



## **Competing aversive and appetitive memories in the crab *Neohelice* and in honey bees**

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The neurobiology of learning and memory has been mainly studied by focusing on exclusive aversive or appetitive learning paradigms. However, real-life experiences involve in many cases stimuli that become predictors of both aversive and appetitive consequences. We studied the learning and memory processes after experiences that contain conflicting information, and evaluated at which extent animals integrate this information to ensure adaptive behavior. Initially we studied this phenomenon by using *Neohelice* crabs. We took advantage of two well described appetitive and aversive learning paradigms and combined them in a single training session. We found that crabs build separate appetitive and aversive memories that compete during retrieval but not during acquisition. Which memory is expressed depends on the balance between the strength of the aversive and appetitive stimuli and on the motivational state of the animals during retrieval. Later on (and still in progress) we moved to honey bees and tested this phenomenon by using appetitive and aversive olfactory conditioning of the proboscis extension response. First we developed a training/testing protocol that allowed us to evidence aversive conditioning after pairing an odor with a bitter solution. We found that aversive conditioning induces memory formation that lasts 24 but not 48 hours. Second, we trained bees in a differential conditioning protocol in which an odor was paired with sugar and a second odor was paired with a bitter solution. We found that bees were able to form two independent memories. Third, we performed an experiment in which after differential conditioning, bees were tested with a mixture that contained the appetitive and the aversive conditioned odors. During test, bees behaved according to the appetitive or to the aversive odor depending on their satiation level. Thus, in honey bees as in crabs, appetitive and aversive memories seem to be stored independently and compete during retrieval.