GENERAL CONSIDERATION

"That there is a small gland in the brain, the pineal in which the soul exercises its functions more particularly than in any other part" (Rene Descartes 1646). Hats off to Rene Descartes, the philosopher physiologist for his prophetic notion that the pineal housed the seat of the rational soul and his farsighted formulation that the eyes perceived the events of the external world and transmitted what they saw to the pineal by way of "strings" in the brain and in response to which the pineal allowed "humors" to pass down "hollow tubes" to the muscle where they produced the appropriate responses. Substitute "nerves" in place of "strings", "hormones" in place of "humors" and "blood vessels" in place of "hollow tubes" and we have the morden concept of the prophetic formulation of Rene Descartes. The above philosophical concept of the functional role of pineal rendered as early as in 1646, when endocrinology, circulation and muscle physiology were still in a premature stage of understanding, bespeaks of the admirable visionary zeal of this philosopher physiologist. It is really astonishing that Rene Descartes could conceive of a status for pineal which we now with over 300 years of scientific hindsight has come to recognize as a neuro-endocrine transducer. Pineal is an organ whose discovery predates that of the pituitary and adrenal as its anatomical descriptions can be found in the writings of Claudius Galen (130-201 AD) who is accredited with the christening of the name pineal. However, the function of this midline azygous structure remained a total mystery till the 20th centuary. Many of the experimental studies in the last three decades or so have succeded in establishing quite a bit of physiology, morphology, cytology, chemistry and pharmacology of the pineal organ. The pineal body or "epiphysis cerebri" is an evagination of the roof of the diencephalon in a site that becomes in the adult the parietal region. During the process of brain morphogenisis, a number of structures originated around the third ventricle, collectively termed as circumventricular organs (Kelly, 1968) of which pineal is one. In certain vertebrates rostral to the pineal another primordium might differentiate, the forerunner of the parapineal organ. In some, the parapineal anlage might fuse with the pineal primordium to form a single structure while in yet others the parapineal might develop as an altogether seperate entity. The parietal eye of some species is the parapineal derivative. Phylogenetically pineal is represented in almost all vertebrate groups except for in the myxinoids, crocodeleans, armadillose, edentates and perhaps dugongs (Kelly, 1968). The wider occurrence of the pineal amongst vertebrates is suggestive of a constancy like that of pituitary and it may be rather fallacious to consider it as an evolutionarily vestigeal structure. Despite this constancy in occurrence, a constancy in function in vertebrates as a whole is not ascribable. Another feature of the pineal is its structural variation met with amongst the vertebrates. Whereas both the pineal and the parapineal organs are photoreceptors as in the case of lampreys, great structural diversity is noted in elasmobranchs and teleosts with some members of both groups lacking the parapineal organs but possessing a well developed pineal organ with photoreceptor cells. In gymnophians and amphibians the only parietal organ is the epiphysis. A vesicular distal portion of the pineal primordium migrates prior to ossification of the skull to form an eye (frontal organ) lying below the skin on top of the skull as in some anurans (Ralph, 1975b). The frontal organ with the intra-cranial pineal structure are together designated as the pineal complex. Reptiles as a group show remarkable variation in the nature of their parietal organs. Sphenodon and some lacertilians have both pineal organ and parietal eye (Gundy and Wurst, 1976). Whereas a sac like pineal organ is found in turtles, a solid glandular pineal is the feature in snakes (Kelly, 1968; Collin and Oksche, 1981). The aves have pineal varying in structure from sac like as in lizards to nearly solid ones as in mammals (Ralph, 1970). Though it is assumed that the pineal body in general is secretory in nature, this aspect of function may be subsidiary in those forms where it is highly developed for photoreception. The non-commital term, pineal organ or pineal body may in this context be more preferable while refering to it in most of the lower vertebrates.

The earliest light mocroscopic observations of Holmgren (1918) on the pineals of frog and dogfish revealed the presence of sensory cells in effective contact with nerve cells bearing resemblance to the retinal cone cells, based on which he suggested that the pineal might function as a photoreceptor or "third eye" in poikilotherms. Within the next few years Ebenhardt Dodt and his German colleagues hinted that the pineal in frog could be a wave length discriminator which can convert light energy of certain wave lengths into nervous impulses. This was followed by the observation of the skin blanching effect of cattle pineal extracts on tadpoles (McCord and Allen, 1927). This was the state of knowledge about the pineal in the first half of the 20th centuary; it appears to be a photoreceptor in the frog, had something to do with sexual functions in mammals and contained a factor that blanched the pigment cells of the tadpoles. The second half of this centuary witnessed a flurry of experimental excavations on pineal structure and functions which led to some sort of crystallisation of ideas and thoughts about pineal function in vertebrates. Accordingly functions such as circadian pace maker, gonadotrophic activity, patterns of integumentary colouration, thermoregulation, photoreception and heat loss regulation have all come to be associated with pineal.

Information on pineal in reproductive functioning is a better documented one. Most of the seasonally breeding animals especially mammals and aves are known to regulate their reproductive activities by a subtle interaction between a variety of external cues with internal cues of which photoperiod, temperature, humidity, annual rainfall, availability of food etc. are some of the important ones. It is only within the last three decades has it been unequivocally established that the biochemical and secretory activities of the pineal are intimately linked to photic information conveyed by the lateral eyes, a tenet which is nothing but the three centuries old prophetic formulation of Rene Descartes come true. The relationship between pineal and reproductive physiology is being increasingly elucidated in the modern era of pineal research. There are more evidences at present to indicate a general influence of inhibition on reproduction by this gland. The relationship between photoperiod and pineal is of a dual nature, with long photoperiod inhibiting pineal function and short photoperiod stimulating its function. It is now recognized that reducing day light length or darkness exerts a favourable influence on pineal activity leading to elaboration and release of pineal principles (melatonin and arginine vasotocin) which have an antigonadal influence. Apparently short photoperiod induced gonadal regression in mammals is mediated via the pineal. Since pinealectomy during periods of long daily photoperiods does not affect the gonadal function while its removal during the shorter day length periods leads to positive stimulation of gonadal functions, it can be easily surmised that shorter photoperiods activates the pineal which in turn through its secretion(s) inhibits the hypothalamo-hypophysio-gonadal axis and thereby induces gonadal involution. Removal of the pineal during shorter daylength periods leads to removal of its inhibiting influence and thereby preventing gonadal regression. This pattern of regulation of seasonal reproductive rhythms is more clearly established for mammals. In lower vertebrates like fishes, amphibians and reptiles the function of photoreception is more implicated. The thermoregulating role of pineal is also gaining increasing evidence in recent times, a function which is being demonstrated in many vertebrate species. The extent of its involvement in the varied functions mentioned remains yet to be defined with clarity, more so with the avian pineal. It is quite likely that the avian pineal represents a conglomerate of all the above functions as scattered evidences are available for each. Good evidence has been accumulated for the involvement of avian pineal in circadian rhythmicity (Gaston and Menaker, 1968; Binkley *et al.*, 1971; McMillan, 1972; McBride and Ralph, 1972; Cogburn *et al.*, 1976; Rutledge and Angle, 1977; Gwinner, 1978). A general scan of the relevant literature of the possible role of pineal in reproduction among the aves fails to yield a common case. In fact a progonadal, an anti-gonadal and even no relation with the gonads whatsoever have all been suggested in various species of birds. Quite likely, negative results might occur due to the fact that appropriate experimental designs have not been made or proper challenges have not been presented especially with regard to temporal features (Ralph _et al._,1979).

It is this temporal aspect which gains credence, as seasonal cycling of the state of reproductive structures is of greater significance in avian than in mammalian species.Besides, the occurrence of pineal in almost all vertebrates also implies the possibility of pineal participating in subtle modifications and regulations of various physiological processes, if not directly albeit indirectly. Speculations on these lines have been sounded by other workers also. "There is now considerable documentation that the mammalian pineal participates in the affairs of gonads, the thyroid, the brain and several other organs and organ systems. One can also find evidence to support the argument that sub-mammalian pineal organs influence pigmentation and behaviour. However, it has not yet been demonstrated that any physiological process in the body is controlled primarily by pineal organs. And presently, no one knows what pineal organs, be they photoreceptive or secretory, are for. This situation is not unique to the pineal and certainly should not lead potential students of pineal physiology to conclude that the pineal has no function. An alternative explanation is that the appropriate questions about pineal functions remain to be asked" (Wurtman _et al._, 1968). Recently, Ralph _et al._ (1979) have stated "There has been much well founded speculation about physiological roles of pineal organs in a few species, but it has proven difficult to formulate a pan vertebrate role for pineal organs. This situation may indicate that either pineal bodies do not have identical functions in different kinds of animals or that they participate in some central, fundamental, regulatory mechanism that underlines the operation of several different organ systems. If the latter is true, one might expect to discover subtle relationships between pineal organs and a number of physiological functions. Such appear to be the case, especially with regard to endocrine organs". Wurtman and Tay (1969) have conjectured pineal gland to be a neuroendocrine device, receiving exogenous and endogenous input and having outputs to several peripheral systems. Further, Quay (1969) thought that pineal organs are primarily concerned with the environment.

