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Week 11 – Parental behaviors. Aggressive behavior.

1) Explain the repertoire of parental behaviors in mice. What is the difference between behavior of virgin and experienced animals? How is parental behavior usually quantified in experiments?

2) Which specific neuron type in which brain area was shown to be central to govern parental behaviors in both sexes? How do sex hormones during pregnancy modify the function of these neurons with an effect on in maternal behavior?

3) Explain what is the resident-intruder test, which experimental pre-requisites does it have? What are the main quantitative readouts and in which way their values characterize aggressive behavior?

4) Which hypothalamic nucleus is currently regarded as a coordinating center of aggressive behaviors? By which experiments the role of its specific neuronal sub-population (which one?) in aggression control was demonstrated? Are these neurons inhibitory or excitatory, and what is their most relevant projection pathway?

5) Name at least two mainly inhibitory nuclei that negatively modulate aggressive behavior, when activated? How is this effect achieved in regard with their connectivity with the other nuclei controlling aggression (see Q4)?

6) Neurons of which transmitter type dominate in the posterodorsal medial amygdala? Discuss possibilities which may explain positive effect on aggressive behavior (i.e. stimulation) upon optogenetic activation of MeApd GABA neurons. What is the requirement for a disinhibition pathway to be functional?

7) Considering both Lectures (Week 10-11), draw a schematic connectivity diagram, from the sensory inputs till the motor behavioral output, relevant and common for most social behaviors in rodents. What are the main large-scale functional blocks of the diagram and with which anatomical sub-divisions of the brain they associate? Using this diagram, recapitulate which nuclei (and cell types) play role in different types of social behaviors.

8) Read and discuss the following paper:

Wei, D., Osakada, T., Guo, Z., Yamaguchi, T., Varshneya, A., Yan, R., Jiang, Y., and Lin, D. (2023). A hypothalamic pathway that suppresses aggression toward superior opponents. Nat Neurosci *26*, 774–787. https://doi.org/10.1038/s41593-023-01297-5. https://www.nature.com/articles/s41593-023-01297-5