

## PHOTOPERIODIC EFFECTS ON HYPOTHALAMIC β-ENDORPHIN AND POMC mRNA

Morgan C, Akil H, Dept. of Physiology and Mental Health Research  
Institute, University of Michigan, Ann Arbor, Michigan 48109-0720

In golden hamsters, short photoperiods (SP) diminish reproductive capacity by inhibiting gonadotropin-releasing hormone (GnRH) secretion (1-3). This inhibition contributes to testicular regression in male hamsters (4). Hypothalamic β-endorphin (β-END) is thought to tonically inhibit GnRH secretion (5) and may further inhibit GnRH neurons during SP (6). To test the hypothesis that hypothalamic β-END tone is increased by SP, we assessed POMC mRNA and β-END content in the mediobasal hypothalamus (MBH) and testicular weight of hamsters after 2, 4, 6, 8, 10, and 18 weeks of exposure to SP (10 h light: 14 h dark). POMC mRNA increased and β-END content decreased over time. The decrease in β-END was positively correlated with a decrease in testicular weight over time. These changes are consistent with the hypothesis that SP increase hypothalamic β-END tone in male golden hamsters.

Adult male Syrian golden hamsters (*Mesocricetus auratus*) were kept in LP (14 h light: 10 h dark) with food and water *ad libitum*. After 3 weeks, half the animals were switched to SP (10 h light: 14 h dark; lights on at 24.00 h). After 2, 4, 6, 8, 10, and 18 weeks, animals from LP and SP were sacrificed by decapitation and total RNA and peptides were extracted from the same mediobasal hypothalamus (MBH) samples using the GITC-LiCl method. Northern Analysis was performed using total RNA which was fractionated on 1.5 % agarose-formaldehyde gels, transferred to nylon membranes, and hybridized with [<sup>32</sup>P]UTP-labeled cRNA of the rat POMC sequence. β-END content was measured by a well characterized radioimmunoassay aimed at the midportion of the peptide. Human β-END was used for the standards and the iodinated trace.

Our results show that animals exposed to SP exhibited complete testicular regression after 8 weeks, as compared to animals in LP. POMC mRNA, the message for the β-END precursor, increased over time during SP, suggesting a change in POMC gene expression, possibly due to increased synthesis of β-END. This increase in mRNA was subtle and reached statistical significance only at later points in the experimental treatment. In those same animals, β-END content decreased over time, suggesting the stimulation of secretion during SP. Moreover, there was a positive correlation between the decline in β-END content and testicular weight during SP ( $r^2 = 0.82$ ).

Our findings suggest that β-END secretion and synthesis are both stimulated by SP. Therefore, we conclude that concurrently with testicular regression in male hamsters, SP increase the tone of the hypothalamic β-END system. Given the regulatory potential of hypothalamic β-END on the reproductive axis, the increase in β-END tone may contribute to inhibition of the reproductive axis during SP. While the correlation between the decline in testes weight and the decline in the hypothalamic content of β-END does not indicate a causal relationship, it does suggest that further investigation of the role of β-END in the photoperiodic regulation of the reproductive axis is warranted.

## REFERENCES

1. S. Gaston and M. Menacker (1967) *Science* 158, 925
2. J. Elliott (1976) *Federation Proceedings* 35, 2339
3. W.E. Berndtson and C. Desjardins (1974) *Endocrinology* 95, 195
4. R. Steger, A. Bartke, and B.D. Goldman (1982) *Biology of Reproduction* 26, 437
5. Schultz, R., A. Wilhelm, K.M. Prinke, C. Gramsch, A. Herz (1981) *Nature* 294, 757
6. A.C. Roberts, N.D. Martensz, M.H. Hastings, and J. Herbert (1985) *Endocrinology* 117,141