

Drosophila melanogaster as model for studying drug addiction – introduction of self-administration paradigm

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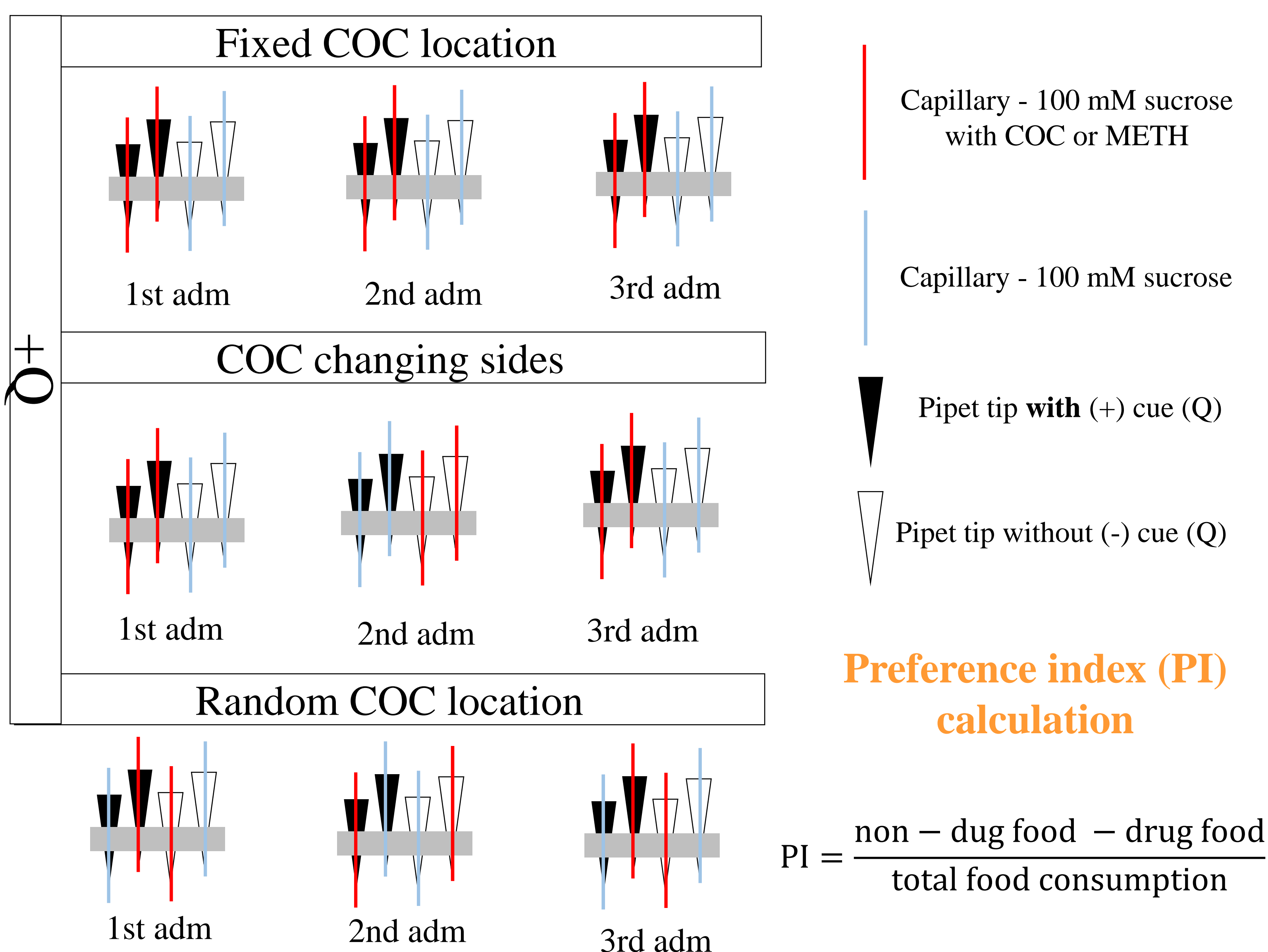
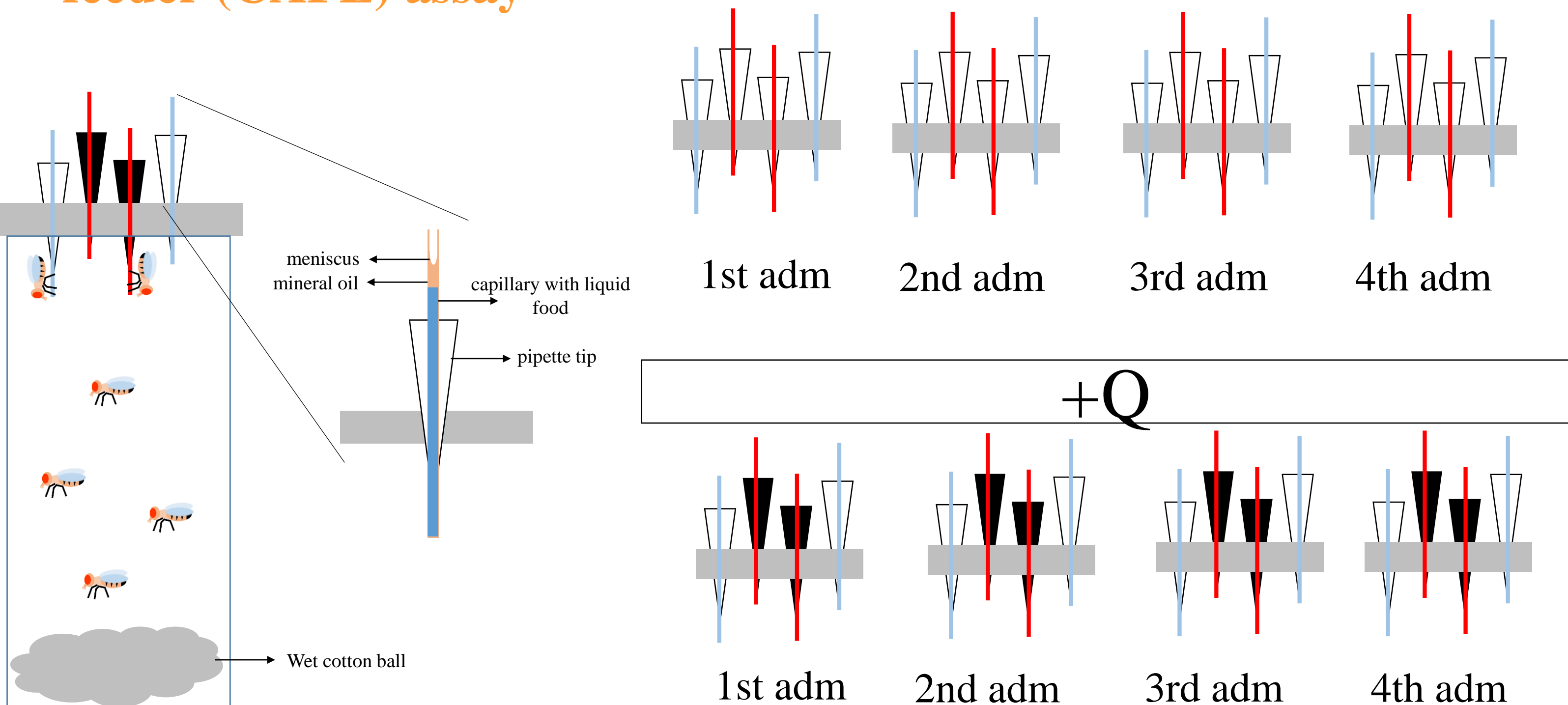
Background