As an offshoot to the facts and speculations about the pineal functions, studies were initiated in this laboratory to understand the possible relationship if any between pineal and gonads together with other endocrines and also between pineal and metabolic physiology on a temporal basis in relation to seasonal reproductive cyclicity of wild feral blue rock pigeon, Columba livia (Patel, 1982). These studies revealed certain definite relationships between pineal and reproductive physiology on one hand and between pineal and other endocrine and nonendocrine organs and metabolic physiology on the other hand. Accordingly, a progonadal role for the pineal was suggested whereby presence of an intact pineal was shown to be essential for maintaining gonadal function during the breeding season. With reference to its relationship with thyroid and adrenals, antagonistic and synergistic interactions respectively were recorded. Probable interaction of pineal with other organs like pancreas, spleen and uropygium was also highlighted. Apart from these, definite alterations in the metabolic physiology in the form of hypeglycemia and reduced hepatic glycogen content together with suppressed mobilization of lipids from liver and muscle were also noted. Based on these observations Patel (1982) had hinted at the possibility of the pineal in wild pigeons having an anti-insulinic and anti avian pancreatic polypeptide role. Deviations from the normal adaptive modulations in the activity of various enzymes like SDH, G_6Pase, ATPase and the nonspecific phosphatases were also shown to occur due to pinealectomy. Further, pinealectomy in the wild pigeons also brought about alterations in ascorbic acid content and ions such as Na^+, K^+ and Ca^{++}. The evaluation of various parameters in the above study indicated that there are definite alterations in body physiology and total body economy in relation to reproductive cyclicity. Pinealectomy tended to interfere with the adaptive modulations in metabolic physiology associated with breeding thereby suggesting a possible indirect cause for the observed gonadal regression in pinealectomised wild pigeons.

It is known that some of the domestic varities of avian species have an antigonadal action of pineal and that domestication can totally modify or eliminate the influence of environment on reproduction. It was thought pertinent in this context to study the seasonal metabolic physiology of tropical domestic pigeons in relation to reproduction and the possible role of pineal in the same and compare the results that accrue with those outlined for wild pigeons previously.

The results obtained from the present study have again proved interesting in the sense the involvement of pineal in reproduction and associated metabolic physiology though very much in evidence, did nevertheless show same differences when compared with those observed for wild pigeons. The most significant outcome of the study is the realisation that the pineal in domestic pigeons is both progonadal as well as antigonadal unlike being only progonadal in the case of wild pigeons. Inferably pineal in domestic pigeons might be elaborating two different principles having season specific influence on the hypothalamo-hypophysio-gonadal axis. Such a conclusion can be drawn from the observed gonadal regression (in both sexes) after pineal ablation in the breeding season and gonadal enlargement and activation post-pinealectomy during the non-breeding season in the present study. Similar dual action of pineal i.e. progonadotropic during the breeding season and antigonadotropic during the non-bredding season has been reported by Saxena et al., (1979) on Indian Weaver birds. It is rather enigmatic as to how the same organ (pineal) can bring about diametrically opposite responses or even both within the same group of animals. In most of the temperate species of aves and mammals, long and short photoperiods are known to act through the pineal to induce gonadal recrudescence and regression respectively. The action of pineal on the hypothalamo-hypophysio-gonadal axis is essentially one of suppression exerted during short photoperiods. Predictably, the hypothalamo-hypophysio-gonadal axis is refractive to the action of pineal during long photoperiods. Moreover the pineal can also be considered to be functioning with reduced efficiency in this context. Though similar mechanisms can be considered to be operative in aves as well, it is however difficult to explain the progonadal role in some species, antigonadal actions in some and both in yet others. Both, the indolamine, melatonin and the polypeptide, arginine vasotocin (AVT) have been shown to possess gonad inhibiting capability in mammals (Tamarkin et al., 1977; Reiter, 1977; Reiter and Vaughan, 1977; Ebels and Benson, 1978). Speculations that the release of AVT from the pineal gland may be under the control of melatonin are also strife (Pavel, 1973; Reiter et al., 1976a). This speculative concept that an amine (melatonin) can bring about the release of a peptide (AVT) within the pineal is attractive as the hypothalamic releasing hormone polypeptides are also released in response to monoamines (Fuxe et al., 1976). AVT, interestingly has also been shown to suppress the release or action of pituitary gonadotrophins in rats (Pavel, et al., 1973) while stimulating prolactin release (Blask et al., 1976). Unidentified presumptive pineal polypeptides structurally distinct from AVT have also been shown to depress circulating levels of LH (Benson et al., 1972). Moreover counter antigonadotrophic actions of continuously available melatonin have also generated considerable interest (Hoffman, 1974; Reiter et al., 1974). Another possible site of action of pineal principles which has not yet been considered is on the gonads themselves directly, modulating the synthesis release or action of GnRH like substances, which in recent times have been increasingly realised as possible modulators of gonadal functioning. In the midst of these observations and speculations, the possible modes and sites of action of pineal principles in controlling gonadal physiology are multiple,and exact mechanism(s) involved in the progonadal, antigonadal or even both pro as well as antigonadal actions of avian pineal is anybody's guess. Only further searching studies on avian pineal and its relationship with gonads can solve the puzzles plaguing the pineal-gonad axis in birds.

Seasonal reproductive activities involve simultaneous activation and expression of many metabolic and other physiological and biochemical changes either as a cause or effect. Though a few of the physiological and metabolic changes may be the effect of gonadal activation, majority of them are however preparative causal alterations heralding gonadal recrudescence.

Such alterations are bound to affect not only the gonads themselves but even other organ systems of the body. Accordingly changes affecting carbohydrate metabolism of the body in general, quantitative and qualitative alteration in lipid distribution in the gonads, tissue ascorbic acid contents, ionic composition of the gonads, gonadal protein content and activity of phosphomonoesterases and steroid dehydrogenases have all been shown to occur in the course of present study on breeding biology of tropical Indian domestic pigeons. Some of the features associated with breeding worth recalling are 1) increased carbohydrate utilization 2) increased AA accumulation coupled with utilization in the gonads 3) reduction in Na^+ ion content coupled with increase in K^+ ion content in the gonads 4) reduced protein content and increased activity of acid and alkaline phosphatases and 5) reduction in histochemically demonstrable cholesterol positive lipids coupled with increased activity levels of steroid dehydrogenases. These observed changes occurring during the breeding season of domestic pigeons could at best be considered to set up a favourable "internal climate" for reproduction. It is obvious that most of these changes were also reported to occur as a package physiological deal even in the wild pigeons (Patel, 1982) and hence could be considered representative of adaptive breeding physiology characteristic of tropical pigeons. No doubt such widespread physiological changes cannot be thought to occur de novo, but should in no uncertain terms involve the participation of many extrinsic and intrinsic factors acting in sequence as a train of events which might in turn affect the functioning of the neuroendocrine orchestra and attune it in a favourable fashion to meet the needs of breeding activities. The favourable disposition of the neuroendocrine axis might alter the quantitative and qualtitative functioning of the various endocrines of the body and contribute to the heralding of the adaptive metabolic physiology associated with breeding. The endocrine pancreas, thyroid and adrenals are the important members of the vertebrate endocrine conglomerate having definite influence on metabolism and physiology of various organs. Justifiably, these three endocrines have been noted to undergo seasonal histomorphological alterations in the course of the present study in the form of decreased pancreas weight and parallel thyroid and adrenocortical activity in conjunction with gonadal activation during the breeding season. Apparently, increased thyroid hormone and increased adreno-cortico-medullary ratio together with the pancreatic hormones contribute significantly to the adaptive breeding physiology.

In the above discussed sequence of events purported to induce alterations in the neuroendocrine axis, pineal might be an essential link and could thereby play an important role in the evocation and expression of adaptive systemic changes. It is this hunch which had been followed up on the present study whereby pinealectomy during both breeding and non-breeding phases have been used as a tool. Interestingly pinealectomy successfully inhibited most of the changes ordained to occur during the breeding season and thereby contributed effectively to gonadal regression. This undeniably indicates the progonadal role of pineal in this species of bird. Surprisingly, pinealectomy performed during the non-breeding months led to a physiological stimulation characteristic of intact birds during the breeding season. This when viewed alongwith the gonadal activation noted to occur concomitantly, prophecy an antigonadal action too of the pineal of tropical domestic pigeons. This is in contradiction to an earlier observations on wild pigeons, where pinealectomy during the non-breeding season was not capable of reversing the gonadal regression, occuring at this period. Obviously the pineal has differential season specific interactions with the neuroendocrine axis in the wild and domestic varieties of tropical Indian pigeons. This is well borne out by the herein observed reverse set of changes affecting the various endocrine glands post-pinealectomy in the two seasons. Whereas pinealectomy induced increase in weight of pancreas during both the seasons (a little curious change), the thyroid and adrenal cortex showed decreased functional status during the breeding period with a concomitant increase in adreno-medullary activity. In contrast, birds pinealectomised during the non-breeding phase depicted increased thyroid activity as well as increased cortico-medullary ratio, a status characteristic of these glands in intact birds during the breeding season. When viewed with the corresponding functional status of the gonads, these changes tend to indicate a parallel adrenal-thyroid-gonadal axis in domestic pigeons. Since an intact pineal has a favourable influence on the parallel functioning of the above triad of endocrine conglomerate, as denoted by the functional suppression of them by pineal ablation during the breeding period, a pineal-thyroid-adrenal-gonad tetrad axis can be considered to be active in the breeding physiology of domestic pigeons. This axis can then be considered to be sensitive to the suppressive action of some pineal principles during the non-breeding period as could be visualised by the secondary activation that could be induced in thyroid, adrenal and gonads during the non-breeding season by pineal ablation.

As has been discussed earlier the breeding activities and gonadal activation are associated with many other favourable causative modulations in general body physiology which are under the purview of the endocrines such as pancreas, thyroid and adrenal. It has become apparent from the present studies that the presence of pineal during the breeding season and its absence during the non-breeding season of Indian domestic pigeons can both elicit similar physiological and metabolic modulations favourable for gonadal functioning. This is well illustrated by the observed suppression of breeding specific metabolic alterations noted in pinealectomised birds during the breeding season (which are more comparable with the physiological status of intact birds in the regression phase) and vice versa during the non-breeding season. The various threads of the present investigation when knitted together yields a fabric of realisation that the pineal in domestic pigeons secrete at least two if not more active principles having a definite say in the reproductive physiology of this species. The possible nature of these principles is at present far from clear and it may be hoped that in the coming years they would become amenable to experimental analysis and thus reveal themselves. The possibility exists that the same or even different pineal substance may influence the hypothalamo-hypophysio-gonadal axis on one hand and the thyroid-adrenal-gonadal axis on the other, and as such needs to be ascertained. It may also be hypothesised that whereas the pineal-hypothalamo-hypophysial interactions may have a direct bearing on gonadal functioning, the pineal-thyroid-adrenal interactions may have an indirect influence on gonadal structure and function by inducing the necessary favourable "physiological climate" for breeding.

