THE MIND Bulletin on Mind-Body Medicine Research

Mind-Body Medicine Research Council

Research

Mobility Coupled with Motivation Promotes Survival: The Evolution of Cognition as an Adaptive Strategy

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In a recent publication [1], we present the hypothesis of an evolutionary and functional relationship between the occurrence and use of the catecholamine dopamine (DA) as a neurotransmitter (messenger)—particularly in invertebrates—and the catecholamines epinephrine (EP) and norepinephrine (NE), messengers that are found only in vertebrates. Interestingly, both are also involved in pathways leading to the production of endogenous morphine, another messenger substance. We assume that the use of EP/NE as messengers represents an evolutionary advantage and adaptation process, whereby this "metabolite" (its biochemical intermediates) is only used "in retrospect" as a neurotransmitter (evolutionary "retrofitting"); on the way to greater mobility, with a need to expand data storage (memory, cognition) within the scope of this expanded radius, additional messengers were needed. Moreover, challenges and "stress" coming with increased mobility (e.g., entering unfamiliar environments) had to be successfully met to ensure survival. The same applies to the synthesis of morphine, which is formed from tyramine and tyrosine via DA (mediated by enzymes that also interact with EP/NE) so that morphine can be chemically classified as an "end product" of a DA-opiate cascade. Morphine's functional importance is the downregulation and termination of a motivational sequence from wanting (appetite) to avoiding (avoidance) to relaxation/quiescence (assertion).

Reference

[1] Stefano, G. B., Kream, R. M., Esch, T. (2023) Mobility Coupled with Motivation Promotes Survival: The Evolution of Cognition as an Adaptive Strategy. *Biology*.12(1):80. https://doi.org/10.3390/biology12010080