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## Week 9 – Instrumental learning

1) Think of examples (possibly from real life, i.e. involving pets, or even people) of different realizations of operant conditioning principles [see lecture slide #13].

2) For the experiments with food-restricted or water-deprived subjects (for example, consider lecture slide #14), classify operant conditioning that is taking place according to the scheme on slide #13. In particular, do you see only reinforcement or also elements of punishment? In case of reinforcement, is it positive or negative?

3) Imagine the following experiment. A water-deprived mouse is confined inside a Y-maze with different visual marks (contexts) on the walls of the left, right arms of the maze and the stem. During its previous experience, the mouse learned that in a context used to label the left arm of the maze, there was a cue-signaling LED, and a nosepoke port activating a water dispenser next to it. Also, the mouse learned that in a context used to label the right arm of the maze, there was a warm spot and occasional food delivery port. Indeed, the maze also had these facilities in its corresponding arms. Finally, the mouse previously learned that the context used to label the stem arm of the Y maze, there was a cotton swab with a bobcat urine.

- Describe the most likely behavior of the mouse placed inside the maze.
- In which arms of the maze we are dealing with retrieval of instrumental learning, and in which not? Where it is not, which type of learning is involved?
- Suggest possible simple modifications of the maze in order to introduce operant conditioning in the arms where it was not present before.

4) Imagine an experiment in which a monkey learns well that pressing a lever after a flash of light would deliver a drop of juice. Later, the flash of light is accompanied by a sound beep, and the monkey is trained with this combined CS for some time. What do you think will happen if at some point only the sound is given, without the initial reward-predicting light cue?

5) Explain a general schematic of how corticolimbic and mesolimbic dopaminergic loops work for processing the reward or punishment. What is the role of disinhibition in this circuit?

6) What is the common principle of how the drugs of abuse work? Provide some examples (substances you remember), with specific mechanisms of action.

7) Read and discuss the following paper:

Lammel, S., Lim, B.K., Ran, C., Huang, K.W., Betley, M.J., Tye, K.M., Deisseroth, K., Malenka, R.C. (2012) Input-specific control of reward and aversion in the ventral tegmental area. *Nature* 491, pp. 212–217. <https://doi.org/10.1038/nature11527>  
<https://www.nature.com/articles/nature11527>