An added diamension to the above interactions is the possible pineal-pancreas relationship which was well exemplified in wild pigeons (Patel, 1982). In the domestic pigeons too such a relationship can be inferred from the observed alterations in carbohydrate metabolism in pinealectomised pigeons. Based on the alterations in hepatic glycogen content and blood glucose noted to occur in pinealectomised wild pigeons on a season specific fashion, a tentative anti-insulinic and anti-avian pancreatic polypeptide action of pineal during the breeding season was suggested (Patel, 1982). This tentative concept has been more critically evaluated in the present study by glucose tolerance test (GTT), insulin response test (IRT), glucagon response test (GRT) and adrenalin response test (ART) in both intact and pinealectomised pigeons during breeding as well as non-breeding periods. The results obtained by these tests have amply demonstrated increased insulin sensitivity and adrenalin sensitivity in pigeon pinealectomised during the breeding phase. Obviously the intact pineal by its antagonistic influence on insulin release or insulin action might be favouring the maintainence of elevated blood glucose level and hepatic glycogenolysis, factors of probable crucial significance in meeting the energy demands associated with gonadal functioning. Significantly this anti-insulinic action of the pineal appears to be exerted only during the breeding season as pinealectomy or even the presence of it during the non-breeding period did not show any variation either in GTT, or IRT responses. The _in vitro_ slice experiments conducted herein have also revealed pinealectomy induced inhibition of glucose uptake and glycogen deposition by liver slices with no alteration in either glucose release or glycogen depletion. Interestingly, the muscle slices of pinealectomised birds were observed to possess potentially increased ability for glucose uptake in response to insulin thus suggesting an increased insulin sensitivity leading to increased peripheral utilization, a concept which was hinted previously based on the observation of decreased blood glucose level and decreased hepatic glycogen content in pinealectomised wild pigeons (Patel, 1982). The pineal-pancreas axis thus gains definite credence and similar studies need to be extended to domestic pigeons too so as to get a comparative idea of the relative importance and extent of involvement of pineal-pancreas axis in the two species of pigeons. It may be also worthwhile to design more experiments on this line so that a general concensus regarding the pineal-pancreas interaction in aves in general could be aimed at. The present studies have opened up possible new vistas and avenues of investigations on pinealology and it can be hoped that the future will reveal more and more of the hidden mysteries of this once considered enigmatic vestigeal organ.

Adam, H. 1957. Beitrag zur Kenntis der hirnventrikel und des ependyms bei Cyclostomen. Anat. Anz., 103 : 173-188 (cited by Wurtman et al., 1968).

Allen, J. M. and Slater, J. J. 1956. Influence of hormones upon the distribution of alkaline phosphatase in mouse adrenal cortex. J. Histochem. Cytochem., 4 : 110-117.

Ambadkar, P. M. and Chauhan, B. C. 1976. Observations on reproductive cycle of Indian house crow, Corvus splendens (Vieillot). I. Histomorphological study of annual testicular cycle. PAVO , 14 : 65-79.

Ambadkar, P. M. and Chauhan, B. C. 1977. Observations on reproductive cycle of Indian house crow, Corvus splendens (Vieillot). II. The annual ovarian cycle : Histomorphological and field study. PAVO, 15 : 48-72.

Ambadkar, P. M. and Gangaramani, N. F. 1981. Early influence of testosterone propionate administration on hepatic recovery in castrated male albino rats. J. Anim. Morphol. Physiol.,28 : 195-205.

Ambadkar, P. M. and Kotak, V. C. 1976. Observations on cyclic histochemical variations of lipids and steroid dehydrogenases in Testis of Feral blue rock pigeon, Columba livia. PAVO., 14 : 80-87.

Ambadkar, P. M. and Kotak, V. C. 1977. Seasonal variations of lipids and steroid dehydrogenases in the ovaries of Feral blue rock Pigeon, Columba livia. J. Anim. Morphol. Physiol., 24 : 118-126.

Andrews, M. J. and Turner, J. M. 1966. Pyridoxal and pyridoxamine phosphate break down by an acid phosphatase preparation. Nature - London, 210 : 1159.

Arendt, J., Symons, A. M., Laud, C. A. and Pryde, S. J. 1983. Melatonin can induce early onset of the breeding season in ewes. J. Endo., 97 : 395-400.

Ariens-Kappers, J. 1965. Survey of the innervation of the epiphysis cerebri and the accessory pineal organs of vertebrates. Progr. Brain. Res., 10 : 87-153.

Arvy, L. 1962. Presence d'une activitie steroido-3β-01-dehydrogenasiques dans l. ovaite de Cortunix cortunix L. et de Gallus gallus L. (Phasiandes, Galliformes). C. R. Ass. Anat., 54 : 50-62.

Asnani, M. V., Patel, P. V., Pilo, B. and Shah, R. V. 1976. Studies on developing avian liver 3. Ascorbic acid level in the liver and Kidney of pigeon during post hatching development, PAVO., 44 : 35-40.

Augustinsson, K. B. 1950. Acetylcholinesterase and cholinesterase. In : '<u>The Enzymes</u>' Summer, J. B. and Hyrback, K. (eds.), Vol.I, Part I, pp. 443-472. Academic Press, New York.

Ayyar, C. B. and Ramachandran, A. V. 1984. Adrenal suppression and gonad activity : Alterations in the protein content and activity of non-specific phosphomonoesterases in the wild pigeons, <u>Columba livia</u>. In : Abstracts 'Fourth Annual Symposium on Reproductive Biology and Comparative Endocrinology' Postgraduate Institute of Basic Medical Sciences, Madras.

Bacq, Z. M. and Alexander, P. 1961. "<u>Fundamentals of radiology</u>", Pergamon Press, New York.

Bailey, C. J., T. W. Atkims and A. J. Matty. 1974. Melatonin inhibition of insulin secretion in the rat and mouse. <u>Hormone Res.</u>, <u>5</u> : 21-28.

Baillie, A. H., Ferguson, M. M. and D. McK. Hart. 1966. "<u>Developments in steroid histochemistry</u>", Acad. Press, London and New York.

Balasubramanium, K. S. and Subramanium, R. S. 1978. Pineal, short photoperiods and reproduction. In : Abstracts 'Third all India Symposium on comparative endocrinology' Utkal University, Bhubaneshwar.

Balough, K. 1966. Histochemical demonstration of 3α hydroxy-steroid dehydrogenase activity. J. Histochem. Cytochem., 14 : 77-83.

Banerjee, A. B. and Ganguli, N. C. 1962. Metabolic studies on scorbutic guinea pigs. II Hepatic glycogen synthesis in vitro and in vivo. J. Biol. Chem., 237 : 14-18.

Banerjee, S. and Gosh, N. C. 1947. Relation of scurvy to glucose tolerance test, liver glycogen and insulin content of pancreas in Guinea pigs. J. Biol. Chem., 168 : 207-211.

Barfuss, D. W. and Ellis, L. C. 1971. Seasonal cycles in melatonin synthesis by the pineal gland as related to testicular function in the house sparrow. Gen. Comp. Endo., 17 : 183-193.

Barysan, U. M. 1980. Lipid metabolism in testicules of boars of different ages. VYESTSI AKAD NAVUK BSSR SYER SYEL SKAHASPAD NAVUK 0(3) : 121-124.

Bengt, S. 1979. Activity of adrenal glands in the pied fly catcher (Ficedula hypoleuca) and its relation to testicular regression. Gen. Comp. Endo., 38 : 162-171.

Benson, B., Matthews, M. J., and Rodin, A.E. 1972. Studies on a non-melatonin pineal antigonadotropin. Acta Endocr., 69 : 257-266.

Benson, B., Miller, C. W. and Sorrentino, S. 1971. Effects of blinding on blood glucose and serum insulin like activity in rats. Texas Rep. Biol. Med., 29 : 513-525.

Bhattacharya, T. K. and Gosh, A. 1965. In : "General endocrinology of the Adrenal Cortex" Edited by I. Chester Jones and I. W. Henderson, Volume I, 1976; Academic Press, London, New York, San Francisco.

Bhujle, B. V. and Nadkarni, V. B. 1974. In : Abstracts, Indo-French seminar on embryology and comparative endocrinology of reptiles (with a session on avian endocrinology) October 6-12th, Varanasi.

Bhujle, B. V. and Nadkarni, V. B. 1976. Steroid synthesizing cellular sites in the testis of crow-phescent, Centropus sinensis (Stephens). PAVO., 14 : 61-64.

Bialy, G. and Pincus, G. 1967. Hormonal influences on phosphatase activity of rat accessory sexual glands. Endocrinol., 81 : 1125-1131.

Binkley, S. 1979. Pineal rhythms in vivo and in vitro. Comp. Biochem. Physiol., 64A : 201-206.

Binkley, S., Kluth, E. and Menakar, M. 1971. Pineal function in sparrows : circadian rhythms and body temperature. Science, 174 : 311-314.

Biswas, N. M. and Deb, C. 1970. In vitro studies on the effects of ascorbic acid and dehydroascorbic acid on $\Delta^5 - 3\beta$ hydroxysteroid dehydrogenase in toad testis. Endocrinol. 87 : 170-173.

Blank, M. L. and Synder, F. L. 1970. Specificaties of alkaline and acid phosphatases in the dephosphorylation of phospholipids. Biochemistry., 9 : 5034-5036.

Blask, D. E., Vaughan, M. K., Reiter, R. J., Johnson, L. Y. and Vaughan, G. M. 1976. Prolactin-releasing and release-inhibiting factor activities in the bovine, rat, and human pineal gland : In vitro and in vivo studies. Endocrinol., 99 : 152-161.

