A possible role of the limbic forebrain areas on gonadotropin secretion was examined in the mature or immature Wistar female rats by means of electrophysiological methods and radioimmunoassay. The results were as follows: 1) Circadian rhythms and 4-day cycle of multiple unit activity (MUA) in the basal hypothalamus and forebrain limbic areas were observed during the estrous cycle. In addition, a characteristic increase of MUA (CB) and a single unit activity was observed in these areas between 13:00 and 18:00 throughout the cycle. 2) Application of electrical or electrochemical stimulation to the arcuate nucleus (ARC), medial preoptic area (MPO), amygdala (AMYG) and the bed nucleus of stria terminalis (BNT) resulted ovulation in the rats, of which spontaneous ovulation was blocked, but not of stimulation of the hippocampus (HPC). 3) Electrical stimulation of the MPO induced an elevation of serum and pituitary LH and FSH, and a decrease of the prolactin. The AMYG stimulation increased serum LH on the days of diestrus II and proestrus and decreased both prolactin. However, while HPC stimulation did not induce any change in the basal level of LH, HPC stimulation did inhibit the MPO-induced increases of LH in serum and pituitary. Furthermore, HPC stimulation induced spontaneous release of LH during critical period and blocked spontaneous ovulation in the acute preparations. The HPC stimulation increased serum FSH on the day of estrus, while decreased on the day of diestrus II. Thus, the function of the HPC is rather phasic being responsible for the release of gonadotropin, and that of the MPO is tonic. 4) In androgenized rats (50 mg of testosterone propionate, injected, s.c. at the 5th day), MPO stimulation increased serum LH and decreased serum prolactin, whereas, an appreciable change was not observed in this area, when comparison were made to normals. On the other hand, remarkable differences were observed in the AMYG and the HPC. That is, AMYG stimulation induced decrease in serum and pituitary LH and no change in serum prolactin. The HPC stimulation increased serum LH and FSH. Furthermore, induction of ovulation by electrochemical stimulation of the AMYG was not observed in these rats and inhibitory influence of the HPC on MPO-induced ovulation weakened in the androgenized rats. Thus, neonatal treatment with androgen resulted imbalance of control mechanism on gonadotropin secretion in the AMYG and the HPC rather than in the hypothalamus. 5) In male rats MPO stimulation did not increase serum and pituitary LH, but AMYG stimulation increased serum LH and decreased serum prolactin. Thus, effects of AMYG or HPC stimulation in male rats were entirely different from those in females. 6) Furthermore, in male rats MPO stimulation in the MUA changes in the ARC was less effective. 7) In prepuberal rats (20-40 days), circadian rhythm of MUA and appearance of CB were observed in the ARC, MPO, AMYG and the HPC between 10:00 and 16:00. A gradual elevation of basal level of MUA in the brain was observed for 2-5 days before vaginal opening until day of vaginal orifice. That the elevation was based on the influence of simultaneous increase of estrogen before onset of puberty, was confirmed. On the day before vaginal opening a frequent appearance of CB was observed, while it disappeared or diminished its episodes on the day of first ovulation. 8) In prepuberal rats (27-28 days) electrical stimulation of the ARC, MPO, AMYG and the HPC increased pituitary LH, FSH and biosynthesis of progesterone in the ovary, while stimulation of only the ARC and the HPC increased serum FSH as well as estrogen biosynthesis. However, when the rats were stimulated 3-days successively, the 3rd stimulation of the HPC did not increase neither serum FSH nor pituitary LH and FSH, while the 3rd stimulation of the MPO and the AMYG increased both FSH. Thus, the hippocampus plays an important role in initiation at the puberty, but the MPO and/or the AMYG replaces for its role during the process.

In conclusion, 1) there are intrinsic rhythms of neural activity in the hypothalamus, MPO, AMYG and the HPC of either mature or immature rats, 2) the brain activity is commonly affected by the sex-steroids, 3) together with both effect of intrinsic factor and steroid feedback in the brain, the release of gonadotropin might be occurred during the puberty and the estrous cycle. The HPC as well as the AMYG is superimposing these processes of gonadotropin secretion, which is fundamentally controlled by the medial preoptic basal hypothalamus.