Setting A Behavioral Task For Assessing Decision Making In Urodele Amphibian

Charlotte Héricé, Manon Bonnet-Save, André Garenne, Jean-Marie Cabelguen, Thomas Boraud

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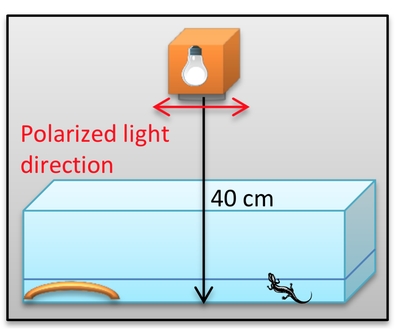
INTRODUCTION

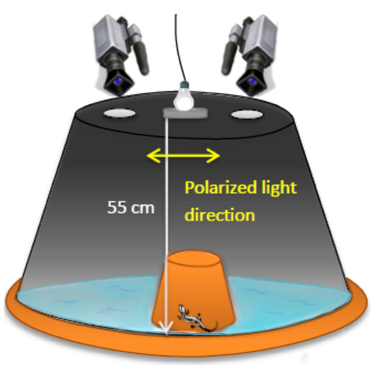
Decision making implies cortical-basal ganglia (BG) loops, but the respective roles of each structure are still debated. Urodeles, by their similitude with mammals in BG organisation, offer a much less level of complexity in understanding this process by the presence of fewer neurons. Therefore, we decided to set up a behavioral test of decision making in this animal. Moreover, their regenerative capacities make them a unique model to study post-lesional plasticity of this process networks. To our knowledge, urodele is the earliest group of limbed vertebrates in which decision-making has been successfully addressed yet.

BEHAVIORAL TEST

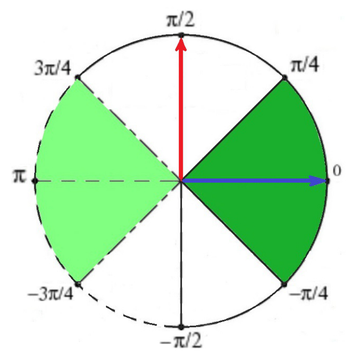
Animals have been trained in associating a polarized light direction to the position of an obscure shelter [1]. Then they were tested according to the feature of the light (non polarized light, NPL; polarized light, PL). Note that the direction of the polarization and the N-S direction of the magnetic field were perpendicularly oriented, both during training and test.



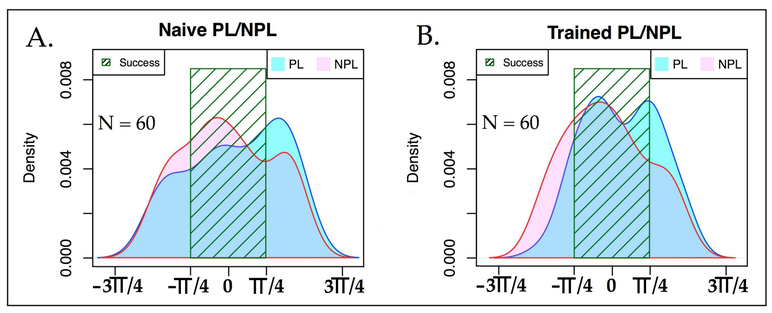
Training tank. *Animals were housed under a 12h:12h polarized light:dark cycle and trained 4 times a day during 3 weeks.*



Test arena. *Testing sessions occurred once a day and by 3 tries for each tested condition.*



Results field reresentation. *Polarized light vector (blue arrow) and terrestrial magnetic orientation (red arrow).*



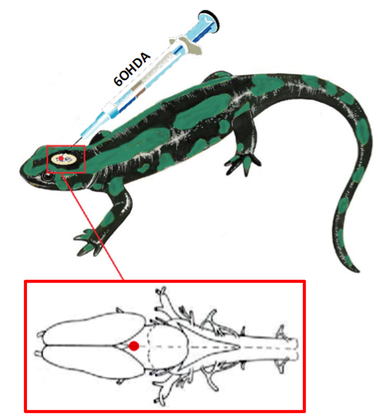
Angle occurrence probability. *Following training, the number of animals in the success zone is increased, showing that training is effective.*

