantities in the fat body of *Drosophila melanogaster* and large quantities of glycogen are utilized during metamorphosis although larval and larval pupal development, and a reverse pattern was observed by Crompten and Birt (1967). In 1958, Gordon and Cherkes demonstrated that catecholamines stimulated the mobilization of lipid from rat adipose tissue. This observation has been repeatedly confirmed and the phenomenon is likely due to the increase in activity of a specific lipase, particularly in response to epinephrine. Several other hormones including glucagon, ACTH and TSH elicit this adipokinetic effect in mammalian adipose tissue, and they cause the lipolytic effect through the mediation of cycle 3-5-AMP (Butcher, 1966). The insect fat body combines the functions of both the mammalian liver and adipose tissue and has the capacity to synthesize and release lipid into hemolymph, where it can be transported to sites of utilization in the form of lipoproteins. The neutral lipids in several insects are transported in the form of diglycerides and that aspects
several insects are transported in the form of diglycerides and that aspects of lipid metabolism are likely under hormonal control (Gilbert 1967b; Wiens and Gilbert 1967). In view of above findings we designed an experiment so as to study the insect growth regulators JH analogue Ro-20-3600, Thyroxine and plant growth regulators Gilberellic acid and Indole-3-acetic acid on the lipid mobilization in the fat body of eri silkworm Philosamia ricini.

Since the fat body is the most important site of storage of substrate in insects and plays a metabolic role analogous to that of the mammalian liver, and it might be the target of one or more central systems. In case of carbohydrate metabolism in Plecoptera maderae in which a factor from the corpus cardiacum acts to stimulate an increase in haemolymph trehalose by the activation of fat body phosphorylase. It is understood that the aspects of lipid, protein and nucleic acid metabolism in the fat body are regulated by endocrine reactions. The thyroxine uncouples oxidative phosphorylation in the locust mitochondria, similarly to mammalian liver mitochondria. It has been proposed that there are two compartments in the moth fat body, one for triglyceride storage, in the site of triglyceride hydrolysis, into the free fatty acids and monoglycerides. The hydrolytic products are then transported to the second compartment where
products are then transported to the second compartment where diglycerides that have a fatty acid pattern necessary for entering the haemolymph are synthesized.

The hormones employed have either one or both compartments and have many metabolic targets different from one another. Hence, we conclude the addition of insect growth regulators and plant growth regulators in the eri silkworm during larval stages have a remarkable role to play at pupal as well as in the life cycle of *Philosamia ricini*. 