J. theor. Biol. (1979) **77**, 537–538

LETTER TO THE EDITOR

Exploration as a Functional Correlate of Endorphins

Low doses of opiate drugs are known to produce behavioral excitation in many species (Kreuger, Eddy & Sumwalt; 1941). In rodents this activation response generally includes increased rearing and ambulation (Fog, 1970; Norton, 1977). We wish to call attention to a novel interpretation of previous findings, i.e. that the activation due to opiates reflects exploration, and that this might imply that endorphins (endogenous opiate-like neuro-transmitters, Akil, 1976; Belluzzi & Stein, 1977) normally mediate some aspects of exploration. This interpretation is of interest since the functional correlates of endogenous opiates are as yet not fully established.

Looking first to the behaviors which opiates elicit, and their relation to exploration, several points of commonality are notable. On the one hand rodents (and other animals) typically utilize ambulation for visual and tactile investigation of a novel environment, and rearing for visual and olfactory investigation (Mackintosh, Chance & Silverman, 1978). Opiates produce similar behaviors (increased ambulation, rearing, and head turning; Fog, 1970; Norton, 1977). Since the behaviors in both circumstances are similar, a common mechanism may be involved. Moreoever, we have observed that untreated rats initially placed in an open field normally show Straub tail elevation (Kreuger, Eddy & Sumwalt, 1944) when moving. This is an index of opiate activation. Ten of eleven rats tested in a standard 1·22 m^2 open field in our laboratory spontaneously showed this response when moving. It was seen within the first five minutes of initial environmental exposure, and no subject showed this response within its home cages (for a 1 h observation period prior to open field testing $P < 0{\cdot}05$ by binomial expansion). Therefore, opiates and exploration share common behavioral responses.

Two explanations of these effects are possible. On the one hand opiates may act as drugs that cause the release of endogenous but non-endorphin transmitters, i.e. perhaps opiates release monoamine transmitters such as norepinephrine or dopamine. A second explanation rests with the ability of opiates to occupy a unique receptor population normally sensitive to endogenous opiate-like ligands. Opiates may mimic the results of the normal transmission process within endorphin containing systems. The involvement of endorphins is suggested in part by our observation of Straub tail during exploration. A second line of evidence rests with the ability of opiate antagonists to reduce exploration related behaviors. We have previously

0022-5193/79/080537+02 $02.00/0

reported in a different context that the opiate antagonist Naloxone normally inhibits the ambulation consequent to placement in a novel environment (Katz *et al.*, 1978). These data may be interpreted as support for the current thesis. Since both exploration and endorphins are not fully understood functionally or neurochemically, our observations offer one point of synthesis for both topics.

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