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Unit 6 – Innate Defensive Behaviors

(Exercise Session Mon 31.3.2025)

1) Read and discuss the following paper:

Tseng, Y.T., Schaefke, B., Wei, P., and Wang, L. (2023**). Defensive responses: behaviour, the brain and the body**. *Nature Reviews Neuroscience* 24, 655-671 (Review Paper).

You can concentrate on the **first half** of the paper.

2) Retinal ganglion cells (RGCs) are the output neurons of the retina. Name three brain structures to which RGCs project. For each of the three brain structures, name one important function supported by the RGC inputs.

3) Superior Colliculus (SC): Explain how the SC is organized, and which layers receive information from the eye. Name two neuron types in the SC and their "visual selectivity", that is, to what kind of visual stimuli these neurons respond best.

4) What is the main function of the Superior Colliculus in mice, and in humans?

5) i) Define what a "looming visual stimulus" is.
ii) Describe two types of behavioral experiments with mice and a looming stimulus, which will evoke two different behavioral responses in the mice.
iii) What is the evolutionary reason for the two behavioral reactions in (ii).

6) Describe the neuronal circuit involved in the escape reaction of a mouse. Name at least three brain areas implicated in the escape reaction, and describe *in-vivo* optogenetic experiments that have been performed to find out about this neuronal circuit.

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7) Olfactory system: Describe the basic cellular organization of the olfactory system. For this, use the following terms and make a corresponding drawing: Sensory epithelium - olfactory sensory neuron (OSN) - main olfactory bulb - glomerulus - Mitral cells, Tufted cells.

8) How many olfactory receptor (OR) genes are there, and what kind of receptors are these? How many OR genes are expressed in a given (single) olfactory sensory neuron (OSN) ?

9) Explain how the information from a <u>given single</u> olfactory sensory neuron (OSN) reaches the olfactory bulb, and how many glomeruli this given OSN innervates. Roughly how many glomeruli are there, and what can you finally say about the combinatorial representation of a given odor / olfactant on the surface of the main olfactory bulb?

10) What is the "vomeronasal organ" (VNO) and the "accessory olfactory bulb" (AOB), and what is their main function?

11) Define the terms "pheromone" and "Kairomone". Give two examples of a kairomones, and explain by which part of the olfactory system they are detected.

12) Describe a behavioral experiment that can be used to assess the "aversive" meaning of kairomones in mice. To which brain areas is the information about a kairomone transmitted?