Botte, V. 1963. La localizzazione della steroide 3β-Olo-dehydrogemasinell ovaio di pollo. Rend Ist. Uni. Camerino., 4 : 205-209.

Boucek, R. J. and Savard, K. 1970. Steroid formation by avian ovary in vitro (Gallus domesticus) Endocrinol., 7 : 292-303.

Bradfield, J. H. G.1951. Phosphatases and nucleic acids in skin glands, cytochemical aspects of fibrillar protein secretion. Quart. J. Micr. Sci., 92 : 87-112.

Burns, J. K. 1973. Serum sodium and potassium and blood glucose levels in cyamoglus monkeys after the administration of melatonin. J.Physiol.,232:84-85.

Cardinali, D. P. 1974. Melatonin and the endocrine role of the pineal gland. In : Current Topics in experimental endocrinology. 2 : 107-128.

V. H. T. James and L. Martini, eds. Academic Press, New York.

Cavazos, L. F. and Feagans, W. M. 1960. Histochemistry and composition of the male reproductive tract of the horned lizard as affected by seasonal variation. Anat. Record., 137 : 3.

Chalana, R. K. and Guraya, S. S. 1974. Histophysiology of steroidogenic tissue in avian ovary. In : Abs. 'Indo-French seminar on embryol. and comp endocrinol of reptiles' (with a session on avian endocrinol.), October 6-12, Varanasi.

Chalana, R. K. and Guraya, S. S. 1976a. Comparative seasonal histochemical observations on the ovarian steroidogenic tissue in birds. In : "Abstracts II All India Symposium on Comp Anim Physiol., Dec 13-15, Nagpur Univ.

Chalana, R. K. and Guraya, S. S. 1976b. Cyclic activity of the interstitial (or thecal) gland tissue in relation to follicular growth and atresia in the ovaries of birds. In : Abs. IV All India, Symp. on Comp. Endocrinol., Nov. 4-6, University of Mysore.

Chalana, R. K. and Guraya, S. S. 1977. Seasonal fluctuation of cholesterol in ovarian compartments of birds. *Ann. Biol. Anim. Bioch. Biophys.*, **17** : 1005-1011.

Chalana, R. K. and Guraya, S. S. 1978. Histophysiological studies on the post-ovulatory follicles of the fowl ovary. *Poult. Sci.*, **57** : 814-~~7~~817.

Chandola, A. and Thapliyal, J. P. 1974. Comparison of chemical, surgical and radiothyroidectomy in spotted Munia, *Lonchura Punctulata Gen. Comp. Endo.*, **22** : 128-131.

Chatturvedi, C. M. and Thapliyal, J. P. 1978. Effect of orchidectomy and male hormone administration on the adrenal of common myna *Acridotheres tristis. Ann Endocrinol.*, **39** : 417-420.

Chatturvedi, C. M. and Thapliyal, J. P. 1980. Light responses of thyroidectomy in common myna *Acriclotheres tristis. Gen Comp Endocrinol.*, **42** : 160-162.

Chen, H. J. 1981. Melatonin failure of pharmacological doses to induce testicular atrophy in male golden hamster. *Life Sci.* **28** : 767-772.

Chevremont, M. and Firket, H. 1953. Alkaline phosphatase of the nucleus. In : International review of cytology II. Bourne, G. N. and Dawelli, J. F. (eds.), Acad. Press, Inc. New York.

Chieffi, G. 1964. Distribution of cholesterol and Δ^5-3β-hydroxysteroid dehydrogenase in chick embryo gonad. Ric. Sci. (Biol)., 5 : 77-84.

Chieffi, G. and Botte, V. 1965. The distribution of some enzymes involved in the steroidogenesis of hen's ovary. Experientia, 21 : 16-17.

Chinoy, N. J. 1969. Source of electron energy for animal metabolism. I. Role of ascorbic acid in the metabolism of avian muscle. Histochemie., 19 : 125-128.

Chinoy, N. J. 1970. Source of electron energy for animal metabolism II. Role of ascrobic acid in the metabolism of insect tissues. The Nucleus., 13 : 55-58.

Chinoy, N. J. 1972a. Ascorbic acid levels in avian tissues and its metabolic significance. Acta Zool.,53 : 121-126.

Chinoy, N. J. 1972b. Ascorbic acid levels in mammalian tissues and its metabolic significance. Comp. Biochem.Physiol., 42(A) : 945-952.

Chinoy, N. J. and Rao, M. V. 1979. Inter-relationship between ascorbic acid and sex hormones in steroidogenic tissues and ascorbic acid synthesizing tissues of albino rats. J. Anim. Morphol. Physiol. ,26 : 36-43.

Chinoy, N. J. and Sheth, K. M. 1977. Effects of alloxan diabetes and insulin administration on the sex accessory gland function in male albino rats. J. Anim. Morphol. Physiol., 24 : 162-172.

Chinoy, N. J., Seethalakshmi, L. and Rao, M. V. 1978. Interaction of steroids with ascorbate via charge transfer complex function. 5th International Congress on hormonal steroids, New Delhi.

Chinoy, N. J., Rao, M. V. and Seethalakshmi, L. 1979. Effect of gonadectomy and sex hormone replacement on tissue distribution of ascorbate in male and female albino rats. Indian J. Exp. Biol., 17 : 1171-1175.

Chinoy, N. J., Sheth, K. M. and Shah, V. C. 1973. A comparative histophysiological study on the normal, castrated and testosterone treated levator ani muscle of rodents. Acta Endocrinol., 74 : 389-398.

Cogburn, L. A. and Harrison, P. C. 1980. Adrenal, Thyroid and rectal temperature response of pinealectomised cockerels to different ambient temperatures. Poult. Sci.,59: 1132-1141.

Cogburn, L. A., Harrison, P. C. and Brown, D. E. 1976. Scotophase-dependent thermoregulatory dysfunction in pinealectomised chickens. Proc. Soc. Exptl. Biol. Med., 153 : 197-201.

Cohen, S. R. 1970. In : Hand book of Neurochemistry Vol.III. Catabolic reactions in the nervous systems. Chapter 4. ed. Lajtha A. Plenum Press.

Collin, J. P. and Oksche, A. 1981. Structure and functional relationship in mammalian pineal gland. In : R. J. Reiter (ed.), The pineal gland, Vol.1 pp.27-67. C R C Press Boca Raton, Florida.

Colombo, G. and Marcus, F. 1973. Activation of fructose 1-6-diphosphatase by potassium ions: loss upon conversion of "neutral" to 'alkaline" form. J. Biol. Chem., 248 : 2743-2745.

Crawford, N. 1958. An improved method for the determination of free and total cholesterol using ferric chloride reaction. Clin. Chem.Acta., 3 : 357-367.

Csaba, G. and Barath, P. 1971. Are langerhan's islets influenced by the pineal body ? Experientia, 27:962.

Culleo, A. C. Hisano, N. and Traezzani, J. H. 1972. The pineal gland and the photosexual reflex in female ducks. Gen. Comp. Endocrinol., 18: 162-168.

Danielli, J. F. 1954. Proc. Roy. Soc. B., 142 : 146-154. Cited by Burstone, M. S. 1962 In : "Enzyme Histochemistry and its applications in the study of neoplasm" pp. 164 Acad. Press, New York.

Daniel, K. O. C.and Norman, Y. S. W. 1978. Effect of glucagon on the metabolism of the Eel (Angilla joponica). Gen. Comp Endocrinol., 35 : 216-225.

Dasgupta, P. and Bhattacharya, S. P. 1984. Histochemical localization and properties of acid phosphatase in testis of a passerine bird, Red-vented Bulbul (Pycnonotus Cafer Linnaeus). Indian J. Exp. Biol., 22 :81-83.

Davis, G. J. and Lynch, G. R. 1982. Diurnal rhythms response to chronic intrahypothalamic melatonin injections in the white footed mouse, (Peromyscus Leucopus). Neuroendocrinology, 35 : 117-122.

Deane, H. W. and Rubin, B. L. 1965. Arch. Anal. Microscop. Morphol. Exptl., cited by Baillie, A. H. et al., 1966.

Delahunty, G., Baues, G., Prack, M. and De Vlaming, V. 1978. Effect of pinealectomy and melatonin treatment on liver and plasma metabolites in gold fish, (Carassius auratus) Gen. Comp. Endocrinol., 35 : 99-109.

Denbow, D. M. and Edens, F. W. 1981. Body temperature response of young chicks to intraventricular injections of various cations and EGTA. Comp. Biochem. Physiol., 68A : 87-90.

Diel, J. F. and Jones, R. R. 1966. Effects of denervation and muscular dystrophy on amino acid transport in skeletal muscle. Amer. J. Physiol. 210 : 1080-1085.

Dipietro, D. L. and Zengerle, F. S. 1967. Separation of properties of three acid phosphatases from human placenta. J. Biol. Chem., 242 : 3391-3396.

Dittmer, J. C. and Wells, M. A. 1969. Quantitative and Qualitative analysis of lipids and lipid components In : Methods in Enzymology. Vol.XIV : 482-530. Lowestein, J. M. (ed.), Academic Press, New York.

Ebashi, S., Oosowa, F., Sakina, T., and Tonomura, Y. 1965. In "Molecular biology of muscular contraction.

Ebels, I. and Benson, B. 1978. A survey of the evidence that unidentified pineal substances affect the reproductive system in mammals. In : Pineal and reproduction. R. J. Reiter, ed. Karger, Basel.

Elena, D. 1980. Studies on hormonal and metabolic effects of pinealectomy in the rat. Rev. Roum. Med. Endocrinol., 18 : 3-14.

Elena, D. Olga, I. and Irina, B. 1979a. Effect of pinealectomy on testosterone, cholesterol and ascorbic acid in rat testis. Rev. Roum. Med. Endocrinol., 17 : 35-38.

