Virtual DANDRITE Lecture

Monday 6 September 2021

15:00 – 16:00

Online via Zoom

Please find Zoom link via the Outlook calendar invitation. If you have not received this, please write an e-mail to Katrine: karasmus@dandrite.au.dk

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A brain circuit for curiosity

Motivational drives are internal states that can be different even in similar interactions with external stimuli. Curiosity as the motivational drive for novelty-seeking and investigating the surrounding environment is for survival as essential and intrinsic as hunger. Curiosity, hunger, and appetitive aggression drive three different goal-directed behaviors—novelty seeking, food eating, and hunting— but these behaviors are composed of similar actions in animals. This similarity of actions has made it challenging to study novelty seeking and distinguish it from eating and hunting in nonarticulating animals. The brain mechanisms underlying this basic survival drive, curiosity, and novelty-seeking behavior have remained unclear. In spite of having well-developed techniques to study mouse brain circuits, there are many controversial and different results in the field of motivational behavior. This has left the functions of motivational brain regions such as the zona incerta (ZI) still uncertain. Not having a transparent, nonreinforced, and easily replicable paradigm is one of the main causes of this uncertainty. Therefore, we chose a simple solution to conduct our research: giving the mouse freedom to choose what it wants—double freeaccess choice. By examining mice in an experimental battery of object free-access double-choice (FADC) and social interaction tests—using optogenetics, chemogenetics, calcium fiber photometry, multichannel recording electrophysiology, and multicolor mRNA in situ hybridization—we uncovered a cell type–specific cortico-subcortical brain circuit of the curiosity and novelty-seeking behavior. We found in mice that inhibitory neurons in the medial ZI (ZIm) are essential for the decision to investigate an object or a conspecific. These neurons receive excitatory input from the prelimbic cortex to signal the initiation of exploration. This signal is modulated in the ZIm by the level of investigatory motivation. Increased activity in the ZIm instigates deep investigative action by inhibiting the periaqueductal gray region. A subpopulation of inhibitory ZIm neurons expressing tachykinin 1 (TAC1) modulates the investigatory behavior.