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ENDOCRINOLOGICAL AND PHOTOPERIODIC INDICES OF AVIAN MIGRATORY BEHAVIOUR —— Birds of migration posses two important indices — one is known as "ZUGUNRUHE" or migratory restlessness and other as "ZUGDISPOSTION" or migratory fattening.

It has been established that if the migratory flight of bird is prevented, the migrants display an intense madness like manner by jumping, whirling and flattering. This display is called "ZUGUNRUHE" or migratory restlessness (Fig-1). Simultaneously before these migratory flight the body weight reaches its maximum due to enormous deposition of fat in their body twice a year. This fat reserve serves as a fuel for this journey. The percentage of fat deposition is directly related with distant and short migration. The deposition is more in distant migrants than the short-migrants.

The relationship between the gonads, premigratory fattening and migratory behaviour has been studied experimently. In white-throated and the white-crowned sparrow castration prior to exposure to long days prevents migratory

fattening, but castration performed after some photostimulation does not interfere with premigratory fat deposition (Wingfield and Farner, 1980). Castration delays and shortens the zugunruhe and reduces its intensity, but does not eliminate it (Wingfield and Farner, 1980) and in white-crowned sparrows, it does not affect the autumnal fat deposition. In male and female white-crowned sparrows, the plasma testosterone concentrations are similar early during vernal migration. Therefore, it may be that testosterone induces hyperphagia. If this is indeed the case, then testosterone has quite a different effect in these species and at this time than its usual nitrogen-retention effect.

The endocrinology of the migration of the white-throated sparrow (Zonotrichia albicollis) has been elucidated by Meier (1976).

The interactions between photoperiod and the endocrine responses that ensue, and the subsequent effects on body fat stores, gonadal size, migratory activity, and the orientation of the birds during migration can be explained by the following chart →

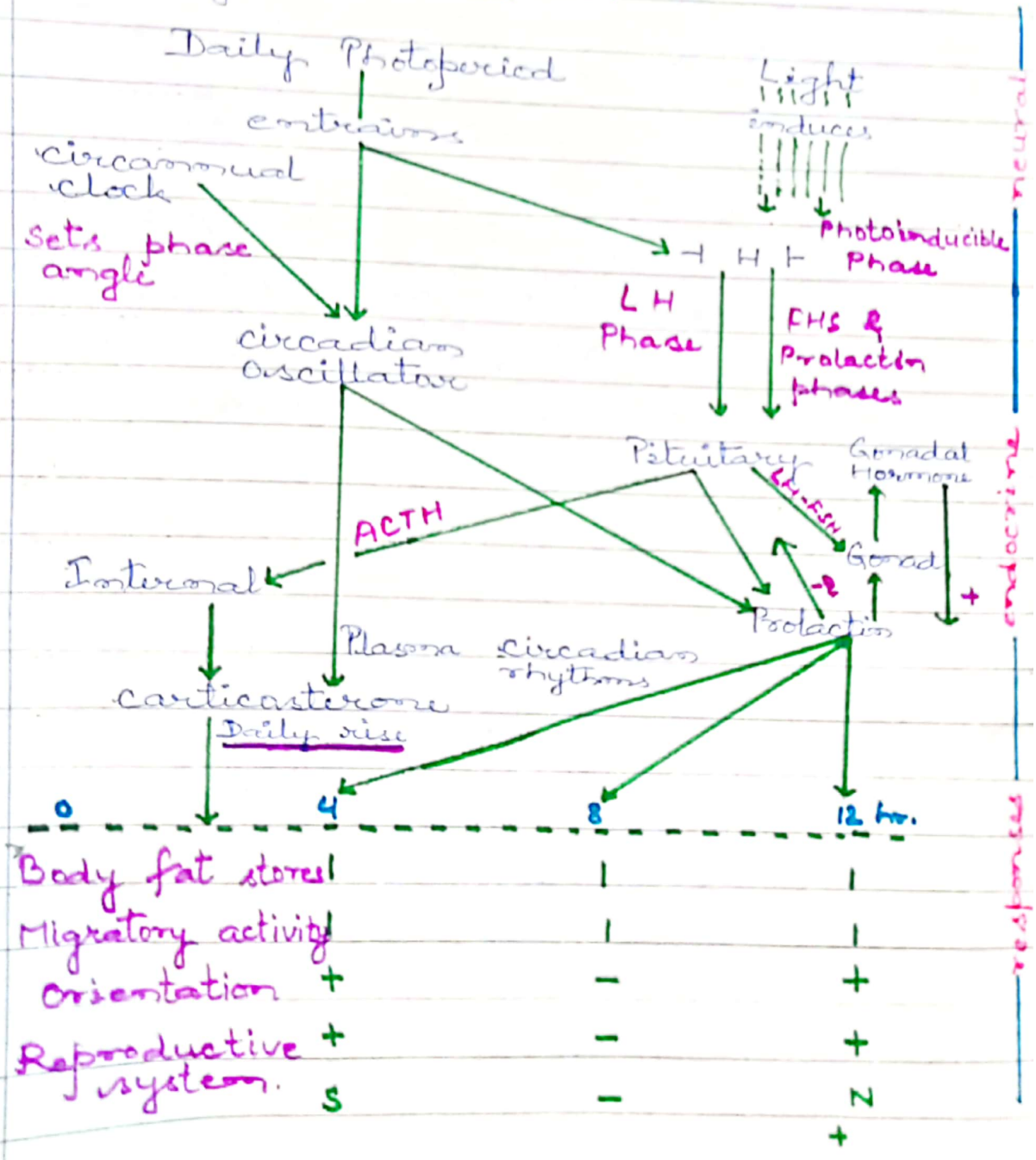

Fig:- Circadian and circannual elements regulating reproductive and migratory conditions in the white-throated sparrow (From, Meier, 1976; reprinted with permission of the Australian Academy of Science)

According to this scheme, there is a circannual clock (i.e. an endogenous clock with a period of about one year), which sets the phase angle of a circadian oscillator (i.e. an endogenous oscillator with a period of about 24 hours) for the release of corticosterone and prolactin. The daily photoperiod entrains the circadian oscillator, so that it has a period of exactly 24 hrs. and it entrains the photoinducible phase for the stimulation of LH and FSH plus prolactin secretion in response to light. The sensitivity of the central nervous system (CNS) AP axis to stimulation by light varies

during the 24 hrs. day, and that the daily photoperiod is its entraining mode determines at what period of the day the CNS-AP system will respond to light by the secretion of the pituitary gonadotrophins. The response of the white-throated sparrow will vary when the difference between the time of occurrence of a high corticosterone secretion and a peak in prolactin secretion vary i.e. when a peak in corticosterone concentration is followed 4 hrs later by a peak in prolactin concentration, hyperphagia and thus deposition of fat, and migratory activity will be high, but the gonads will not be stimulated, and the birds will orient themselves in a southerly direction. When the time difference between the peak