Elena, D. Olga, I. and Irina, B. 1979b. Decrease of testosterone, cholesterol and ascorbic acid in rat testis after administration of pineal polypeptides. Rev. Roum. Med. Endocrinol., 17 : 109-112.

Espinal, J., Dohm, G. H. and Newsholme, E. A. 1983. Sensitivity to insulin of glycolysis and glycogen synthesis of isolated soleus-muscle strip from sedentary, excercised trained rats. Biochem. J. 212 : 453-458.

Ewing, L. L., Noble, D. J. and Ebner, K. E. 1964. Effect of epinephrine and competition betweem males on the in vitro metabolism of rabbit's testis. Can.J.Physiol.Pharmacol., 42 : 527.

Farrar, E. and Frye, B. E. 1977. Seasonal variation in the effects of adrenalin and glucagon in Rana pipiens. Gen. Comp Endocrinol., 33 : 76-81.

Farrar, E. and Frye, B. E. 1979. A comparison of adrenalin and glucagon effect on carbohydrate levels of larval and adult Rana pipiens. Gen.Comp. Endocrinol.,39: 372-380.

Fiske, C. H. and Subbarao, Y. 1925. The colorimetric determination of phosphorus. J.Biol.Chem.,66:375-400.

Folin, O. and Malmros, H. 1929. Micromethod for glucose estimation in blood. J. Biol. Chem., 83 : 115-120.

Friede, R. L. 1964. In : Topographical brain chemistry : Academic Press. New York, London.

Fuxe, K., Hokfelt, T., Lofstrom, Johansson, O., Agnati, L., Everitt, B., Goldstein, M., Jeffcoate, S., White, N., Eneroth, P., Gustafsson, J. A., and Skett, P. 1976. On the role of neurotransmitters and hypothalamic hormones and their interactions in hypothalamic and extra hypothalamic control of pituitary function and sexual behaviour. In : Subcellular mechanisms of Reproductive Neuroendocrinology., pp. 193-246, F. Naftolin, K. J. Ryan and J. Davies, eds. Elsevier, Amsterdam.

Garnier, D. H., A., Tixier-Vidal, R., Gourdji, D. and Picart, R. 1973. Ultra structure of the Leydig cells and sertoli cells in the testicular cycle of the pekin duck: Biochemical and cytoenzymological correlations. Z. Zellforsch. Mikrsk. Anat., 144 : 369-394.

Gaston, S. and Menakar, M. 1968. Pineal function. The biological clock in the sparrow. Science., 160 : 1125-1127.

Ghiretti, P. 1950. On the activity of acid and alkaline phosphatase during tail regeneration in Triturus cristatus (Laur). Experientia., 6 : 98-100.

Goldman, B., Hall, V., Hollister, C., Roychoudhury, P., Tamarkin, L. and Westrom, W. 1979. Effects of melatonin on the reproductive system in intact and pinealectomised male hamsters maintained under various photoperiods. Endocrinology., 181 : 82-88.

Goodwin, T. W. : Recent advances in biochemistry (Churchill, London, 1960).

Gorman, M. L. 1974. The endocrine basis of pair forming behaviour in male eider (Someteria mollissima). Ibis, 116:451-465.

Gundy, G. C. and Wurst, G. Z. 1976. The occurrence of parietal eyes in recent Lacertilia (Reptilia) J. Herpatlol. 10 : 113-121.

Guraya, S. S. 1976a. Comparative histochemical observations on steroid synthesizing cellular sites of non-mammalian vertebrates. Z. Mikrosk. Anat. Forsch (Leipz)., 90 : 705-719.

Guraya, S. S. 1976b. Morphological and histochemical observations on follicular atresia and interstitial gland tissue in the columbid ovary. Gen Comp. Endocrinol., 30 : 534-538.

Guraya, S. S. 1976c. Recent advances in the morphology, histochemistry and biochemistry of steroid synthesizing cellular sites in the non-mammalian vertebrate ovary. Int.Rev.Cytol.,44: 365-409.

Gwinner, E. 1978. Effect of pinealectomy on circadian locomotor activity rhythms in European starlings, (Sturnus Vulgaris). J Comp Physiol., 126A : 123-126.

Hafiez, A. A. and Bartke, A. 1972. Effect of hypophysectomy on cholesterol metabolism. J. Endo., 52 : 321-326.

Haldar, M. C. and Thapliyal, J. P. 1979. Pineal-adrenal relationship in a Lizard (Calotes versicolor). Gen.Comp Endocrinol., 39 : 414-416.

Haldar, C. and Thapliyal, J. P. 1980. Inverse seasonal cytological cycles in testis and pineal organs of the blood sucker (Calotes versicolar). Herpatologica, 36 : 116-119.

Haldar, C. and Thapliyal, J. P. 1981. Effect of melatonin on the testis and sexual segments in garden lizard (Calotes versicolor). Can J. Zool., 59 : 70-74.

Harri, M. and Hedenstam, R. 1972. Calorigenic effect of adrenaline and noradrenaline in the Frog. (Rana temporaria) Comp Biochem., 41A : 409-419.

Hazelwood, R. L. 1973. The avian endocrine pancreas. Amer. Zool., 13 : 699-709.

Hazelwood, R. L. 1977. "Pancreatic control of avian carbohydrate metabolism", In : Abstracts of the first International Symposium on Avian Endocrinology, Calcutta, India.

Heath, H. W. and Lynch, R. G. 1981. Effects of 18 weeks of daily melatonin injection on reproduction and temperature regulation in the mouse, (Peromyscus Leucopus) J. Exp. Zool., 216 : 193-196.

Heinrikson, R. L. 1969. Purification and characterisation of a low molecular weight acid phosphatase from bovine liver. J. Biol. Chem., 344 : 299-307.

Heubner, O. 1898. Tumor der glandular pinealis. Deut. Med. Wochschr 24 (pt.2) : 214-215.

Herbert, U. 1981. Effects of pinealectomy and melatonin on the photoperiodic gonadal response of the male Lizard (Anolis Carolinensis). J. Exp. Zool., 217 : 417-422.

Hilton, F. K. 1961. Relationships of testicular cholesterol to hormonal activity and behavior in the starling. Proc. Soc. Exptl. Biol. Med. 107 : 653.

Hofman, A. F. 1968. In : Hand book of physiology :"Alimentary canal secretion" Vol.2 ; (C. Code, ed.), Chapter 117 - pp. 2507-2533 In : General, comparative and clinal endocrinology of the adrenal cortex" Edited by I. Chester Jones and I. W. Henderson Volume 1. 1976, Academic Press, London, New York, San Francisco.

Hoffman, R. A. and Reiter, R. J. 1965. Pineal gland : Influence on gonads of male hamsters. Science. 148 : 1609-1611.

Hoffman , K. 1974. Testicular involution in short photoperiods inhibited by melatonin. Naturwissenschaften, 61:364-365.

Holmgren, N. 1918. Cited by Wurtman, R. J. and Axelrod, J. "The pineal gland". Sci. Amer. 213 : 50-60.

Homma, K., Mcfarland, L. Z. and Wilson, W. O. 1967. Responses of the reproductive organs of the Japanese quail to pinealectomy and melatonin injections. Poult Sci.,45: 314-319.

Houssay, A. B. and Pazo, J. H. 1968. Role of pituitary in the thyroid hypertrophy of pinealectomised rats. Experientia., 24 : 813-814.

Houssay, A. B., Pazo, J. H. and Epper, C. E. 1966a. Effects of the pineal gland upon the hair cycles in mice. Acta. Physiol. lantinoam., 16 : 202-205.

Houssay, A. B., Pazo, J. H. and Epper, C. E. 1966b. Effects of the pineal gland upon hair cycles in mice. J. Invet. Dermatol., 47 : 230-237.

Ishibashi, T., Hann, D. W., Srivastava, L., Kumaesan, P. and Turner C. W. 1966. Effect of pinealectomy and melatonin on feed consumption and Thyroid hormone secretion rate. Proc. Soc. Exptl. Biol. Med., 122 : 644-647.

Jallageas, M. and Assenmacher, I. 1974. Thyroid gonadal interactions in the male domestic duck in relationship with the sexual cycle Gen. Comp Endo., 22 : 13-20.

Jallageas, M., Tamisier, A. and Assenmacher, I. 1978. A comparative study of the annual cycles in sexual and thyroid function in male peking ducks, (Anas platyrhynchos) and Teal, (Anas Crecca). Gen. Comp. Endo., 36 : 201-210.

Jeejeebhoy, K. N., Joseph, H. O., Rajni, M. and Robertson, A.B. 1980. Hepatotropic effect of insulin on glucose, glycogen and adenine nucleotides in hepatocytes isolated from fasted adult rats. Gastroenterology, 78 : 556-570.

Jerry, V. 1978. Testing the TRH hypothesis of pineal function. Med. hypothesis., 4 : 376-387.

Jerry, V., Reiter, R. J. and Anderson, R. A. 1979. Effects of the pineal and melatonin on thyroid activity of male golden hamsters. Gen Comp Endo., 38 : 189-195.

Jerry, V., Richardson, B. A., Vaughan, M. K., Johnson, L. Y. and Reiter, R. J. 1982. Effects of melatonin on thyroid physiology of female hamsters. Neuroendocrinology.,35: 79-85.

Jiri, V. and Illnerova, H. 1982. Effect of photoperiod on the growth of reproductive organs and on pineal-N-acetyltransferase rhythm in male rats treated neonatally with testosterone propionate. Biol. Reprod.,27 : 517-522.

John, T. M., Beamish, F. W. H. and George, J. C. 1980. Diurnal variation in the effect of exogenous indolamines on blood metabolite levels in the rain bow trout, (Salmo gairdneri) Comp. Biochem. Physiol. C Comp. Pharmacol., 65: 105-110.

Johnson, A. D. 1970. Testicular Lipids in "The Testis" Vol.II Biochemistry (edts. A. D. Johnson, W. R. Gomes and N. L. Vandemark) Academic Press, New York and London.

