Is PKC53e-activity in motorneurons involved in operant self-learning in Drosophila ?

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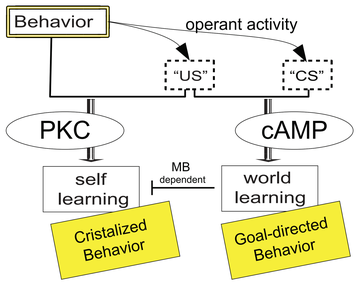
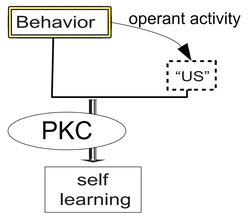
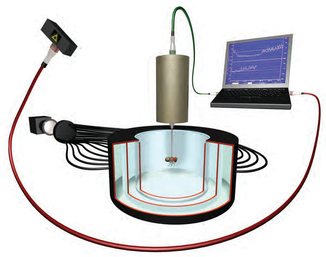
Operant self-learning in Drosophila

Colomb J, Brembs B. The biology of psychology: “Simple” conditioning? Communicative & integrative biology. 2010;3(2):142-5



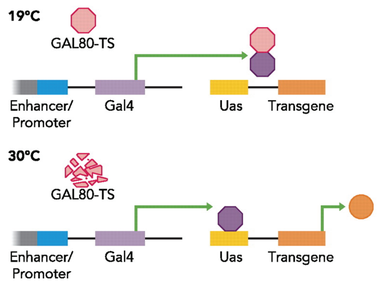


Torque meter



TARGET System:

temporal and spatial control of expression



Open data - Open code

data: http://dx.doi.org/10.6084/m9.figshare.830423
(raw torque data is also on figsare,
link to rawdata can be found on the result file).
labview code to perform the experiment:
http://dx.doi.org/10.6084/m9.figshare.664133

code for graphical representation and statistical analysis:
https://github.com/jcolomb/learningdata

Localisation

In neurons

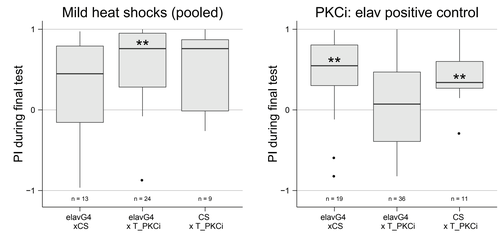


Fig.1 Inhibition of PKC pan-neuronally prevents self-learning formation. While no effect is seen after a weak heat shock (left), a 4h at 35°C heat shock activates the inhibitor, preventing self-learning formation (right). This shows that the effect is due to PKC inhibition and not to another genetic factor. Stars denote significant difference from 0 using a Wilcox text.

Probably motorneurons

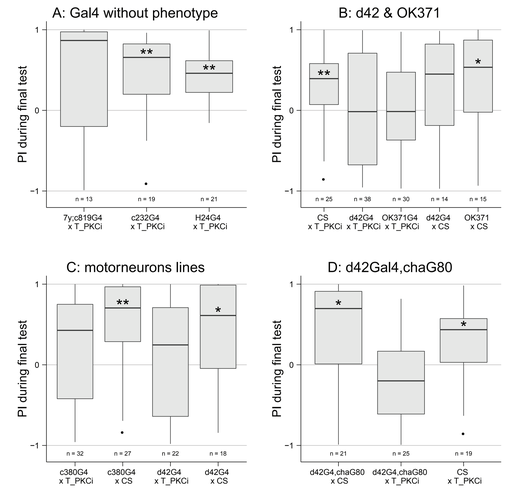


Fig.2 Following the same protocol as in Fig.1, we restricted spacially the expression of the PKC inhibitor. A. expression in mushroom bodies or central complex does not affect learning. B. Expression in glutamatergic neurons (OK371) or d42Gal4 neurons are apparently sufficient to block learning. C. Expression in d42 or c380, two Gal4 lines known to show expression in motorneurons, prevents self learning. D. Restricting the expression in d42Gal4 positive, non-cholinergic neurons is sufficient to prevent self-learning formation.Stars denote significant difference from 0 using a Wilcox text.

Gene

Maybe PKC53e

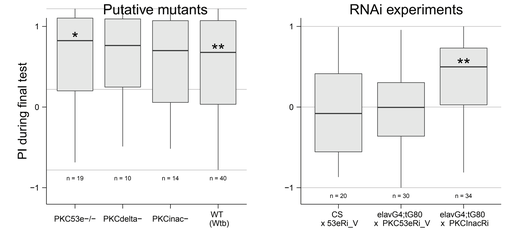
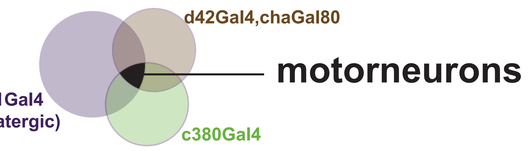


Fig.1 Putative mutants and RNAi experiments are unconclusive. left: all the flies with mutagens inserted in the PKC genes show normal learning scores. Right: Inducing RNAi against PKCinaC with a 2 days heat shock did not affect learning. The construct countainining the RNAi against PKC53e induced a phenotype even when it is not induced by Gal4 expression. Technical problems cannot be ruled out, such that the experiment is not conclusive.

Conclusions



The drosophila operant self-learning task seems to depend on PKC-dependent cellular changes in motorneurons. This is reminiscent on the results obtained in down-reflex conditioning in mammals (including humans), where learning induce changes in the intrinsic properties of motorneurons.

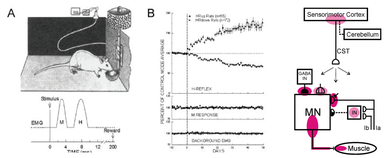


Fig.1 and 4 in: Reflex conditioning: A new strategy for improving motor function after spinal cord injury
Xiang Yang Chen, Yi Chen, Yu Wang, Aiko Thompson, Jonathan S. Carp, Richard, L. Segal, and Jonathan R. Wolpaw
Ann N Y Acad Sci. 2010 June ; 1198(Suppl 1): E12–E21. doi:10.1111/j.1749-6632.2010.05565.x.