CATECHOLAMINE SYSTEMS REFLECT AGING WHILE REMAINING PLASTIC IN AN AVIAN MODEL

M. A. Ottinger[1], K. Chen[1], M.A. Abdelnabi[1], N. Thompson[1], C. Viglietti-Panzica[2], and G. C. Panzica[2]

[1]Department of Animal and Avian Sciences, University of Maryland, College Park, MD 20742; [2]Department of Anatomy, Pharmacology, and Forensic Medicine, University of Torino, c.so M.d'Azeglio 52, I-10126 TORINO (Italy)

Norepinephrine (NE) and dopamine (DA) are critical neurotransmitter systems that regulate behavior, reproduction, metabolism, and motor responses. We have characterized a rapidly aging avian model, which exhibits age-related functional deterioration in reproduction, metabolism, behavior, visual and auditory systems. Aged reproductively senescent males remain responsive to exogenous testosterone, which restored reproductive behavior and the preoptic area neural systems known to modulate behavior (Ottinger, et al., 1997; Brain Res. Bull. 44: 471). In vitro study of parasagittal hypothalamic slices from young, and old males and females revealed that the amplitude of pulsatile gonadotropin releasing hormone (GnRH-I) release decreased, accompanied by diminished response to NE stimulation. Immunohistochemistry for tyrosine hydroxylase (TH), a required enzyme for synthesis of DA and NE was used to localize catecholamine immunoreactive (CA-ir) neurons and fibers in the prosencephalon and mesencephalon during aging. Comparison of young reproductive, photoregressed (non-reproductive) young, middle-aged, and old senescent male Japanese quail (Coturnix japonica) showed loss of CA-ir neurons in old senescent males; whereas young and middle aged males did not differ. Finally, old senescent males were pharmacologically treated with adrenergic receptor agonists or exogenous testosterone followed by adrenergic receptor antagonists. Results showed stimulation of reproductive behavior with agonist treatment and inhibition of behavior with antagonists. These data support the hypothesis that deteriorating presence and function of catecholamine neural systems are key elements of the process of aging.