Johnston, D. W. 1956. The annual reproductive cycle of the California gull. Part I and II, Condor., 58: 134-162, 206-222.

Johnson, O. W. 1961. Reproductive cycle of the Mallard duck. Condor., 63 : 351-364.

Johnston, P. G., and Zucker, I. 1980. Antigonadal effects of melatonin in white footed mice (Peromyscus Leucopus). Biol. Reprod., 23 : 1069-1074.

Joss, J. M. P. 1973. Pineal-gonadal relationship in the Lamprey, (Lampetra fluviatilis). Gen. Comp Endo., 21 : 118-122.

Karppanen, H., Vapaatalo, H., Lohovaars, S. and Paasonen, M.K. 1970. Studies with pinealectomised rats. Pharmacology., 3 : 76-84.

Karppanen, H. and Vapaatalo, H. 1971. Effect of an antagonist, Spironolactone, on pinealectomised rats. Pharmacology., 6 : 257-264.

Keller, J. and Alina, P. 1979. Glucagon effect on glycogen content of chicken liver and Muscle. Acta Physiol. Pol., 30 : 553-561.

Kellog, D. A. and Glenner, G. G. 1966. Histochemical localisation of human term placental 17β-Estradiol dehydrogenase reaction. Nature, 187 : 763.

Keele, C. A. and Neil, E. 1971. In "Samson Wright's applied physiology" 12th edition. English Language Book Society publication.

Kelly, D. E. 1968. Pineal anatomy. In : R. J. Wurtman, J. Axelrod and D. E. Kelly. The pineal, 1-45 Academic Press New York.

Kinsen, G. A. and Singer, B. 1967. The pineal gland and the adrenal response to sodium deficiency in the rat Neuroendocrinology., 2 : 283-293.

Kinsen, G., Wahid, A. K. and Singer, B. 1967. Effect of chronic pinealectomy on adreno-cortical hormone secretion rates in normal and hypertensive rats. Gen Comp Endo., 8 : 445-454.

Kitay, T. I. and Altchule, M. D. 1954. "The pineal gland : A review of the physiological literature" University Press, Harvad.

Klockars, M. and Wagelius, O. 1969. Lysosomal enzymes in regenerating rat liver. Proc. Soc. Exp. Biol. Med., 131 : 218-222.

Kotak, V. C. 1979. Certain histoenzymological and endocrinological observations on the reproductive cycles of indian feral blue rock pigeon, Columba livia . A Ph. D. Thesis submitted to M. S. University of Baroda, Baroda, India.

Kugler, O. E., Frankenstein, P. W. and Raffertz, K. A. Jr. 1956. Histochemical localization of alkaline phosphatase, glycogen and nucleic acid in the female reproductive organs of the Cockoach, (Periplanata americana). J. Morphol., 98 : 235 - 250.

Levey, I. L. 1973. Effects of pinealectomy and melatonin injections at different seasons on ovarian activity in the lizard, (Anolis Carolinensis). J. Exp. Zool., 185 : 169 - 174.

Levine, S. Z., Marples, E. and Gordon, H. 1941. In : "The vitamins" Vol.I. Sebrell, W. H. Jr. and Harris, R. S. Academic Press, New York, 1967.

Lewis, R. A. 1975a. Reproductive biology of the white crowned sparrow, (Zonotrichia Leucophrys Peugetensis Grinnel).1. Temporal organization of the reproductive and associated cycles. Condor., 77 : 46-59.

Lewis, R. A. 1975b. Reproductive biology of the white crowned sparrow II. Annual control of reproductive and associated cycles. Condor., 77 : 112-124.

Lofts, B. 1968. Patterns of testicular activity. In : Perspectives in endocrinology : Hormones im the lives of lower vertebrates" E. J. W. Barrington and C. B. Jrgenson, Eds., pp-239-304, Acad. Press, New York.

Lofts, B. and Lam, W. L. 1973. Circadian regulation of gonadotrophin secretion. J. Reprod. Fert., Suppl. 19 : 19.

Lofts, B. and Marshall, A. J. 1959. The post nuptial occurrence of progestins in the seminiferous tubules of birds. J. Endocrinol., 19 : 16-21.

Lofts, B. and Murton, R. K. 1973. Reproduction in birds. In "Avian biology" Vol. III Farner, D. S. and King, J. R., Eds., Academic Press, London and New York.

Loisel, G. 1903. Les graisses du testicule chez quelques mammiferes. Compt. Rend. Soc. Biol., 55 : 619.

Lowry, O. H., Rosenbrough, N. J., Fary, A. L., and Randall, R. J. 1951. Protein measurement with the Folin phenol reagent. J. Biol. Chem., 193 : 265-275.

Manimekalal, S. E. U. and Govindarajulu, P. 1980. Lipid Pattern in female reproductive tissues during different phases of estrous cycle. Ind. J. Physiol. Pharmacol.,23 : 333 - 341.

Mapson, L. W. 1953. Function of ascorbic acid in plants; Harris and Marrian (eds.). "Vitamins and Hormones" Vol. II, pp. 1-25 Academic Press, New York.

Marques, M. 1967. Effect of prolonged glucagon administration to turtle, (Chrysemysol orbignye). Gen Comp Endo., 9 : 102 - 109.

Marshall, A. J. 1949. On the function of interstitium of the testis. The sexual cycle of wild bird, (Fulmarus glacialis) (L.) Quart. J. Microscop. Sci., 90: 265.

Marshall, A. J. and Coombs, C. J. F. 1957. The interaction of environmental, internal and behavioural factors in Rook, (Corvus frugilegus). Proc. Zool. Soc. Lon.,128 :545-589.

Massie, E. D. 1968. Thyroid hormone effects on testicular metabolism and function. Masters Thesis, Ohio State University, Columbus, Ohio.

Mazur, A., Carleton, A. and Carlsen, A. 1961. Relation of oxidative metabolism to the incorporation of plasma iron ferritin in vitro. J. Biol. Chem., 236 : 1109-1116.

McBride, S. E. and Ralph, C. L. 1972. Is the pineal a biological clock in birds ? Am. Zool.,12: 34.

Mc Cord, C. P. and Allen, F. P. 1927. Cited by : Wurtman, R.J. and Axelrod, J. 1965a. "The pineal gland" Sci.Amer., 213 : 50 - 60.

Mc Farland, L. Z., Wilson, W. O. and Winget, C. M. 1969. Response of the chicken pineal gland, blood and reproductive organs to darkness. Poult. Sci., XIVIII.

McKeown, B. A., John, T. M. and George, J. C. 1975. Diurnal variation in effect of melatonin on plasma growth hormone and glucose in the Pigeon. Endocrinol. Exp., 9 : 263-268.

McMillan, J. 1972. Pinealectomy ablishes the circadian rhythm of migratory restlessness. J. Comp. Physiol., 70 :105-112.

McPherson, R. J. and Marion, K. R. 1982. Seasonal changes of total lipid in the Turtle (Sternotherus odoratus). Comp. Biochem. Physiol., 71A : 93-98.

Mieiklejohn, A. P. 1953. The physiology and biochemistry of ascorbic acid. In : "Vitamins and Hormones". Vol.XI, pp. 61-96. Harris, R. S. and Marrian, G. E. (eds.), Academic Press, New York.

Menakar, M. and Zimmerman, N. 1976. Role of the pineal in the circadian system of birds. Am. Zool., 16 : 45-55.

Mihail, N. and Giurgea, R. 1979. Aspects of carbohydrate metabolism after pinealectomy in normal and pancreactomised Pigeon, (Columba livia). Rev. Roum. Med. Endocrinol., 17 : 255 - 258.

Miller, M. R. and Lagios, M. D. 1970. The Pancreas In : Biology of the Reptilia (eds.) C. Gans. Vol.3. pp.319-346. Academic Press London, New York.

Misra, C. and Thapliyal, J. P. 1980. Effect of enucleation, pinealectomy and photoperiods on pineal and gonad of the lizard (Calotes versicolor). Indian J. Exp. Biol., 18 : 682 - 685.

Mondon, C. E. and Burton, S. D. 1971. Factors modifying carbohydrate metabolism and effect of insulin in perfused rat liver. Amer. J. Physiol., 220 : 724 - 734.

Moog, F. 1946. The physiological significance of the phosphomonoesterases. Biol.Rev., 21 : 41 - 59.

Mori, J. G. and George, J. C. 1978. Seasonal histological changes in the gonads, thyroids and adrenals of the canada goose, (Branta canadensis). Acta Anat., 101 : 304-324.

Mortimore, G. E., King, E., Mondon, C. E. and Glinsmann, W.H. 1967. Effects of insulin on net carbohydrate alterations in perfused rat liver. Am. J. Physiol., 212 : 179-183.

Motta, M., Fraschini, F. and Martini, L. 1967. Endocrine effects of pineal gland and of melatonin. Proc. Soc. Exptl. Biol. Med., 126 431-435.

Moura, J. L., Menezes, C. E. L., Veiga, J. A. S., Langoni, H. and Linder, C. 1982. glycemic and lipolytic response to the action of epinephrine and norepinephrine in the Pigeon. CIENC CULT (SAO PAULO) 34 : 58 - 63.

Mukherjee, D. and Bhattacharya, S. 1982. Ovarian cholesterol dynamics in teleost, (Channa punctatus) Bloch : Relationship with reproductive cycle and response to gonadotrophins. Gen Comp Endo., 46 : 141 - 149.

Murlidhar, S. S., Dayal, C. S. Rameshbabu and S. R. Arora. 1983. Effect of melatonin on glucose tolerance and blood glucose circadian rhythm in Rabbits. Ind. J. Physiol. Pharmacol., 27 : 209 - 217.

Narbiatz, R. and De Robertis, E. M. 1968. Post-natal evolution of steroidogenic cells in the chick ovary. Histochemie., 15 : 187 - 193.