The self-administration paradigm is a behavioral phenotype that can be measured in laboratory animals and models features of addiction. *Drosophila* preferentially consumes ethanol-containing food, however it is not known if the same is true for psychostimulants, cocaine (COC) and methamphetamine (METH).

Methods

To test if flies will voluntarily self-administer psychostimulants we used the two-choice Capillary Feeder (CAFE) assay, where flies can choose between capillaries with drug-food or a non-drug food. Liquid non-drug food contained 100 mM sucrose aqueous solution, while drug-food contains 100 mM sucrose solution with COC (0,10 and 0,15 mg/mL) or METH (0,20 mg/mL). Preference Index (PI) was calculated based on the consumption of drug-food minus non-drug food, normalized by all food. There were 6 flies per tube, capillaries were changed daily and PI was calculated per tube.

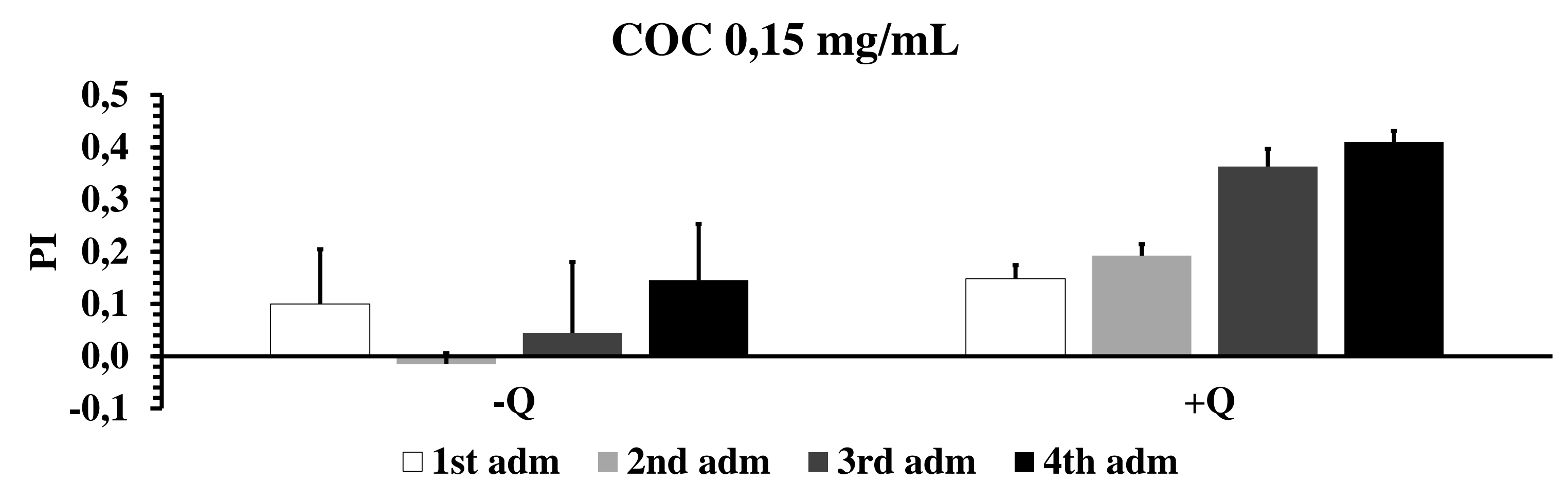
Modification of capillary feeder (CAFE) assay



