

# Vasopressin and the Individual Differentiation in Aggression in Male House Mice

J. C. COMPAAN,<sup>a,b</sup> J. M. KOOLHAAS,<sup>a</sup> R. M. BUIJS,<sup>c</sup>  
C. W. POOL,<sup>c</sup> A. J. H. DE RUITER,<sup>a</sup> AND  
G. A. VAN OORTMERSSEN<sup>a</sup>

<sup>a</sup>*Department of Animal Physiology  
University of Groningen  
9750 AA Haren, the Netherlands*

<sup>c</sup>*Netherlands Institute for Brain Research  
1105 AZ Amsterdam, the Netherlands*

A number of immunocytochemical studies show that the vasopressinergic (AVP) system in the rat brain is far from homogeneous. For example the AVP innervation of the lateral septum (LS), originating from the medial amygdala and bed nucleus of the stria terminalis, appears to be sexually dimorphic and testosterone (T) dependent. At an adult age, T appears to induce AVP synthesis in these neurons, whereas neonatal T enhances the degree of AVP innervation of the LS, as part of the sexual differentiation.<sup>1</sup> Adult as well as neonatal T is involved in behavior, not only in the behavioral differentiation between the sexes, but also in the individual differentiation of social behavior within the male sex. For example, at an adult age, male house mice selected for high levels of aggressive behavior (short attack latency, SAL) display a higher plasma-T level and androgen sensitivity compared to the nonaggressive males (long attack latency, LAL). Surprisingly the LAL males show the highest levels of neonatal T production, suggesting that high neonatal T leads to a downregulation of the pituitary gonadal axis together with a reduction in adult aggressive behavior.<sup>2</sup> In view of this role of T in the individual differentiation in aggressive behavior within the male sex, it was expected to find an individual differentiation of LS-AVP as well. Recent studies both in SAL and LAL males indicate that also in the house mouse the LS-AVP innervation is T dependent. Moreover, quantitative immunocytochemical analyses revealed the highest density of AVP fibers in the LS, especially in the posterior part, of the adult LAL males. Not only a higher fiber density was found, but the fibers also contain more AVP. Present experiments are aimed at demonstrating the causal relationship between the variation in neonatal T and the individual differentiation in adult AVP in the LS within the male sex.

The functional significance of the individual difference in the T-dependent AVP system with respect to the differences in aggressive behavior is not yet clarified. A number of behavioral studies on SAL and LAL males show that the individual differentiation in aggressive behavior reflects a more fundamental differentiation in active or passive coping behavior, based upon the degree in which behavior is guided by

<sup>b</sup> Address for correspondence: University of Groningen, Department of Animal Physiology, P.O. Box 14, 9750 AA Haren, the Netherlands.



environmental stimuli.<sup>3</sup> For example, LAL males rely more on spatial cues than SAL males, suggesting a differential involvement of hippocampal information in the organization of behavior. Recent studies indicate that LS-AVP is involved in the modulation of hippocampal mechanisms.<sup>4</sup> The AVP-immunopositive boutons and hippocampal axon terminals frequently terminate on the same somatospiny neurons in the LS. Hence, it seems that neonatal T is involved in the development of the two coping strategies, possibly by way of its organizational action on AVP-dependent hippocampal information-processing mechanisms.

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