Narbiatz, R. and Kolodny, L. 1964. Δ^5 3β-OH-Steroid dehydrogenase in differentiating chick gonads. Z. Zellforsch., 63 : 612 - 617.

Narang, G. D., Singh, D. V. and Turner, C. W. 1967. Effect of melatonin on thyroid hormone secretion rate and feed consumption of female rats. Proc. Soc. exptl. Biol. Med., 125 : 184 - 188.

Nathani, M. G., Idrees, B., Nath, N., Daginewala, H. F. and Nath, M. C. 1971. Ascorbic acid metabolism in adrenalectomised rats. Metabolism., 20 : 1036-1043.

Ogle, T. F. and Kitay, J. I. 1976. Effect of pinealectomy on adrenal function in vivo and in vitro in female rats. Endocrinology., 98 : 20 - 24.

Oishi, T. and Konishi, T. 1978. Effects of photoperiod and temperature on testicular and thyroid activity of Japanese quail. General & Comp. Endocrinol.,36 : 250-254.

Oksche, A. 1965. Survey of the development and comparative morphology of the pineal organ. In : Structure and Function of the Epiphysis Cerebri. (J. Ariens-Kappers and J. P. Schade, eds.) pp. 3-29. Elsevier,Amsterdam.

Park, C. R. 1981. Regulation of hepatic glucose output : Some current concepts. J JPN DIABETIC SOC 24 : 1051-1063.

Parton, C. I. and Parton, C. 1922. Sur L inuolation estivale des caractres scrueles seandarires du plumage chez le canard male et sur les modifications parellelles du testicule chez le meme animal·Comp. Rend. Soc.Biol., 87 : 227

Patel, C. D. 1982. Certain investigations on the involvement of pineal in general metabolism and seasonal physiology of the feral blue rock pigeon, Columba livia. A Ph. D. Thesis submitted to M. S. University of Baroda,Baroda, India.

Pavel, S. 1973. Arginine vasotocin release into cerebrospinal fluid of cats induced by melatonin. Nature.,246:183-184.

Pavel, S., Petrescu, M. and Vicoleanu, N. 1973. Evidence of central gonadotrophin inhibiting activity of arginine vasotocin in the female mouse. Neuroendocrinology., 11 : 370 - 374.

Pearce, A. G. E. 1968. Histochemistry Theoretical and Applied. J & A Churchil Ltd., London.

Petterborg, L. J., Reiter, R. J. and Brainard, G. C. 1981. Ovarian response of pinealectomized and intact white-footed mice. (Peromyscus leucopus) kept under naturally short photoperiod. Experientia (BASEL)., 37 : 247.

Pevet, P. C., Haldar, M. and Ocal, T. 1981. The independency of an intact pineal gland of the inhibition by 5-Methoxytryptamine of reproductive organs in male hamster. J. Neural Transm., 52 : 95 - 106.

Pilo, B. and Patel, P. V. 1978a. Neuroendocrine control of uptake and metabolism of glucose in avian liver. PAVO, 16 : 162 - 178.

Pilo, B. and Patel, P. V. 1978b. Influence of insulin and acetylcholine on transport of glucose and deposition in liver slices of pigeon and rat. Indian J. Exp. Biol., 16 : 929 - 932.

Pitis, M., Nicolescu, A. and Tasca, C. 1970. Effect of pinealectomy on the gonads in newly born and immature rats. Rev. Roum. Endocrinol., 7 : 37-41.

Plager, J. E. and Matsui, N. 1966. An in vitro demonstration of the anti-insulin action of cortisol on glucose metabolism. Endocrinology., 78 : 1154 - 1158.

Purohit, V. D., Barrur, P. K. and Bhatnagar, M. K. 1977. Histochemical localisation of chicken 3β hydroxysteroid dehydrogenase in the testis of chicken-pheasent hybrids. Histochem. J., 9 : 293 - 299.

Quay, W. B. 1965. Experimental evidence for pineal participation in homeostasis of brain composition. Progr. Brain. Res., 10 : 646 - 653.

Quay, W. B. 1969. The role of the pineal gland in environmental adaptation. In Physiology and pathology of adaptation. Mechanisms: Neural-Neuroendocrine-Hunoral. Bajusz, E. (eds.). pp. 508 - 550.

Quay, W. B. 1974. Pineal Chemistry. Carles C. Thomas, Springfield, Illinois.

Quay, W. B. 1976. Seasonal cycle and physiological correlates of pinealocyte nuclear and nucleolar diameters in the bats, Myotis lucifugus and Myotis Sodalis. Gen. Comp. Endocrinol., 29 : 369 - 375.

Quay, W. B., Payer, A. F., Parkening, T. A., Barerji, T. K. and Collins, T. J. 1982. Melatonin inhibition of pituitary adrenal, testicular and accessory gland growth in male golden hamsters: Pineal dependence and organ differences with shielding and intracranial surgery. J. Neural Transm., 53 : 59 - 74.

Rackallio, J. 1970. Enzyme histochemistry of wound healing Prog. Histochem. Cytochem., 1 : 1 - 101.

Ralph, C. L. 1970. Structure and alleged function of avian pineals. Amer. Zool., 10 : 217 - 235.

Ralph, C. L. 1975. The pineal gland and geographical distribution of animals. Int. J. Biometerol., 19 : 289-303.

Ralph, C. L. 1976. Correlations of melatonin contents in pineal gland, blood and brain of some birds and mammals. Amer. Zool., 16 : 35 - 43.

Ralph, C. L. 1983. Evolution of pineal control of endocrine function in lower vertebrates. Amer. Zool., 23 : 597-605.

Ralph, C. L., Firth, B. T., Gern, W. A. and Owens, D. 1979a. Pineal complex and Thermoregulation. Biol. Rev.,54: 41 - 72.

Ralph, C. L., Firth, B. T. and Turner, J. S. 1979b. The role of the pineal body in ectotherm Thermoregulation. Amer Zool., 19 : 273 - 293.

Ramachandran, A. V., Patel, C. D., Asnani, M. V. and Shah, R.V., 1984a. Seasonal histometric alterations of the gonads of normal and pinealectomised feral blue rock pigeons Columba livia (Gmelin) Communicated for Indian J. Exp. Biol.

Ramachandran, A. V., Patel, C. D., Asnani, M. V. and Shah, R. V. 1984b. Seasonal histometric alterations of the thyroid and adrenals of normal and pinealectomized feral blue rock pigeons Columba livia (Gmelin) Communicated for Indian J. Exp. Biol.

Ramachandran, A. V., Patel, C. D. and Shah, R. V. 1984c. Seasonal quantitative alterations in glycogen and phosphorylase activity in liver and muscle of normal and pinealectomized feral blue rock pigeons Columba livia Communicated for J. Anim. Physiol. Zool.

Ramachandran, A. V., Radhakrishnan, N. and Shah, R. V. 1975. Cytochrome oxidase and ascorbic acid in the normal and regenerating tail of the scincid lizard, Mabuya Carinata Acta anat., 93 : 411 - 420.

Rasmussen, H. 1975. Mechanism of hormone action, In : Endocrinology and Diabetes. Kryston, L. J. and Shaw, R. A. Published by Grune and Stratton publishers, New York, San Franscisco, London.

Reddy, P. R. K., Prasad, M. R. N. and Misra, U. K. 1972. Seasonal variations in the pattern of lipids in the sexual segment, kidney and liver of the Indian house lizard, Hemidecytlus flaviviridis. Comp. Biochem. Physiol., 41 : 63 - 76.

Reiter, R. J. 1968. Morphological studies on the reproductive organs of blinded male hamsters and the effects of pinealectomy or superior cervical ganglionectomy. Anat. Rec., 160 : 13 - 24.

Reiter, R. J. 1974. Circannual reproductive rhythms in mammals related to photoperiod and pineal function : a review. Chromobiologica., 1 : 365 - 395.

Reiter, R. J. 1975. Exogenous and endogenous control of the annual reproductive cycle in the male golden hamster : Participation of the pineal gland J. Exp. Zool., 191 : 111 - 120.

Reiter, R. J. 1977. "The Pineal." Eden Press, Montreal.

Reiter, R. J. 1978. Interaction of photoperiod and seasonal reproduction as exemplified by blinding in the hamster. In : The Pineal and reproduction, progress in Reproductive Biology (ed., Reiter, R. J.), Vol.4, S. Karger, Basel.

Reiter, R. J. 1980. Photoperiod : Its importance as an impeller of pineal and seasonal reproductive rhythms. Biometeorol., 24 : 57 - 64.

Reiter, R. J. and Vaughan, M. K. 1977. Pineal antigonadotrophic substances : Polypeptides and indoles. Life Sci., 21 : 159 - 172.

Reiter, R. J., Vaughan, M. K., Blask, D. E. and Johnson, L. Y. 1974. Melatonin : Its inhibition of pineal antigonadotrophic activity in male hamsters. Science., 185 : 1169 - 1171.

Reiter, R. J., Lukaszyk, A. J., Vaughan, M. K. and Blask, D.E. 1976. New horizons of pineal research. Amer. Zool., 16 : 93 - 101.

Rene Descartes. 1646. Cited by Reiter, R. J. 1970. A precis of the pineal odyssy. Amer. Zool., 10 : 189 - 190.

Richard, H. N. and Weir, G. C. 1979. Insulin stimulates somatostatin and inhibits glucagon secretion from the perfused chicken pancreas-duodenum., Life Sci., 24 : 1747 - 1750.

Riddle, O. 1923. Studies on the reproduction in birds. XIV. Suprarenal hypertrophy coincident with ovulation. Amer. J. Physiol., 66 : 322 - 329.

Roe, J. H. 1954. Chemical determination of ascorbic acid. In : Methods of Biochemical Analysis. Vol. I, Glick, D. (ed.) New York, Interscience publishers.

Rogers, K. T. 1960. Studies on chick brain of biochemical differentiation related to morphological differentiation and onset of function. Histochemical localisation of alkaline phosphatase J. Exp. Zool., 145 : 49 - 59.