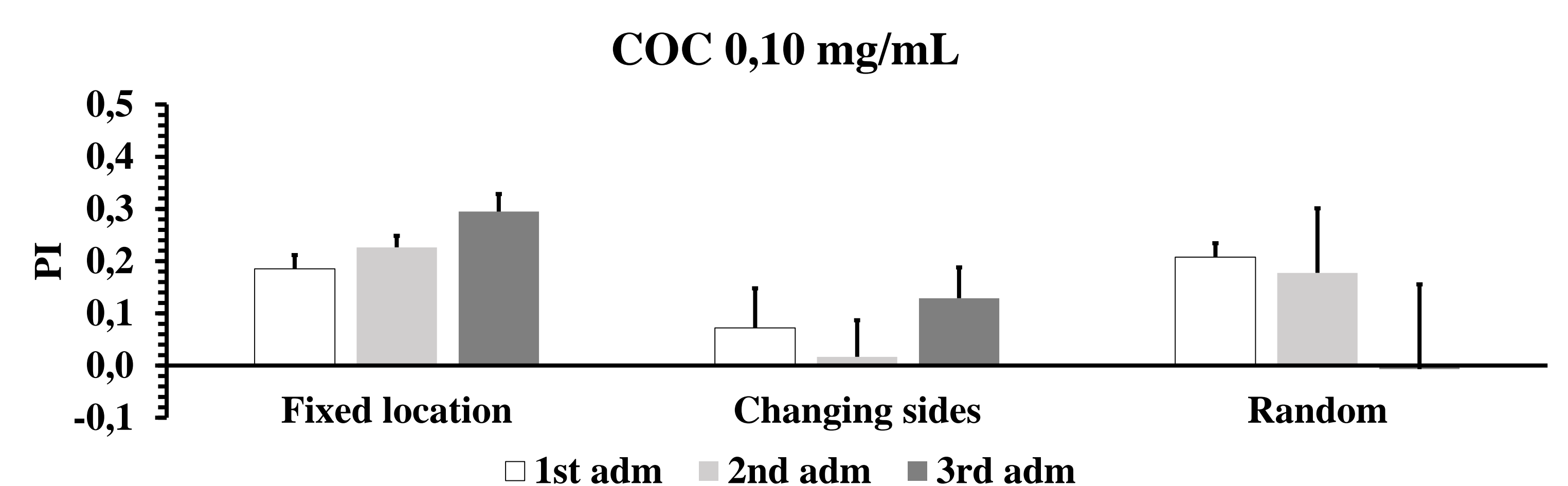
Results

PI for COC is positive and increases over consecutive days, while PI for METH is positive on day one, but then decreases over consecutive days. COC preferential consumption is enhanced by pairing drug to cue and location. After period of abstinence from cocaine-containing food flies rapidly return to the same or greater PI, suggesting relapse-like effect.

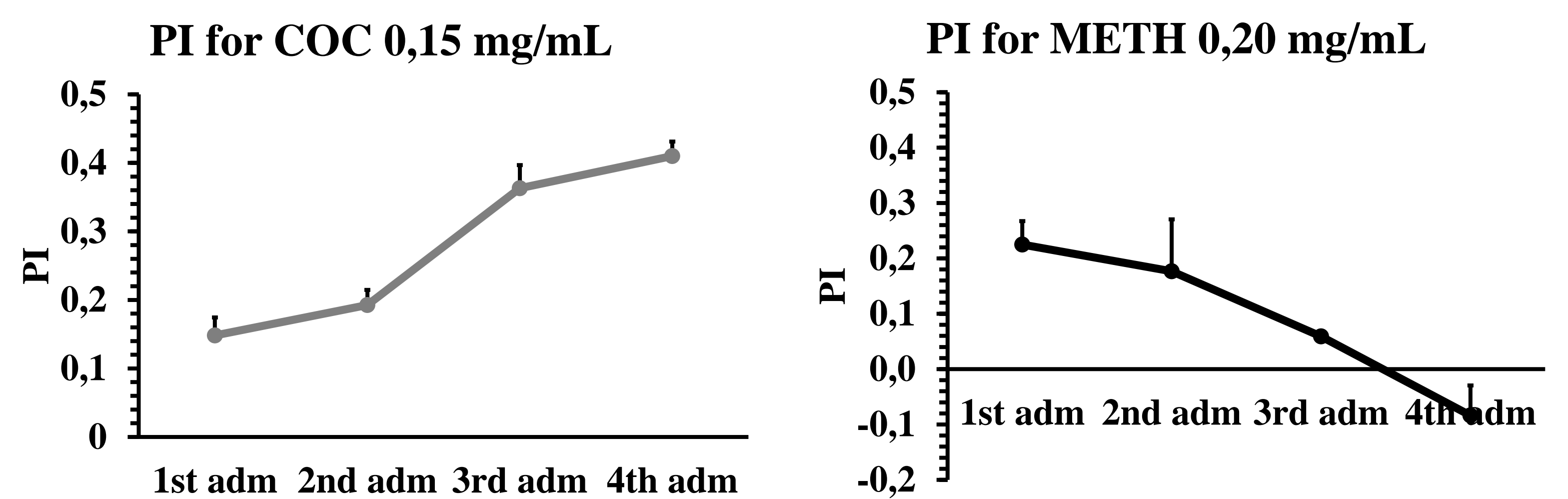
a) COC preferential consumption depends on cue