ANIMALS

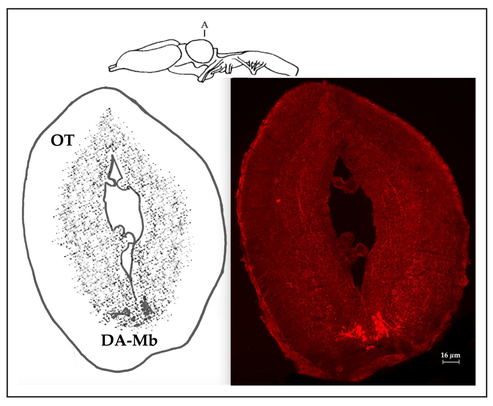
All the experiments were performed on fully metamorphosed amphibian urodeles (*Pleurodeles waltlii*) (13 months post-hatching). We used 20 animals for the behavioral test and 7 for the DA system lesion (preliminary results obtained for 2 out 7 animals are reported).

DOPAMINERGIC SYSTEM LESION

The animals were deeply anaesthetised via immersion in a 0.1% aqueous solution of tricaine methanesulfonate (MS-222). The micro-pipette containing a 6-OHDA solution was inserted into the brain through a small hole surgically drilled at the junction of the parietal and frontal bones in the cranial midline.

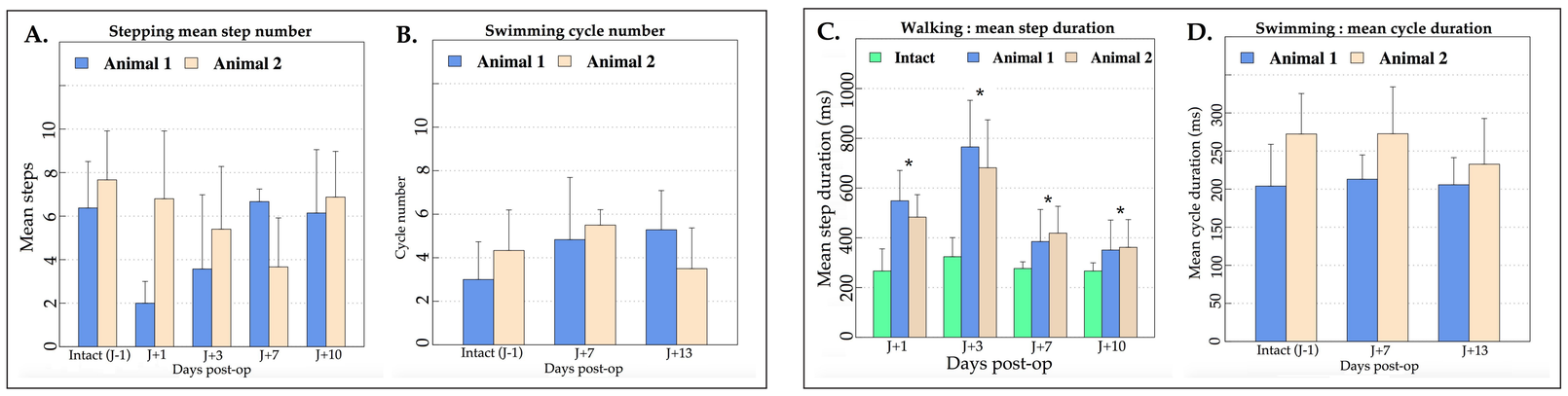


Injection site [3]. *The red dot indicates the 6-OHDA injection site, directly into the third ventricle at the level of diencephalic/mesencephalic dopaminergic (DA) neurons.*



Identification of DA neurons : Immunohistochemical identification.*OT: Optic Tectum. DA-Mb: DA cells groups of the midbrain. Antibodies raised against tyrosine hydroxylase (TH). The study will be focused on the ventral diencephalic/mesencephalic TH$^+$ cells, which are consistently affected by 6-OHDA administration in the third ventricle.*

The number of successive steps during each walking episode (A) and the step duration (C) were mesured for each animal before, 7 days and 10 or 13 days after the 6-OHDA injection. A similar quantification was performed for swimming cycles (B, D).



The effect of 6-OHDA. *The 6-OHDA lesion induced clear short-term effects on the walking behavior. By contrast, the swimming behavior seemed unaffected.*

FUTURE DIRECTION

This paradigm gives us access to a motor decision making mode. In a second step, we will perform selective electrical lesions of the pallium (i.e. the cortex in lower vertebrates), the thalamus and the basal ganglia to determine the respective role of each structure. We will then study implication of dopamine in this behavioral task by 6-OHDA lesions.

INSTITUTES

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SOURCES

Video recordings are available by flashing the QR-code. Mail contact:
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