Rosenthal, I. M., Bonting, S. L. Hogan, W. and Pirani, C. L. 1960. A.M.A.J. Diseases Children., 99 : 185-192. (Cited by Burstone, 1968).

Rusch, H. P. and Kline, B. E. 1941. The inhibition of phospholipid oxidation by carcinogenic and related compounds. Cancer Res., 1 : 465 - 472.

Rutledge, J. T. and Angle, M. J. 1977. Persistance of circadian activity rhythms in pinealectomised European starlings (Sturnus vulgaris) J. Exp. Zool. 19 : 341 - 348.

Salmon, L. I. and Stubbs, D. W. 1961. The defect in ascorbic acid synthesis by hypophysectomized rats. Biochem. Biophys. Res. Commun., 4 : 239.

Samuels, L. T., Helmreich, M., Lasater, M. and Reich, H. 1951. An enzyme in endocrine tissue which oxidizes Δ^5-3β hydroxysteroid to α, β unsaturated ketones. Science,, 113 : 490.

Sandy, S. and Russel, J. R. 1971. Lack of Pineal-Induced gonadal regression in dark exposed or blind hamsters after surgical isolation of the Medial-Basal Hypothalamus. Gen. Comp. Endo., 17 : 227 - 231.

Sayler, A. and Wolfson, A. 1967. Avian Pineal gland : Progonadotropic response in the Japanese quail. Science. 158 : 1478 - 1479.

Sayler, A. and Wolfson, A. 1968. Influence of the pineal gland on gonadal maturation in the Japanese quail. Endocrinology., 83 : 1237 - 1246.

Sayler, A., Dowd, A. J. and Wolfson, A. 1970. Influence of photoperiod on the localisation of Δ^5 3β hydroxy steroid dehydrogenase in the ovaries of maturing Japanese quail. Gen. Comp. Endo., 15 : 20 - 30.

Saxena, R. N., Malhotra, L., Ravikant and Baweja, P. K. 1979. Effect of pinealectomy and seasonal changes in pineal antigonadotropic activity of male Indian weaver bird (Ploceus philipinus). Indian J. Exp. Biol., 17 : 732-735.

Scott, D. M. and Middleton, A. L. A. 1968. The annual cycle of the brown headed cow bird (Molothrus ater) Can. J. Zool., 46 : 77 - 87.

Seifter, S., Dayton, S. Novic, B. and Muntwyler, E. 1950. The estimation of glycogen with anthrone reagent. Arch. Biochem., 25 : 191 - 200.

Setchell, B. P., Wailes, G. M. H., and Linducr, H. R. 1965. Effect of undernutrition in testicular blood flow and metabolism and the output of testosterone in the ram. J. Reprod. Fertility., 9 : 149.

Shellabarger, C. J. 1953. Observation of the pineal in white leghorn cappon and cockerel Poultry Science., 32 : 189 - 197.

Sheth, K. M. and Chinoy, N. J. 1977. Effects of cold and heat stress on secretory activity of sex accessory reproductive glands of male albino rats. J.Anim.Morphol.Physiol., 24 : 173 - 185.

Sigma Technical Bulletin, No. 104, Sigma Chem. Co., 3500. Dekalb. St., St. Louis 18, Mo. U.S.A.

Silverin, B. 1973. Mechanisms regulating breeding in birds. Zool. Revy., 35 : 51 - 56.

Silverin, B. 1975. Reproductive organs and breeding behaviour of the male pied flycatcher *Ficedula hypoleuca* (Pallar) Ornis. Scand., 6 : 15 - 26.

Shimazu, T. 1967. Glycogen synthetase activity in liver regulation by the autonomic nerves. Science., 156 : 1256-1257.

Simkiss, K. 1964. Phosphatase as crystal poisons of calcification. Biol. Rev. 39 : 487 - 503.

Sinha, R. C. 1982. Effects of gonadal hormones on the lipid metabolism of the frog *Rana esculenta*. Experientia (Basel), 39 : 1066 - 1067.

Singh, A. K. and Prasad, G. C. 1981. *In vivo* and *in vitro* studies on the pineal-Thyroid relationship. Indian J. Med. Res.74 : 420 - 427.

Skinner, J. D., Vanzyl, J. H. M. and Van Heerden, J. A. H. 1973. The effect of season on reproduction in the black wildebeest and red hartebeest in south Africa. J. Reprod. Fert., Suppl. 19 : 101 - 110.

Smith, M. J. and Brereton, Le, G. J. 1976. Annual gonad cycle in the eastern rosella, platycercus eximinus (Psitaciformes platycercidae). Aus. J. Zool., 24 : 541-556.

Sols, A. 1949. Fosfatases Revision de la literature de 1947-1948. R. esp. Fisiol., 5 : 57 - 129.

Stalsberg, H. 1965. Effects of extirpation of the epiphysis cerebri in 6-day chick embryo. Acta Endocrinol.Suppl., 97 : 1 - 119.

Stettan, M. R. 1964. Metabolism of inorganic phosphate .1. Microsomal inorganic pyrophosphate phosphotransferase of rat liver. J. Biol. Chem., 239 : 3576 - 3583.

Stetson, M. H., Watson, W. M. and Tale, D. B. 1983. Role of pineal and its hormone melatonin in the termination of photorefractoriness in golden hamsters. Biol. Reprod., 29 : 689 - 696.

Straus, W. 1964. Occurrence of phagosome and phagolysosomes in different segments of the nephron in transport, digestion and extrusion of intravenously injected horse radish peroxidase. J. Cell. Biol., 21 : 295 - 308.

Srere, P. A., Chaikoff, I. L., Treitman, S. S. and Burstein,L. S. 1950. The extrahepatic synthesis of cholesterol. J. Biol. Chem., 182 : 629.

Szent Gyorgyii. 1957. Bioenergetics. Acad. Press. New York.

Tamarkin, L., Lefebvre, N. G., Hollister, C. W. and Goldman, B. D. 1977. Effect of melatonin administered during the night on reproductive function in the syrian hamster. Endocrinol., 101 : 631 - 634.

Tanner, W. D. and Hungerford, G. F. 1962. Sodium and potassium excretion in pinealectomised and adrenalectomised rats. Proc. Soc. Exp. Biol. Med., 109 : 388 - 396.

Thapliyal, J. P. and Pandha, S. K. 1967. The thyroid and the hypophysial gonadal axis in the female spotted munia, (Uroloncha Punctulata). Gen Comp. Endo., 8 : 84 - 93.

Thapliyal, J. P., Pati, A. K., Singh, V. K. and Lal, P. 1982. Thyroid, gonad and photoperiod in the hemopoiesis of the migratory Red-headed bunting, (Emberiza bruniceps) Gen. Comp. Endo., 46 : 327 - 332.

Threadgold, L. T. 1956. The annual gonad cycle of the male jackdaw, Corvus monedulus : Quantitative aspects. La celluli., 58 : 45 - 54.

Tingari, M. D. 1973. Histochemical localisation of 3β-and 17β-hydroxysteroid dehydrogenases in the male reproductive tract of the domestic fowl, (Gallus domesticus). Histochemie J. 5 : 57 - 65.

Tomkins, G. M. and Isselbacher, K. J. 1954. Enzymic reduction of cortisone. J. Am. Chem. Soc., 76 : 3100-3101.

Urasaki, H. 1973. Effect of pinealectomy and photoperiod on oviposition and gonadal development in the fish, (*Oryzias Latipes*). *J. Exp. Zool.*, 185 : 241 - 246.

Urry, R. L., Kathryn, A., Dougherty, J. L. F. and Ellis, L. C. 1976. Factors other than light affecting the pineal gland : Hypophysectomy, Testosterone, Dihydrostosterone, Estradiol, Cryptochidism and stress. *Amer. Zool.*, 16: 79 - 91.

Vaughan, M. K., Vaughan, G. M., Blask, D. E., Barnett, M. P. and Reiter, R. J. 1976. Arginine vasotocin : Structure-activity relationship and influence on gonadal growth and function. *Amer. Zool.*, 16 : 25 - 34.

Vlaming, V. L., Vodicnik, M. J., Meyer, R. A. and Meyer, M. H. 1979. Effect of pinealectomy on serum K^+ and Cl^- levels in Gold fish, (*Carassius auratus*) *Gen Comp Endo.*, 37 : 131 - 133.

Wattenberg, L. W. 1958. Microscopic histochemical demonstration of steroid 3β-Ol-dehydrogenase in tissue reaction. *J. Histochem. Cytochem.*, 6 : 225-232.

Weber, R. and Nichus, B. 1961. The acid phosphatase activity in the tail of xenopus larva during growth and metamorphosis. *Helv. Physiol. Acta.*, 19 : 103 - 117.

Wilbrandt, W. 1975. Energetics of sugar transport In : "Comparative physiology-Functional aspect of structural materials". Bolis, L., Maddrell, H. P., Schmidt-Nielson, K. (eds.) North Holland Publishing Company, Amsterdam.

Woods, J. E. and Domm, L. V. 1966. A histochemical identification of the androgen producing cells in the gonads of the domestic fowl and albino rats. Gen Comp Endo., 7 :559-570.

Wurtman, R. J. 1973. Introduction : Neuro-transmitters and monoamines. Fed. Proc., 32 : 1769 - 1772.

Wurtman, R. J. and Axelrod, J. 1965. "The pineal gland." Sci.Am., 213 : 50 - 60.

Wurtman, R. J. and Tay-Anton, F. 1969. The mammalian pineal as a neuro-endocrine transducer. Recent Progress in Hormone Research., 25 : 493 - 522.

Wurtman, R. J., Axelrod, J. and Barchas, J. D. 1964. Age and enzyme activity in the human pineal. J. Clin. Endocrinol. Metab. 24 : 299 - 301.

Wurtman, R. J., Axelrod, J. and Kelly, D. E. 1968. "The pineal gland". pp. 145 . Academic Press, New York.