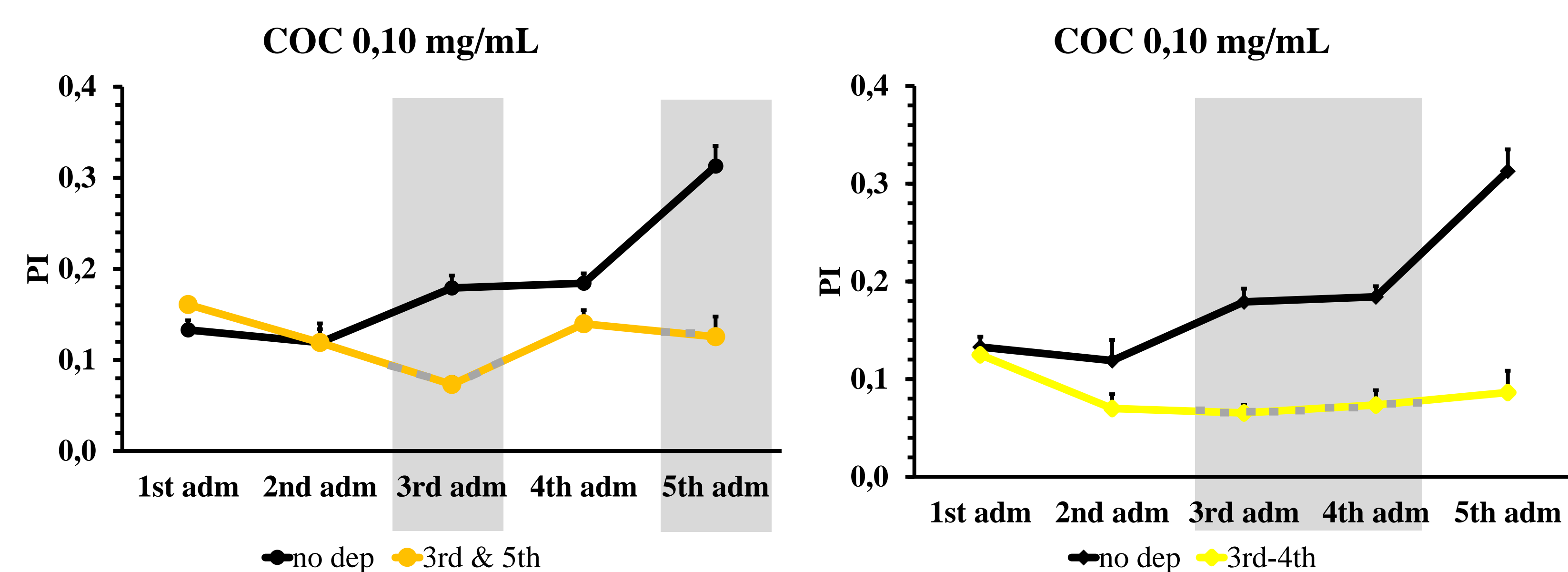
b) COC preferential consumption depends on cue and location



c) Different preferential consumption for COC and METH



d) COC food deprivation causing relapse like-effect



Conclusion

1. *Drosophila* preferentially consumes drug-food over sugar-food.
2. There is a difference in preferential consumption of METH and COC suggesting mechanistic difference of action.
3. Dependence of preferential consumption on cue and location suggests inflexibility of behavior and/or involvement of mechanisms of learning and memory.

Based on the above data we propose that self-administration phenotype can be useful in dissecting neural mechanisms underlying drug-seeking behavior.